THE SEVENTEENTH

ANNUAL REPORT

AND

ABSTRACT OF PROCEEDINGS

OF THE

BRIGHTON AND SUSSEX

NATURAL HISTORY SOCIETY,

ADOPTED AT A MEETING HELD

SEPTEMBER 8, 1870.

BRIGHTON:

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1870.

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49, Grand-parade.

At the Seventeenth Annual Meeting of the BRIGHTON AND SUSSEX NATURAL HISTORY SOCIETY, held at the Dispensary, September 8th, 1870,

IT WAS RESOLVED,—

That the Report, Abstract of Proceedings, and Treasurer's Account now brought in be received, adopted, and entered on the minutes, and printed for circulation as usual.

That the cordial thanks of this Meeting be given to the Honorary Secretaries and Honorary Librarian for their labours in preparing the same.

That the following gentlemen be elected the Officers of the Society for the ensuing year :—President : Mr. F. Merrifield ; Treasurer : Mr. T. B. Horne ; Committee : Mr. R. Glaisyer, Mr. J. Dennant, Rev. J. H. Cross, Mr. G. D. Sawyer, Mr. Haselwood, and Dr. Badcock ; Honorary Secretaries : Mr. T. W. Wonfor, 38, Buckingham Place, and Mr. J. C. Onions, 56, Middle Street ; Honorary Librarian : Mr. Gwatkin, 49, Grand Parade.

That the sincere thanks of this Meeting be given to the Vice-Presidents, Treasurer, Committee, Honorary Secretaries, and Honorary Librarian for their services during the past year.

SPECIAL BUSINESS.

That the following Rule be adopted and printed with this day's proceedings :—

"That the Officers of kindred Societies, not resident in Brighton, shall be eligible for Election as Honorary Members without the necessity of contributing papers or specimens, and shall enjoy all the privileges of Honorary Members elected under Rule 5."

(Signed),

T. H. HENNAH,

PRESIDENT.

IT WAS ALSO RESOLVED,—

That the warmest thanks of this Meetingto presented to Mr. T. H. Hennah, for his able conduct as President during the past year.

REPORT.

In presenting the SEVENTEENTH ANNUAL REPORT, your Committee have the pleasure of recording the continued prosperity of the Society; but regret the loss it has sustained by the death of Mr. Eden and Mr. William Verrall: the former gentleman was one of the Vice-Presidents, and both took an active interest in the prosperity of the Society.

The state of the finances continues to be satisfactory; there being a balance of £1 19s. in the hands of the Treasurer, after expending £16 19s. in the purchase of New Books and Periodicals, and in the publication of "The Moss Flora of Sussex."

The following Books have been presented to the Society during the year, viz.: Scientific Opinion, presented by the Editor; Nature, presented by the Editor; a Pamphlet on the Decapod Crustacea that have been found on the Coast at Eastbourne, by F. C. S. Roper, presented by the Author; a Pamphlet on Butterfly Scales, characteristic of Sex, by T. W. Wonfor, presented by the Author; Roper's Catalogue of Works on the Microscope (second copy), presented by the Author; a List of Macro Lepidoptera, occurring in the neighbourhood of Folkestone, by H. Guard Knaggs, presented by T. W. Wonfor, Esq.; a Pamphlet; The Earth's Antiquity, by James Gray; Manifestations of Disease in Morbid Phenomena, by Duncan, and Outlines of Oryctology, by James Parkinson, presented by W. E. C. Nourse, Esq.; Lyell's Geology, 3 vols., presented by Miss Barnard; a Pamphlet on Ice, by C. Ward, presented by the Author; Papers from the Eastbourne Natural History Society, presented by the Society.

The following Books have been purchased during the year, viz.: The Anatomy and Physiology of the Blow Fly, by B. T. Lowne, 1 vol.; the Palæontographical Society's Volume for 1869;

Microscopic Objects figured and described, by J. H. Martin, 1 vol.; Sowerby's English Botany, the 10th vol.; Transactions of Linnean Society, part 4, vol. 26; and part 2, vol. 27; Stainton's Tineina, vols. 7, 8, and 9.

Serials: Entomologist, 1 vol.; Entomologist's Monthly Magazine, 1 vol.; Geological Magazine, 1 vol.; Popular Science Review, 1 vol.; Quarterly Journal of the Microscopical Society, 1 vol.; Quarterly Journal of Science, 1 vol.; Science Gossip, 1 vol.; Student, 1 vol.; Zoologist, 1 vol.

The number of Volumes in the Library, which at the date of the last Report was 611, has since been increased to 643. The circulation of the Books continues to increase; and your Committee are pleased to hear from the Honorary Librarian that they have been used with great care by the Members who have had them, and are consequently very little injured.

Donations of slides, for the Society's Cabinet, have been received from the following gentlemen:—Möller's Diatom Type Slide, No. 2, from Mr. Hollis; and 53 Slides from Messrs. Hennah, Smith, Wonfor, and Dr. Hallifax.

It having been suggested to your Committee that the usefulness of the Society would be much extended if increased facilities could be afforded to the Members for microscopical study, your Committee recommended the formation of a Microscopical Section, which should provide for the study of subjects connected with the use of the Microscope, and for the more frequent intercourse of such Members as were interested in microscopical study; that these objects could be obtained by monthly meetings, where papers on strictly microscopical subjects could be read: such readings to be restricted to 20 minutes, so that time might be afforded for the examination of objects and the comparison of observations; by the formation of a Cabinet to which Members be invited to contribute slides, particularly of such objects as illustrate the Natural History of Sussex. Members to have specimens from the Cabinet for home examination, under certain restrictions, and by encouraging the exchange of slides among the Members. The Section to consist of all Members of the Society who signify their wish to the Secretaries to join the Section. The government to be under the present officers of the Society until the annual meeting, when the Committee should suggest rules for its future government. The meetings to be held on the fourth Thursday in each month, at eight o'clock in the evening; the Chair to be taken by the President or a member of the Committee; when, after the ordinary and special business of the evening, the meeting should resolve itself into a conversazione, at which slides, illustrative of the subject of meeting, should have precedence of other objects of interest and novelty. Before separating, the subject of the next meeting should be announced. This recommendation was adopted at a special meeting of the Society. The first meeting was held on May 26th, an abstract of the proceedings of which, and of the three following meetings, will be found embodied in the year's proceedings of the Society. Your Committee recommend the continuance of the Microscopical Meetings under the management of the officers of the Society. The effect will be to make the meetings of the Society fortnightly instead of monthly,—the first in each month for ordinary, and the second for microscopic purposes.

The thanks of the Society are due to the Brighton and Hove Dispensary and to the Medico-Chirurgical Society for the use of the room at the Dispensary in which the meetings of the Society are held, and to those gentlemen who have read papers and exhibited microscopes and specimens, and contributed to the Library and Cabinet.

The Field Excursions, since the last Report, have been as follows:—October, 1869, Uckfield; May, 1870, Balcombe; June, 1870, Findon (by invitation of H. Willett, Esq.); July, 1870, Black Rock, and a Dredging expedition; August, 1870, Steyning; September, 1870, Lewes.

The Annual Excursion took place on the 30th of June, to

Balcombe, from whence the Members with their friends walked through a very beautiful and interesting country to Staplefield, where they were hospitably entertained at luncheon by J. F. Hancock, Esq. They afterwards visited Slaugham Place, and proceeded to Hayward's Heath to dinner. It was altogether a most pleasant and successful excursion.

In December of 1869, a Clock was presented privately (owing to a domestic bereavement) by the Members to Mr. Gwatkin, Hon. Librarian, as a slight token of the esteem and regard in which he was held by the Society.

In concluding their Report, your Committee beg to request the Members to endeavour to promote the prosperity of the Society, by bringing its merits under the notice of their friends; by contributions of works of Natural History to the Library; of Photographs, or Drawings of Objects of Natural History, for the Album; and of Slides for the Microscopical Cabinet; and particularly by reading papers during the ensuing year.

At a Special Meeting of the Society, held on the 10th of March, the following additional Rule was made, viz.,—

"That a difficulty having arisen respecting the records of the Society, the Secretaries shall take, or cause to be taken, minutes of all proceedings, and shall read the same at the ensuing meeting; and Members of the Society shall be requested to assist the Secretaries with notes of objects shewn, and abstracts of papers read, so that a record of the work done by the Society may be preserved; and that they shall have authority to publish the proceedings of the Society, as they may think proper, unless forbidden to do so by the author of any paper."

ABSTRACT OF PROCEEDINGS.

1869-70.

September 9th.—A Microscopical Meeting.

Mr. T. H. Hennah exhibited a living beetle, showing the structure of the mouth, and *Marchantia polymorpha*, showing fructification and elaters.

Mr. J. Smith exhibited fructification of Hepaticæ.

Mr. Glaisyer exhibited *Sphagnum Squarrosum*, with porous cells and spiral fibres.

Mr. Gwatkin exhibited skin of toad, fossil wood from the Great Desert, lung of the boa constrictor, and large intestine of ostrich.

Dr. Hallifax exhibited sections of insects, viz. : lady-bird, showing optic nerve and ventral ganglia; bee, showing tongue and suctorial apparatus ; house-fly, showing proboscis ; and eggs of parasites of Bohemian pheasant and Mallee bird.

Mr. T. Cooper exhibited sections of yew tree, &c., embryo oysters, and Polycystina.

Mr. R. Glaisyer exhibited sections of crab shell, pinna, mitra, and Australian foraminiferæ.

Mr. Davidson showed foraminiferæ from Nice.

Mr. Wonfor exhibited *Pleurosigma formosum* and *P. angulatum* with a Reade's prism; injected preparations of Dr. Thudicum's trichinous rabbit; and a series of slides of *Pulex penetrans*, chigoe, or jigger, lent by Mr. T. Curties, of Holborn, and consisting of the male and female : female with enlarged and globular abdomen, containing eggs, &c.

October 14th.—An evening for the exhibition of Specimens.

Mr. J. Dennant exhibited several rare birds, lent him by Messrs. Pratt and Sons, shot recently in the vicinity of Brighton, the most striking being a variety of the wheat-ear, having a white splash on the right wing; a tawny pipit, shot on the 5th of September at Rottingdean, by Mr Guthrie; and a hoopoe, shot on the 15th of September at Preston (this was quite a young bird, as was evident from its plumage, and probably bred in England).

Mr. Elphick exhibited ears of wheat, affected by smut, obtained near the Race-hill, and pointed out that, if proper care were taken when sowing, smut ought not to be found. This led to a discussion on the various forms of fungus, as seen in the cereals, and the methods employed in destroying them.

Mr. Smith exhibited a collection of American and Norwegian mosses and sphagna, some of them of great rarity; two very rare ones, in beautiful condition, were *Splachnum luteum* and *S. rubrum*, from Norway. It was pointed out that these, like many of the family, were only found on the excreta of herbivora, while others as *Tetraplodon mnioides*, &c., were found on the excreta of carnivora. Among the Sphagna were *S. Molle*, recently discovered in Sweden.

Mr. Nicholls exhibited a common gannet, sent him that morning by his brother, evidently a recently killed one; but he could not say where it was shot.

Mr. R. Glaisyer exhibited shells of a kind of *Unio*, remarkable for their very great thickness and the strength of the hinge, found in the rapids of North American rivers, and a specimen of the *pinna*, with its byssus. From the latter gloves, stockings, and other small articles are manufactured, resembling silk in their appearance; it does not, however, appear capable of taking any dye.

Mr. Wonfor exhibited varieties of butterflies and moths, taken this year, among which were dwarf specimens of small white, varieties of common, clifden and chalk-hill blues, varieties of *Agrotis Saucia*, and specimens of *Trigonophora Empyræa*, &c., and mentioned that two specimens of the rare moth, *Leucania vitellina*, had been taken near Brighton. He also mentioned that he had seen at Swaysland's living specimens of Richard's pipit and a young rosy bull-finch, taken on the Downs, besides a specimen of the little gull, shot near the head of the New Pier.

November 12*th*.—On "Mosses," by Mr. C. P. SMITH.

The first appearance of mosses is a green mass of threads called the *prothallus*, on which buds are formed, which develop into the perfect plant. The stem consists of cellular tissue, the cells being more or less elongated, some few exhibiting faint indications of spiral structure. In length the stem varies from a few inches to several feet, while, in Buxbaumia, it is so reduced as to appear, at first sight, absent.

The two main divisions are recognizable by the methods of branching, viz., the *Acrocarpi* or terminal fruited, and the *Pleurocarpi* or lateral fruited.

The leaves vary very much, and generally consist of but one layer of cells; exceptions, however, are seen in *Leucobryum and Sphagnum*; sometimes leaves are found consisting entirely of parenchymatous and prosenchymatous cells, but generally the basal cells are more lax than those at the tip. With one exception they are without Stipules.

The margins of leaves vary, the most remarkable being the *equitant*, which partially sheath each other.

The amount of chlorophyll is also variable, some being saturated with green, others nearly white from its absence, while various shades of brown, olive, purple, and black are met with.

The simplest form of reproduction is by *gemmæ*, which occur on various parts of the plant; but the true generation is by male and female flowers, first discovered by Hedwig 90 years ago—for a long time disbelieved, but now accepted as an established fact.

In *Acrocarpi* the female flowers are at the apex, the male at or one side, while in the *Pleurocarpi* the male and female flowers are generally in the vicinity of each other.

The various parts of the flower, such as perigone, antheridium, antherozoids, archegonia, sporangia, calyptra, columella, and peristome were next described in detail, and illustrated by enlarged drawings of the various parts.

The economical properties and *nidi* were next described, and it was pointed out that to the microscopist they opened fields of research unsurpassed by any other branch of natural history.

A number of microscopical preparations, illustrative of the paper, was then exhibited.

Mr. Smith then presented to the Society a complete Bryological Flora of the County of Sussex. (This has since been published by the Society.)

Mr. Davies presented a rare grass, *Gastridium lendigerum*, obtained by him October, 1869, in the Weald of Sussex.

December 9th.—On "The Gemmæ of Mosses," by Mr. C. P. Smith.

In flowering plants, the seed is an embryo plant, provided with a stem, root, and leaves, which only require developing to produce a perfect plant. In mosses, however, the spore is but a simple cell, without any germ or embryo of a future plant, which gives rise to an intermediate state : so that mosses are plants of two or rather alternating generations.

In the first, the spore gives rise to the prothallus, pro-embryo, protonema, or any other name which botanists may bestow,—perhaps prophyton would be as good a name as any.

The first generation is completed when the different sexual organs are formed, by the co-operation of which the primary mother-cell of the first generation is produced, which afterwards becomes the fruit rudiment, and eventually the capsule,—thus completing the second generation.

In addition to this kind of generation, there was another by means of *gemmæ*, or sprouts. In all known British mosses, none of the Pleurocarpi are as yet known to show gemmæ, which Wilson defines as loose granular bodies, capable of becoming plants.

Schimper says the little gemmæ arising from the axils of *Webera annotina* form new plants, the granules that form the powdery matter in *Aulacomnion*, the lenticula in the beautiful cups of modified leaves in *Tetraphis*, the brown filamentous masses on the paginæ or on the tips of leaves in *Orthotrichum* and *Syrrhopodon*, the pale radicles covering the leaf apices of *Leucobryum*, the pale radicles overrunning the stems of *Dicrana*, and certain leafy appendages in other plants all take the place of seeds and greatly assist in the multiplying of plants.

In *Tortula papillosa*, which grows on trees in Sussex and elsewhere, and has a thick spongy nerve, with both pagina and nerve papillose, the gemmæ are found on the upper parts of the inside of the leaf. The fruit of this moss is unknown except in Australia. *Didymodon gemmascens* has the nerve excurrent and the tip crowded with gemmæ. In *Tetraphis pellucida* they are in pedicellate clusters, with leaf cups at the ends of separate stems. In *Webera annotina* they assume the form of buds in the axils of barren branches. *Bryum atropurpureum* has tubercles or bulbs in the axils of leaves. On the leaves of *Orthotrichum Lyellii* grow little strings of cells, which have been thought to be of confervoid nature, and have been called *Conferva castanea* and *C. orthotricha*, but it has been demonstrated that these confervæ gradually develop into young plants of mosses. *Oncophorus glaucus* has a great number of cells, forming a dense mass at the tip of the leaf, and which in the damp season give rise to a great number of young plants ; hence this plant is common in countries when it does not bear fruit. The gemmæ invariably precede the fruiting time in such mosses as are known to produce capsules.

The question arose, was there any means of showing whether they differed from the spores which had been matured in capsules. The subject of the growth from gemmæ had not been thoroughly investigated ; it was his intention to investigate the phenomena, when he hoped to lay before the Society some new facts. Hofmeister had grown plants from single detached leaves, and in this case, as in the spores, the pro-embryo of the second generation was formed.

The paper was illustrated by drawings and bryological specimens prepared by Mr SMITH, and exhibited under microscopes by the following gentlemen :—

Among the most striking were *Mnium cuspidatum*, hermaphrodite flowers, showing archegonia, antheridia, and paraphyses ; *Neckera oligocarpa*, female flowers, consisting of archegonia and paraphyses ; *Mnium hornum and Polytrichum commune*, by Mr HENNAH, shewing male flowers.

Cinclidium Stygium, with cupuliform peristome, *Ceratodon purpureus*, peristome with divided teeth ; section and leaf of *Polytrichum formosum*, covered with papillæ ; *Ephemerum serratum*, with prothallus and young buds, by Mr. SMITH.

Pottia cavifolia, section of leaf exhibiting layers ; *Orthotrichum Lyellii* with confervoid gemmæ on the leaves—this is the *conferva castanea* of the early botanists ; *Sphagnum acutifolium*, exhibiting two sets of cells, one set containing spirals, by Mr SEWELL.

Aulacomnion androgynum, showing gemmæ on "pseudopodia," *Ulota phyllantha*, with gemmæ on the tips of the leaves—in this case the gemmæ are aggregated cells ; and *Tetraphis pellucida*, in which the gemmæ are enclosed in a lenticular bud, by Mr WONFOR.

January 13th, 1870.—"On Volcanic Theories," by Mr. J. E. MAYALL.

If science were nothing more than a registry of facts, it would still be a degradation to assign everything to a special cause, a plan pursued in the past, and which had led to extravagant theories. It was well known that no one branch of science could be taken alone, but in relation to others ; the study of geology was connected with the astronomical motions of the earth, and volcanic action was intimately allied to astronomy.

Taking the ideas of Laplace respecting the extent of the solar atmosphere, and the manner in which nebulous matter would break off into zones, which, on cooling, would assume the spheroidal form, and go on rotating, it was evident the planets rotated in the same direction, and nearly in the same plane, as the sun. Not only did geology show that the earth had passed through various stages of development, but spectrum analysis revealed the fact that the composition of the sun and earth was the same, and meteorites contained the same metals as our earth.

The rocks forming our earth's crust were both aqueous and volcanic, and though the latter agency was now less violent than in the past, still very great submarine action was going on and raising the bed of the Pacific Ocean. Countries like France, India, &c., in which no volcanoes at present are in an active state, had, ages ago, as evidenced by the nature of their mountains, been centres of great disturbance.

Turning to the 400 active volcanoes, they could be arranged into 22 series, and were most of them near the sea and nearly parallel to the coast line; their heights, which varied from 939ft. to 23,000ft. above the level of the sea, their geographical position and dates of eruption had all been tabulated; yet no systematic observations had been made on any one of them. It had been noticed that earthquakes preceded or followed volcanic eruptions, as was the case with the earthquake at Lisbon, which shook one-twelfth part of the earth's surface; and the eruptions of Vesuvius in 1767, so well described by Sir W. Hamilton. The interior of the earth contained a molten mass, portions of which, separating, caused local action; when the molten matter came in contact with water, it swelled out and produced upheavals, fractures, &c.

Looking at the volcanoes it would be seen they were in parallel lines, having a spiral tendency, and corresponding to the cork-screw motion of the earth. The great mass of volcanic action lay between the tropics; if beyond, it was deeply connected with the molten matter. From the comparative density of the earth, it was evident the mass augmented in density towards the centre, in addition to the tendency of pressure to produce a similar result. Not only on the earth, but in the moon, evidences of volcanic action were apparent, and almost nightly Pratt, of Brighton, was adding something new in connection with the Volcano Plato. Solar spots and other phenomena shewed that great volcanic disturbances were going on in the sun, while spectrum analysis revealed the fact that it was in a state of perpetual incandescence.

The corkscrew motion of the earth, produced by the nutation of its axis and the precession of its equinoxes, altering the position of the earth in relation to the sun, explained how portions now in Arctic regions, had, at one time, a temperate climate; and accounted for the curves taken by the lines of volcanoes. The deeper-seated the volcano, the heavier would be the metals thrown out, and seeing that the equatorial diameter was 25 miles greater than the polar, it followed that the crust between the tropics was thinner,—hence the action was greater and more frequent within the torrid zones. All the chains agreed in their curve with the corkscrew motion of the earth, and went to prove an intimate connection between volcanic and astronomical action, and as this movement was slow, the development of the earth had been slow and progressive.

Mr. MAYALL communicated a note on what he believed to be a new fact in connection with coal gas. While engaged in the Spectrum Analysis of organic bodies he had found the presence of copper interfere with the results. Examining the solutions no trace of copper could be found; it then occurred to him that the copper might be present in the common coal gas used in the Bunsen lamp. Having candles, with wicks dipped in the chlorides of several metals always handy as standard spectra, he compared the flame of a copper candle with the flame of the coal gas, and found their spectra identical. He inferred from this that the copper was generated from pyrites contained in the coal.

February 10th.—On "Seeds," by Mr. T. W. WONFOR.

Commencing with the first appearance of the ovule, in the unexpanded flower-bud, as a pimple consisting of an aggregation of cells, its gradual development and impregnation by the pollen, together with its several parts, were traced, until the perfect seed, ready for dissemination and containing within it the embryo of the future plant, was fully formed.

The various modes by which the seed is disseminated, the great number produced by some plants, the power possessed by some seeds of resisting extremes of heat and cold, and the wonderful property possessed by many seeds of preserving their vitality under apparently very adverse circumstances and for long periods of years, were each discussed.

On the subject of artificial selection, a point not sufficiently regarded by agriculturists and florists, it was shown what might be done in increasing both the size and number of seeds by carefully following a plan similar to that adopted with such success by Mr. F. Hallett, of Brighton.

Reference was next made to seeds as objects for the microscope. Having spent several years in the collection and examination of the seeds of wild and cultivated plants, as objects for the microscope, he considered few things in the vegetable kingdom presented such diversity of form, markings, and beauty. Although unwilling to lay down any law for classification, by means of the external appearance of seeds, he had often been able, in the case of unknown seeds, to determine the family to which they belonged, from certain peculiarities common to many plants of the same family.

Among some of the most interesting families, affording good microscopic objects, might be mentioned the *scrophulariaceæ*, containing the mulleins, foxgloves, figworts, paulownias, &c. ; the *compositæ* containing many curious seeds ; the *caryophyllaceæ* or pink family, containing a very great number of very beautiful seeds, not the least beautiful being the common chickweed and the ragged-robin ; the *papaveraceæ* exhibiting great variety of markings ; and the *orchidaceæ*, characterized by what had been termed the appearance of net purses, each containing a single gold coin.

The majority required no other preparation than that of being mounted dry. Some, like the orchids when mounted in balsam, formed good polariscope objects. For making out the several coats of the seed, the embryo, &c., sections cut on the plan, recommended by Dr. Hallifax, gave admirable results.

The paper was illustrated by a large collection of seeds, and by microscopic preparations, including sections shewing the several parts made by Dr. Hallifax.

Mr. Wonfor also exhibited a collection of galls, found on British plants, made by Mr. W. H. Kidd ; and read a description of each and of the insects producing them, as well as their parasites, drawn up by the same gentleman. This collection, intended for the Brighton Museum, has since been placed in the Economic Section.

March 10*th*.— * "A Sketch of the Geological History of England, so far as it is at present known," by Mr. Clifton Ward, was read by Mr. T. W. Wonfor.

The changes brought about by submersion, deposition, elevation, denudation, &c., together with a description of the animal and vegetable types of the various periods, were very graphically described; while the amount of land above water in England at the different periods was represented by a series of fifteen charts.

April 10*th*.—A report on Soundings, made by Sir E. Parry, in 1818, in Arctic Seas, by Mr. T. H. Hennah.

The history of these soundings was this: Mr. J. Cordy Burrows, some years since, purchased from the widow of Sir E. Parry his geolcgical collection, among which were some soundings labelled in Sir E. Parry's hand-writing. The geological specimens were placed in the Brighton Museum, but the soundings were given to Mr. Peto, who, in January of this year, handed them over to Mr. Hennah for examination.

The soundings were made by Sir E. Parry, in his Arctic Expedition of 1818, in Davis's Straits and Lancaster Sound, between Lat. 68 N. and 76.15 N., and Long. 73 W. and 78.34 W., in depths between 22 fathoms and 1,158 fathoms.

Those from shallow water consisted of fragments of stone and coral, water worn evidently by a strong current; Zoophytes, a microscopic madrepore, and the tube of an annelid were found in them. From deeper localities the soundings were rich in organic *debris*,

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* This paper has since been published by Trübner and Co., 90, Paternoster Row.

much of the same being in the form of the Testæ of arenaceous Foraminiferæ of different kinds ; Diatomaceæ, particularly large Coscinodisci, were very abundant. Sponge Spiculæ also abounded, but shelly Foraminiferæ and Polycystinæ were very scarce.

Of the Foraminiferæ in many cases casts only of the inside of the shells were found. The sand from Lancaster Sound, Lat. 73 N., and 673 fathoms, borings of annelids, still containing the skins of the inhabitants, were found, affording conclusive evidence of the existence of life at great depths in Arctic Seas.

It was much to be regretted that the soundings, which might years since have taught so valuable a lesson, should have been allowed to remain unexamined until their historical interest and the prominence of deep sea-soundings had caused their being brought to light.

Allusion was then made to the recent discoveries of Carpenter, Jeffreys, and Thompson in relation to the physical condition of deep seas – to the geological changes now going on, as of old—and to the addition to our recent Fauna of many species before known only in a Fossil state. Dr. Carpenter found large areas of very low temperature in the temperate and intertropical zones coexistent with high surface heat. The fauna of these cold areas in low latitude corresponded precisely with that found in Sir E. Parry's soundings from Arctic Seas. When the bottom temperature was high the fauna changed its character. The cretaceous formation was shown to be going on in warm localities, and a greensand accumulation in close proximity under deprivation of heat.

Satisfactory theories respecting the means of sustenance had been offered through the increase in our knowledge of the forms of life. The lowest forms—mere living jelly—were assumed to absorb nourishment from the different remains of surface life, these in turn affording food for higher organisms. Carpenter found in the gases, separated from deep water, a constant increase of carbonic acid gas where life abounded, and a corresponding decrease where it was scanty. In the ocean, as on the land, food and oxygen, excretion and carbonic acid, were the conditions and consequences of life. It was impossible to over-rate the discoveries of Carpenter and others.

It might be mentioned that the Difflugia of our heath streams afforded convenient examples for the examination of the Arenaceous Foraminiferæ in a living state.

The subject of the fund being raised for the widow and family of the late Professor Sars was introduced by Mr. HENNAH ; but the Society not having power to vote its funds for such a purpose, a subscription was made among the members present, to be forwarded to Professor Gwyn Jeffreys, who had brought the subject before the British scientific world.

May 12th.—An Evening for Specimens.

Dr. BADCOCK exhibited a large piece of fossil wood, recently obtained at Portland Island.

Mr. PENLEY laid on the table a copy of the first part of the Flora of Tunbridge Wells, by Dr. Deakin ; and specimens of Oak, picked up at Tunbridge Wells, which were stained by a fungus, *Helotium æruginosum*, growing in the oak. This supplies the green wood seen in Tunbridge Wells ware.

Dr. HALLIFAX commented on the growth of this fungus, and stated he had raised it from spores obtained from specimens of the green colored oak. There was no doubt of the true nature of the fungus, for in thin sections of the infected wood, the mycelious threads, and at times the spores, could be detected.

Mr. WONFOR remarked on the fact, that this fungus was specially found in woods in England and France, where the Hastings sands cropped out, which would lead to an inference that there was something peculiar in the chemical conditions of the soil, &c., favorable to its development.

Mr. HENNAH exhibited a couple of sea mice, *Aphrodita hispida*, dredged up off Brighton a few days before, and remarked on the hairs as microscopic objects ; he also announced that Mr. Peake had found a Pygidium on the lace-wing fly, *chrysopa Perla* which he believed was an original discovery.

Mr. DENNANT exhibited a bottle of ooze, obtained in the Porcupine Expedition, in Lat. 47-35 N., Long. 12-15 W., at a depth of 2,435 fathoms, the surface temperature being 65.5 Fahr., bottom temperature, 35.5 F.; pressure equal to 457 atmospheres, or nearly three tons to the square inch. The ooze consisted of calcareous mud, containing Globeriginæ and Foraminiferæ.

Dr. HALLIFAX exhibited a number of very beautiful micro-photographs, taken by himself, some of the most striking being: stomach of owl (40 diam.) showing the glandular structure; teeth of medicinal leech (480 diam.) in which the true nature of the teeth was well shown; sections of the proboscis of the blow-fly, one transverse the other vertical, intended to exhibit the rasping teeth in the centre of the disc—in the photographs they were almost isolated and stood out very conspicuously; poison bag of spider, with poisonous fluid exuding therefrom,—(in mounting, a slight pressure on the covering glass had caused the poison fluid to exude); a curious spine of echinus, tracheæ of silk-worm, and tongue of bee.

Mr. WONFOR exhibited cluster cups on the dog-violet and common nettle; cast of owl, consisting of fur and bones of mice; and cocoons and eggs of the emperor moth, *Saturnia Carpini*, and forty-three males of the same moth, attracted in two days at Polegate and Tilgate by one female; and read a paper on the power possessed by some female moths of attracting the males of the same species in great numbers and from long distances.

The *Saturnia Carpini* belonged to a group, the females of many of which are noted for the peculiar property they possess of collecting, or, as the old entomologists named it, "sembling" the males from long distances. Some consider the females emit an odour perceptible to the sense of smell in the opposite sex, though the existence of such an organ has not yet been satisfactorily localized by naturalists. Be that as it may, they certainly have the power of drawing from long distances, and in great numbers, the males of the same species, who, as it were, intoxicated, rush wildly after the females, heedless of danger, and allow themselves to be captured with the greatest ease. Nay, what is more strange, few persons walking over districts where these creatures abound ever see them, unless they are provided with a virgin female, and then, under favourable circumstances, and always against the wind, the males come flying up singly, in twos and threes, The result of two days at Polegate and Tilgate was detailed, when 50 males were attracted by one female, and settled on a gauze-covered box, 11 at the former and 39 at the latter, in each case against the wind, and between 2.30 and 4 o'clock. A series of experiments last year with the Oak Eggar Moth were also detailed.

Now, the question naturally arose, by what sense were these creatures attracted? It could not be by sight, for the females were in a box on the side of a slope, and the males flew across the valley and close to the surface of the ground. When trying similar experiments with other species, a field with a wood at the end was selected, and the males were seen flying over the tops of the trees. If it were by smell, then the odour, to us quite imperceptible, is wafted to enormous distances.

Another very natural question arose: did the same state of things prevail with other insects? To a certain ascertained extent it did, and, doubtless, the list of known examples might be extended, if experiments were tried. In the case of the Apterous and Semi-apterous moths, such as *Orgyia*, *Cognostegma*, and many others, the females hardly move from the place where they emerge,—nay, some of the Vaporers even lay their eggs on the empty cocoon, and there is little to wonder at in the males seeking their society; but with those species which possess the power of very rapid flight, the fact of the females remaining stationary and quiet is very remarkable.

This peculiarity has long been known to British entomologists, by the older of whom, such as Barbet, Moses Harris, and Haworth, it is termed "sembling."

Examples of "sembling" with the Lappet *(G. Quercifolia)*, Convolvulus Hawk *(S. Convolvuli)*, Satin Moth *(P. Salicis)*, and the Lackey *(P. Neustria)*, were described, and it was stated that other examples could be given to prove the point that this power of "sembling" was not confined to one family of moths. Those who had the time and opportunity should try experiments with females of each family, and see whether the same law did not prevail, more or less, with all. Several male butterflies may often be seen round one stationary female; and last autumn, wishing to diminish the *tipulæ* daddy-longlegs, he (Mr. W.) instructed his youngster to collect all the females he could as they emerged from the grass. As he caught them he placed them in a paper box made out of an envelope, and became somewhat annoyed by finding the males not only flying at, but alighting on him in great numbers. This was considered another case of "sembling."

Some very extraordinary statements respecting the enormous distance to which the males of the Tusseh moth fly in India, recorded in Vol. VII. of the Linnean Transactions, were next mentioned; and attention was called to the idea that one of the reasons why males were attracted at times was owing to their having periods of flight.

A curious confirmation of the idea that the moths had times of flight was given on Saturday, May 7th. Mr. Goss had taken a female up to Balcombe in the morning, and had not attracted a male until between two and three o'clock, between which time and a quarter to four o'clock five were attracted. Now, curiously, the time agreed exactly with the times at which in every case the males *Carpini* began and ceased coming up, on the 22nd and 26th of April.

May 26*th*.—"Microscopical Section."—On Systematic *Recent* Examination with moderate powers, by Mr. T. H. HENNAH.

Whether we regard the extension of our knowledge of Natural History, the success of this Section, or our own pleasure in microscopic study, Systematic *Recent* Examination, with moderate powers, is alike indispensable. Most of the discoveries with the microscope have been made with instruments of moderate power and cost, and have resulted from patient, diligent observation, and have depended less upon the instrument than upon the method and perseverance of the workers.

Pride in the possession of a fine instrument, and a consequent desire to exhibit its powers, often leads to the exclusive study of conventional test objects, which, while it gives command of the microscope in a special way, and stimulates opticians to improvements, too frequently arrests original investigation. The ordinary work of the Naturalist can, in the first instance, be better pursued with low than with high powers. Extreme nicety of preparation and elaborate illumination are not required with them, while the excellence of modern halfs and fifths is so great that appeals to higher powers are only occasionally needed. Whether we use high or low powers, we should—in original investigations—be on our guard against the unconscious tendency of the mind to make "the wish father to the thought;" and, although we cannot be altogether free from preconceived ideas, their influence should be limited to the *suggestion of enquiry.*

The structure of some of the diatom valves, which, although demonstrated nearly fifteen years ago, was, in consequence of the erroneous views of Griffiths, Wallich, and others, held still to be an open question, until only last year, the President of the Royal Microscopical Society announced *his* demonstration of their structure as a "*New birth to the Microscope.*"

Most conducive to a true knowledge of objects is their examination in a recent state, and an acquaintance with the appearance of ordinary things will be found much more valuable than the settlement of a *diatom* or *podura* question.

Our principal object, however, should be to enquire into the natural history of our own locality, the minute fauna of which has been but imperfectly examined.

Our shore offers every inducement to extend research. The smaller crustaceans are scarcely known amongst us, although two of the most curious and interesting—the *Caprella* and *Ammothea*—abound on the weed at Kemp Town and give promise of allied species of greater rarities as a reward for search. Acorn barnacles and shore crabs are instances of strange metamorphosis, as are also the polyps, of which *laomedu obliqua* and *geniculata* abound. The urn-shaped egg cases of *purpura lapillis* and the ribband-like strap of eggs of *doris tuberculata* can generally be found to illustrate the extraordinary embryonic development of the mollusca; there is, in fact, scarcely a limit to the list of subjects waiting for examination.

For a full appreciation of minute structure comparison with permanent specimens is both necessary and interesting. They cannot, however, be seen under sufficiently varied conditions, and we may as well take an ancient Egyptian as a specimen man as trust exclusively to the mummies in balsam which fill our cabinets; we must, instead,—as students of Nature,—follow her home and watch her ways patiently, as far as we can.

Nothing can be known of the protozoa, or rotatoria, unless we examine them in life. Cyclosis in vegetable cells must in like manner be seen in life to be seen at all. The generation of the cyrtogams would be really hidden if the germination of their spores had not been a subject of unwearied attention.

The structure of the Foraminiferæ was not demonstrated by Carpenter without systematic work. The discovery of the alternation of generations was due to careful study, and the knowledge of the fact of the Polyps of our shores having other existences as free swimming Medusæ considerably modified our previous ideas respecting them. The well-known sections of insects, by Dr. Hallifax, show the viscera and nervous system undisturbed, and—better still—the advantage to others, as well as to ourselves, of well directed work.

As a concluding illustration, the stupendous tale of past life, read by the microscope in our chalk cliffs, would have been incomplete without that systematic comparison with the bottom of the present ocean, which has proved the persistence through ages, not only of the laws of Nature, but of the forms of life.

Our interest must increase with well-directed study, and numberless facts, which we at first pass by unnoticed, may eventually teach lessons of lasting use.

We can all make some advance to such knowledge by the systematic study of recent things, and by our work justify the formation of this section of our Society.

The meeting then resolved itself into a Conversazione, at which the following gentlemen exhibited microscopic objects :—

Mr. J. Dennant exhibited sections of fossil teeth from the coal measures.

Dr. Hallifax showed some of his sections of insects, in which the internal parts were displayed *in situ*, one of the most striking being the lady-bird.

Mr. Cooper exhibited deep sea soundings from different localities, and Foraminiferæ from Hastings, the Mediterranean, and Australia.

Mr. Sewell exhibited injected preparations of Dr. Thudicum's rabbit, an animal possessing a world-wide reputation from being fed at times on muscle containing *Trichina spiralis;* the presence of entozoa was traced in all parts of the voluntary muscle, but nowhere else.

Mr. Aylen showed a number of entomological preparations.

Dr. Addison exhibited blood, as acted upon directly by various agents, such as diluted sherry, &c., the effect produced was an alteration in the appearance of the blood discs, and, as some expressed it, the formation of tails; this was considered by no means the least interesting part of the evening's display.

Mr. Peake exhibited the *pygidium* of the lace-wing fly, *chrysopa perla*, discovered by himself. The existence of this peculiar structure has long been known in the flea, but has not been pointed out in any other insect.

Dr. Kebbell exhibited with a Nachet's prism the rasping teeth situated on the disc of the proboscis of the blow-fly.

Mr. Smith showed fruit of Hepaticæ and Epicarpal Stomata of moss, *funaria*. These are only found on the fruit of mosses, and never on the leaves.

Mr. Hennah showed plant circulation in the hairs of the *Tradescantia*, spider-wort, and remarked that every microscopist should possess a root of this plant is his garden; pollen showing the production of the pollen-tubes and Caprellæ from Black Rock, Kemp Town; and Desmids, mounted in 1865, in the water in which gathered, and showing the chlosophyl well preserved.

Mr. Wonfor exhibited a slide of Diatoms, mounted by Müller, of Holstein, on which, in the space of a quarter of an inch, 408 separate siliceous skeletons of plants were arranged in symmetrical rows. This slide, which was a marvel of skill in microscopic mounting, arrangement, and perfection of specimens, was kindly lent for the occasion by Mr. T. Curteis, of Holborn. It was to the student of this department not simply a wonderful slide, but a cabinet of objects; in fact, a printed catalogue lay by the side of the microscope for reference to any particular valve. He also exhibited live caterpillars of the emperor moth; very gorgeous crystals of *hematoxylyn*, the colouring matter obtained from log-wood; artificial *alizarine*, prepared from an oil of coal gas (the discovery of this substance is regarded as a great triumph in chemistry, as it resembles the red dye obtained from madder); polyzoa, and other interesting objects.

In addition to these microscopic objects, Dr. HALLIFAX exhibited a number of beautiful microphotographs of his own taking; and Mr. J. HOWELL, pebbles picked up on the beach, shewing encrinites, pentacrinites, bryozoa, cidaris spines, &c.

June 9th.—On "Diptera and their Wings," by Mr. PEAKE.

While wings are common to the whole order of insects, the Diptera consist entirely of two-winged flies, which, instead of a second or hinder pair of wings, have little thread-like bodies, terminated by knobs; these are called *Halteres*, were originally considered balancers, but are now supposed by some to be *olfactory* organs, by others organs of *hearing*.

From many points of resemblance, he thought they were analogous to the hind wings of insects, and that, at present, their special use had not been ascertained. Besides the *Halteres*, they also had winglets *(alulæ)*, which were thought to be only appendages to the fore wings.

Among the Diptera, three classes of flies were found, differing in the form of their bodies and the shape of their wings; first, the slender flies, such as gnats, having long bodies, narrow wings, and long legs, but without winglets; secondly, those whose bodies, though slender, are more weighty, as the *Asilidæ*, having larger wings, shorter legs, and very minute winglets; lastly, those like the house-fly, with short, thick, and often very heavy bodies, furnished with proportionate wings, shorter legs, and conspicuous winglets. From these circumstances it might be inferred that the long legs of the light-bodied flies acted as rudders, while the winglets of the larger and heaviest-bodied flies assisted the wings in flight.

The wings may be described as transparent membranous organs, consisting of two laminæ, united by veins or nervures, and upon their arrangement, and the form of the antennæ, the distinguishing characters of the Diptera are formed. The several parts of the wings and nervures, and their differences, as seen in the great groups, *Nemocera* and *Brachycera*, were next described, and the paper illustrated by very beautiful drawings, made by Mr. Peake, with the Camera lucida, from preparations of the wings and their parts, and by microscopical preparations of the wings, &c.

June 23*rd*.—"Microscopical Section."—Mr. T. W. Wonfor on "Infusoria."

If any vegetable or animal substance was placed in water, in a few days the water was found to be full of minute organisms: to these the name of *Infusoria*, or infusion animalcules, had been given, but many of those first called *Infusoria* had by latter observers been placed in the vegetable kingdom; while others, at first named as distinct species, had been proved to be the early stages of higher animals, and others were now classed among a different group of animals. The class *Infusoria* was, therefore, much more limited than at one time supposed to be, and increased knowledge might prove that many more were only the early stages of other types of life.

The nature of their substance, mode of development, increase, and propagation were then described. So widely were they distributed that scarcely anywhere can water be found which does not contain some Infusoria. Many will only live in fresh water; others are found in salt or brackish water; while others are only to be met with in water containing decomposing vegetable or animal substance. Hence water contaminated by sewage matter always shows certain types. Many are only to be found in particular infusions, while others are common to several.

Their appearance, under certain conditions, had led to theories respecting spontaneous generation, a much debated and debatable point; but as the atmosphere seemed, according to the researches of Tyndall and others, to be full of germs, their sudden appearance in favourable situations was not surprising. The water in which flowers were kept was sure to yield some sorts; in fact, he had an abundant supply of one kind from some water in which mignonette had been only three days. Water in bird fountains and water bottles, if not looked after, would be sure to contain Infusoria.

The rest of the evening was spent in examining the different forms of Infusoria brought for exhibition.

July 14*th*.—"On the Annual Excursion by Mr. T. W. Wonfor."—The district visited on the occasion of the 16th Annual Excursion was Balcombe, for Staplefield and Slaugham Place, proceeding to Hayward's Heath to dinner. The objects seen and obtained, the places visited, and the chief incidents of the day were duly described.

Mr. J. Robertson then read a paper on "Sussex Centenarians, with remarks on Thomas Guerin."

He considered one of the functions of a Natural History Society was to verify the statements of all persons in the County claiming to be centenarians. He would not enter into the questions of periodicity or any of the great problems on life, about which man knew less than of many other things, but confine himself to the question whether men or women had lived over 100 years. In 1858 he had, in the public papers, demanded proofs of the birth of those cases alleged to be over 100.

Sir G. C. Lewis had pointed out that, in the annals of the Peerage, where the records of births, &c., were accurately preserved, no cases of such longevity were to be found. Seven years ago he had found two cases, which were fully proved, and which he recorded in the tenth vol. of *All the Year Round*, viz., John Banks, of Seaford, who died in 1854, and whose baptismal register he had seen in the Church of East Blatchington: "1755, Feb. 9; baptised, John, son of John and Ann Banks.'

Extracts were given from the article respecting him and Robert Bowman, of Irthington, Cumberland, who completed his 115th year in 1820, and whose case was for 40 years under the notice of the Societies of Edinburgh.

Two cases in the County of Sussex had been proved, viz., Mary Constable, whose baptismal register had been seen by Archdeacon Otter, at Cowfold, by which she appeared to have attained the age of 101; and Mary Luxford, baptised at Hailsham in 1758, who reached the age of 101.

There were still living several beyond 90 who were making up to the century. Thus, Mrs. Glaisyer, mother of the last year's President, was 95; and Thos. Andrews, baptised at Hellingly, December 11, 1774, was now over 95. Dr. Barker saw a copy of the register taken in 1814, and saw Andrews a few days since in vigorous health. Phœbe Hessel, by her tombstone, was said to be 108; but the register of her birth is wanting. The late Sake Deen Mahommed, who died 24th February, 1851, was reported to be 102; but he came from a country where registers are not kept.

Thos. Guerin, who is said to have attained his 104th year on the 14th of May last, is reported to have been baptised in the parish of Skariff, Co. Clare. Attempts have been made to obtain his baptismal register, but without success at present. Perhaps the action of the Society, through some scientific Society in that county, might clear up this point. In a pamphlet published about Guerin, who might be seen daily on the cliff, he is reported as being born May 14th, 1766.

The question naturally arose, not why some lived so long, but why so many die? Medical evidence showed that most died of disease, and not of natural causes. Further enquiry might lead to the reason why some lived so long.

In the course of discussion, the case of William J. Lüning, of Merton College, who died at the age of 103, was cited as a case which had been proved.

Mr. Robertson exhibited fruit of the snail plant, which exactly resembles a snail in appearance. This plant is very common in the South of France.

In alluding to the Dredging expedition of the preceding

Saturday, Mr. Hennah spoke of the value of the "towing net," which could be used from the Pier as well as from a boat in obtaining surface life, such as the eggs of fish, medusæ, the zoœ of crabs, &c.

July 28th.—Microscopical Section. "On the Eggs of Articulata," by Mr. T. W. Wonfor.

While the eggs of all animals differed in their appearance and markings, the general characters were the same, viz., the germ vescicle, the yolk substance, and the vescicular envelope; the chemical constituents of these being albumen, fatty matter, and a substance not precipitated in water; the whole was enclosed in a shell membrane, or *chorion*, in some cases provided with a lid, or *operculum*, to facilitate the escape of the larva.

This lid was very palpable in some eggs, but neither so evident nor its use so apparent in others, seeing the larva ate their way through the shell itself.

At the apex of the eggs was a point called the *micropyle*, from which it was asserted the larva *always* emerged, and with which its mouth was connected; but the examination of a large number of eggs of different species had convinced him that so far from the mouth of the larva being situated at the micropyle, or that the creature escaped by it, being the fact, it was quite the exception in a vast majority of cases.

The colour of eggs seemed to depend on the colour of the yolk-globules, and changed as the embryo advanced, eventually becoming a very dark brown or black. In some eggs the changes could be watched; but in others the chorion, consisting of three layers, was so thick as to prevent examination, except by very delicate dissection.

The females, as a rule, deposited the eggs; but many examples occurred in which they were retained by her and deposited as larvæ. This was seen in the *crustaceæ*, many of which hatched them, either in external ovaries or in a space between the body of the parent and the posterior part of the shell ; in the black beetle *(blatta orientalis)*, which retained the larvæ in egg boxes until the creatures were ready to emerge ; in the blow fly, in which the eggs were hatched within the body, and deposited as maggots ; and in the *coccus*, which converted her body into a shield for the protection of the eggs.

Some creatures, by means of special apparatus, placed their eggs in the food of the larvæ ; some, like the ichneumons, within the bodies of other creatures ; and while some made no other provision than that of placing the eggs on suitable food, others constructed cells, suspended them in cocoons, covered them with varnish, rolled them in pellets, or glued them to the hair or feathers of animals.

As objects for the microscope, apart from their physiological interest, they were among the most beautiful things in Nature, presenting an almost infinite diversity of form, colour, and markings. Perhaps no other class of objects from the animal kingdom afforded so great an absence of uniformity and so much beauty.

Some of the most striking were the earth mite *(Tetranychus lapideus)*, which laid a discoid egg on stones on our Downs ; one of the blow-flies *(Anthomyia pluvialis)*, which deposited winged, honey-combed eggs ; and the lace-wing fly *(Chrysopa perla)*, which attached elliptical eggs by long stalks to the leaves of plants infested by Aphides, on which the larvæ fed. That afternoon he had discovered that they also fed on the eggs of other creatures, a fact, as far as he was aware, not noticed or recorded. The eggs of the Puss Moth looked like minute oranges ; the cabbage butterfly laid a primrose coloured egg, somewhat resembling lobster traps ; the common blue butterflies' eggs resembled exquisite ivory carvings ; but some of the most striking were found among the bird parasites. Those of the Bohemian pheasant resembled some of the polycystina, those of the ground hornbill were so much like polyzoa that they might be mistaken for sea mats. The parasite of the Australian Mallee bird resembled the seed-vessel of the corn flower, while that of the of Indian black-winged peacock was so much like a flower that a photograph or drawing of it might well be mistaken for an exquisite flower.

Those from which the larvæ had escaped make very beautiful objects. While in some cases it was necessary to perforate and extract the contents to prevent their shrinking, others, after steeping in benzole, might be mounted as dry objects.

The rest of the evening was spent in examining a large collection of eggs, &c., provided by Mr. WONFOR, and in viewing some beautiful photographs of bird parasites' eggs lent by Mr. Curteis, of Holborn.

At a Special Meeting, held the same evening, it was resolved that a letter of invitation, similar to the one of last year, be sent to the British Association, inviting them to hold their Meeting for 1871 at Brighton; such letter to be accompanied by a list of inducements of the same nature as sent last year; that Mr. Mayall be requested to present the letter of invitation, and to represent the Society before the Council of the British Association; and that he be empowered to state that, in the event of the invitation being accepted, the Officers and Members of the Society would do all in their power to assist in carrying out the objects of the Association.

August 11*th*.—On The Vertebrate and Invertebrate Eye compared by Dr. HALLIFAX.

Homology and analogy existed throughout the great divisions of the animal kingdom: homology signifying correspondence of structural components; analogy, ccrrespondence of function or use.

The fore-extremity — with the same components — is the arm in man, the leg in the race-horse, the wing in the bird, the fin in the fish, and the paddle in the seal,—all different expressions of uniformity of plan.

The wing of the fly and bird had the same function; but the former derived its structure from the external, the latter from the internal skeleton.

The vertebrate and invertebrate eye, in like manner, presented the same homology throughout.

Taking the human eye as an example, in addition to our knowledge of its anatomy, we have personal knowledge of its functions. In explaining its structure, it was mentioned that the retina,

—only about the 1-120th of an inch in thickness,—has five lay-
and while the other parts of the eye fulfil a mechanical or phy-
office, its function is vital or mental.

It was necessary to dwell longer on the compound eye of the invertebrates, as our knowledge of its structure is still imperfect. Little advance had been made for 200 years until the German physiologists lately showed that the eyes of insects and crustaceans—with a common function—pres[illegible] many homologies with those of vertebrates.

In the eye of the dragon-fly, the bulbed ends of the nerve fibres are not, as has been supposed, crystalline lenses, but true representatives of the rods and cones of the baccillary layer of the retina—the percipient element of the eye. These bulbed nerves are each covered with pigment, except that, where they come in contact with the lenses, there are apertures representing those of the vertebrate pupil. The lenses are the outer hexagonal facets, each a double convex lens of itself, the inner surface the most convex, and placed in contact with a bulbed nerve, each with its independent nerve forming a distinct eye. The facets in the compound eyes of insects can be numbered by hundreds, but as, with the human eyes, the two images are perceived as one, so the mental perception of the fly recognizes but a single object.

There was an absence in the eyes of insects of the crystalline lens and vitreous humor of the vertebrates, although the essential lens and cones are represented. The numerous facets of the eyes of insects allow, from their position, of extreme range of vision, and render unnecessary the powerful muscles of the vertebrate eye. The eyes of insects were most fitly placed and formed. With reference to their organization generally, organs should always be considered with reference to general structure.

In the single eyes of insects, placed between the compound eyes, and in those of spiders, he conceived that the spherical portion at the back of the single eye was an enlargement of the cornea, and not a vitreous humor.

He then exhibited, under the microscope, beautiful sections of the eyes of insects, in demonstration of his subject, which was well illustrated by diagrams.

August 25th.—"Microscopical Section."—An evening on mounting microscopic objects, when practical instruction in some of the different methods of mounting objects for the microscope was given by the following gentlemen :—

Mr. Hennah showed how to mount diatoms as dry objects, in the course of which operation he gave a caution against using a pipette in taking them out of the store bottle, giving preference to a glass-rod.

He next illustrated the mode of mounting in glycerine jelly, one of the most valuable agents in preserving animal tissue or vegetable preparations; and pointed out that objects could be temporarily preserved in it, and laid by without fear of injury, until time could be found for finishing the preparation.

Dr. Hallifax gave instruction in his method of making shallow or deep cells for objects mounted in fluid, and detailed the experiments he had made with different substances to form a cell of any thickness, which should be permanent, and, at the same time, not be acted upon by the medium in which mounted. He had found a mixture of marine glue and shell-lac gave the best results.

Several ingenious contrivances for removing minute objects from fluid, floating them on the slide in the exact position required, as well as a modification of the turn-table for enabling the brush to be held steadily in a perpendicular manner, were also shown by Dr. Hallifax.

Mr. Wonfor showed how to fix cells with marine glue, and illustrated the process of mounting dry objects, from the fixing the cell to the finishing the slide ready for the cabinet. For dry objects, he had found nothing so permanent as glass cells, or, what was far cheaper, brass rings, either of which could be easily attached by marine glue, the most trustworthy cement for fixing. He had tried a great variety of cells, and found objections to all but glass and metal.

Mr. Wonfor also exhibited one of Dr. Mathews' improved turn-tables for making shallow cells, and pointed out its superiority over the old form.

The comparative value of different cements was discussed, and several practical hints in minutiæ of mounting and preparation were given by the same gentlemen during the evening.

Treasurer's Account.

For the Year ending September 1st, 1870.

Cr.	£	s.	d.
By one year's Subscription to the Dispensary	2	2	0
" One year's Subscription to the Ray Society	1	1	0
" One year's Subscription to the Palæontographical Society	1	1	0
" Fire Insurance on Books to 29th September, 1870	0	10	0
" Printing	9	1	0
" Stationery and Bookbinding	6	8	8
" Salary to Assistant Secretary	1	10	0
" Tea and Coffee	3	13	8
" Commission on Subscriptions received by Collector	1	1	0
" Messenger, for delivering Notices	2	5	0
" New Books and Periodicals	11	13	0
" Publication of the "Moss Flora of Sussex"	5	6	0
" Cabinet for Microscopical Slides	3	0	6
" Postage Stamps, Lamp Oil, and Sundries	0	19	6
Balance	1	19	0
	£51	11	4

Dr.	£	s.	d
To Balance from 1868-9	1	1	4
" Subscriptions in arrear on 1st September, 1869, since received	9	10	0
" Subscriptions due on 1st September, 1869, since received	37	0	0
" Entrance Fees	4	0	0
	£51	11	4

Examined and found correct,

GEO. D. SAWYER,
ROBERT GLAISYER, } Auditors.

THE EIGHTEENTH

ANNUAL REPORT

AND

ABSTRACT OF PROCEEDINGS

OF THE

BRIGHTON AND SUSSEX

NATURAL HISTORY SOCIETY,

ADOPTED AT A MEETING HELD

THURSDAY, SEPTEMBER 14TH, 1871.

BRIGHTON:
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1871.

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BRIGHTON AND SUSSEX

NATURAL HISTORY SOCIETY,

ADOPTED AT A MEETING HELD

THURSDAY, SEPTEMBER 14TH, 1871.

BRIGHTON:
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1871.

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MR. T. W. WONFOR,	MR. J. C. ONIONS,
38, Buckingham-place.	56, Middle-street.

Honorary Librarian

MR. GWATKIN,
49, Grand-parade.

At the Eighteenth Annual Meeting of the Brighton and Sussex Natural History Society, held at the Dispensary, September 14th, 1871,

It was Resolved,—

That the Report, Abstract of Proceedings, and Treasurer's Account now brought in, be received, adopted, and entered on the minutes, and printed for circulation as usual.

That the cordial thanks of this Meeting be given to the Honorary Secretaries and Honorary Librarian for their labours in preparing the same.

That the following gentlemen be elected the Officers of the Society for the ensuing year :—President : Mr. W. M. Hollis ; Treasurer : Mr. T. B. Horne ; Committee : Dr. Badcock, Mr. Haselwood, Mr. G. D. Sawyer, Mr. G. Scott, Mr. C. P. Smith, and Mr. R. Glaisyer ; Honorary Secretaries : Mr. T. W. Wonfor, 38, Buckingham Place, and Mr. J. C. Onions, 56, Middle Street ; Honorary Librarian : Mr. Gwatkin, 49, Grand Parade.

That the sincere thanks of this Meeting be given to the Vice-Presidents, Treasurer, Committee, Honorary Secretaries, and Honorary Librarian for their services during the past year.

SPECIAL BUSINESS.

That the following new Rule be adopted,—"That Ladies be admitted as Subscribers to the Library of the Society, with the privilege of attending the Excursions, on being elected in the same way as ordinary Members, and on payment of the usual Subscription, but without an Entrance Fee."

That "17 years" be substituted for "20 years," in Rule 3.

(Signed),

F. MERRIFIELD,

President.

It was also Resolved,—

That the thanks of this Meeting be presented to Mr F. Merrifield, for his able conduct as President during the past year.

REPORT.

In presenting the Eighteenth Annual Report, your Committee have the pleasure of recording the continued prosperity of the Society, which has considerably increased in numbers during the past year; but regret the loss sustained by the death of Mr. R. Peek, who took great interest in the prosperity of the Society.

The state of the finances continues to be satisfactory; there being a balance of £12 0s. 1d. in the hands of the Treasurer, after an expenditure of £19 5s. 11d. in the purchase of New Books and Periodicals. Your Committee have reserved a larger balance, in view of the expense to be incurred in publishing a Catalogue.

The following Books have been presented to the Society during the year, viz.: Animaux sans vertibres, by Lamark, 7 Vols.; Conybear and Phillips' Geology of England and Wales, 1st Part, 1 Vol.; Bulletins de L'Académie Royal de Belgique, Tome 27 and 28; Catullo, Tratto sopra la Constituzione Geognostico-fisica dei terreni alluviali o postdiluviani delle province Venete; Disquisizioni Paleontologiche intorno A. J. Corrallarii Fossili delle Rocce terziarie del distratto di Messina, di Guiseppe Sequenza, 2 Parts in 1 Vol.; Histoire Naturelle de Lacépide, by Desmarest, imperfect, 1 Vol.; Tennant's British Fossils; in all, 14 Vols., presented by Thos. Davidson, Esq. Reports of the Quekett Microscopical Club, from 1868—70, inclusive; Journal of the Quekett Microscopical Club; Seventh Annual Report of the Lewes and East Sussex Natural History Society; Third Report and Proceedings of the Eastbourne Natural History Society; Seventh Report of the Belfast Naturalists' Field Club; from the respective Societies. The Natural History of the British Diatomaceæ, by A. Scott Donkin, Esq., 1 Part; Ice, a Lecture delivered before the Keswick Literary Society, by J. Clifton Ward, Esq., from the Author; Descriptive List of Flint Implements, found at St. Mary Bourne, by Dr. Stevens, from the Author; Ten Pamphlets on Rizopods, Sponges, Diatoms, &c., by Dr. G. C. Wallich, from the Author; Vol. 12 of the Linnean Society's Journal, presented by Dr. Addison; Rashleigh's Specimens of British Minerals, and Ellis's Arrangement of many curious and uncommon Zoophytes, presented by T. H. Hennah, Esq.

The following Books have been purchased during the year:— The Descent of Man and Selection in Relation to Sex, by C. Darwin, 2 Vols.; Transactions of the Linnean Society, 3rd Part, Vol. 27; Monograph of the Gymnoblastic or Tubularian Hydroids, by Allman—Ray Society; The British Species of the Angio Carpous Lichens, by W. A. Leighton; Owen on the Vertebrates, 3rd Vol.; The Students' Elements of Geology, by Sir C. Lyell; Issue from the Palaeontographical Society for 1870; Cooke's Handbook of British Fungi, 2nd Part; Hewitson's Eggs of British Birds, 2 Vols.; How to Work with the Microscope, by Lionel S. Beale, 4th Edition; Newman's Illustrated Natural History of British Butterflies; Robinson's Parks, Promenades, and Gardens of Paris; Leighton's Lichen Flora; M. A. Lower's Sussex, 2 Vols.; Journal of Linnean Society, 11 Vols.

Serials: Entomologist, 1 Vol.; Entomologist's Monthly Magazine, 1 Vol.; Geological Magazine, 1 Vol.; Monthly Microscopical Journal, 1 Vol.; Popular Science Review, 1 Vol.; Quarterly Journal of the Microscopical Society, 1 Vol.; Quarterly Journal of Science, 1 Vol.; Science Gossip, 1 Vol.; Student, 1 Vol., *the publication of which has ceased;* Zoologist, 1 Vol.

The number of Volumes in the Library, which at the date of the last Report was 643, has since been increased to about 700. The circulation of the Books continues to increase. The Library having received very numerous additions since the last Catalogue was printed, your Committee have ordered a new edition, which is now in the course of preparation for the Press.

Donations of Slides, for the Society's Cabinet (which now contains 188 Slides), have been received from the following gentlemen:—

Mr. Curteis	12	Mr. Hennah	18
Mr. Eden	3	Mr. Neate	12
Mr. Gwatkin	16	Mr. Sewell	6
Mr. Marshall Hall	2	Mr. C. P. Smith	6
Dr. Hallifax	12	Mr. Wonfor	42

Donations of Water-coloured Drawings, Sketches, Photographs, and Micro-photographs, have been made by Mr. Penley, the Rev. J. H. Cross, Mr. T. H. Hennah, and Dr. Hallifax.

Your Committee have much pleasure in reporting that the Monthly Microscopical Meetings have been decidedly successful and have added very materially to the usefulness of the Society. They recommend their continuance.

Your Committee also recommend that on one evening of the year a Conversazione of the Members and their friends shall be arranged, to which Ladies may be invited.

The thanks of the Society are due to the Brighton and Hove Dispensary and to the Medico-Chirurgical Society for the use of the room at the Dispensary in which the Meetings of the Society are held, and to those gentlemen who have read Papers, exhibited microscopes and specimens, and contributed to the Library, Album, and Cabinet.

The Field Excursions, since the last Report, have been as follows:—October, 1870, to Hassocks Gate, for Woolstonbury; 1871, May, to Balcombe; June, to Barcombe, for Plashett Park; July, to Hassocks Gate, for Plumpton; August, to Black Rock, and to Barcombe, by special invitation from Mr. Grantham; September, to Shoreham, for Old Salts, Lancing.

The Annual Excursion took place on the 30th of June, to Arundel, where the Members with their friends were hospitably entertained at luncheon by W. W. Mitchell, Esq., the Mayor. They afterwards visited Arundel Park and (by the kind permission of His Grace the Duke of Norfolk) the private gardens and grounds attached to the Castle.

In concluding their Report, your Committee beg to request the Members to endeavour to promote the prosperity of the Society, by bringing its merits under the notice of their friends; by contributions of works of Natural History to the Library; of Photographs or Drawings of Objects of Natural History for the Album; and of Slides for the Microscopical Cabinet; and particularly by reading Papers during the ensuing year.

ABSTRACT OF PROCEEDINGS.

1870-71.

SEPTEMBER 8TH.

AN EVENING FOR THE EXHIBITION OF SPECIMENS.

Mr. POCOCK exhibited a fine specimen of *Deilephila Galii* (madder hawk moth), caught by his father in a garden at Kemp Town.

Mr. WONFOR mentioned that, possibly owing to the very dry summer, this comparatively rare moth, and the rarer one, *D. Livornica* (striped hawk moth), had been plentiful : about 20 specimens of the two having been taken near Brighton and Lewes. Larvæ, from which moths were subsequently bred, had also been found near Brighton.

Mr. WONFOR exhibited dwarf specimens—with one exception caught ones—of several butterflies and moths, to show that dwarfs were found in Nature, as well as produced by artificial rearing ; and several blue varieties of the females of three species of "the blues," in which the blue markings were almost as bright as those of the males.

Mr. MERRIFIELD, remarking on the dwarfs, stated that, as a rule, bred specimens were smaller than caught ones. There were exceptions ; for he had, in some cases, bred far finer moths than were generally caught. Some insects, by in-breeding, so degenerated that they were hardly half the natural size.

Mr. POCOCK stated that among the hawks, especially in the case of *S. Ligustri*, bred specimens were generally finest.

Messrs. HOWELL and WONFOR exhibited specimens of Websterite, Allophane, Selenite, and other peculiar minerals, obtained in the excavations for the main drainage works in Vernon-terrace and Clifton-hill. The Websterite differed very much from that obtained from Newhaven, while the geological position of the Websterite and Allophane was peculiar.

Mr. Merrifield remarked that a seam of Websterite could be traced in the chalk cutting at the Cliftonville Station.

Mr. Howell also exhibited flint intercalated with Websterite, rolled chalk, obtained 7 feet below the surface at the bottom of New England Hill, and a fossil Mammalian tooth, found in the main drainage excavations in 1866, in drift chalk.

Mr. Ardley exhibited specimens of jet, ammonites, belemnites, and impressions of leaves, recently obtained by him at Whitby.

Dr. Badcock exhibited specimens of sea-weed, *Sargassum vulgare,* obtained by him in the Gulf Stream in 1864.

Mr. C. P. Smith exhibited specimens of *Sargassum bacciferum,* washed ashore on the West Coast of Ireland.

Mr. Wonfor exhibited amber, containing a four-winged fly; different ores of copper from the Burra-Burra Mine, Australia; and a portion of a fossil bone, possibly reptilian, from a sandstone quarry near Balcombe.

September 22nd.

MICROSCOPICAL MEETING. SUBJECT: "SECTIONS AND SECTION CUTTING."

Dr. Hallifax gave practical instruction in his methods of making sections. Starting with a Beck's section-cutting instrument, intended especially for making wood sections, he had found that the accurate workmanship and delicate screw enabled him to make sections 1000th part of an inch thick.

For soft substances, with the gun-metal block and a slip of paper, he contrived a cell, into which he poured melted wax, and in this the object to be operated upon, previously coated with gum and dried, was arranged. By using a razor instead of a chisel, he was enabled to make very delicate sections, the graduations of the screw enabling him to determine their thinness also.

When the sections were floated in water, the gum dissolved and cleared the objects of the surrounding wax. By such a method he had made very thin sections of brain, spinal cord, insects, animal and vegetable tissues, seeds, leaves, &c., specimens of which, and of the retina of the eye of a sheep, were handed round as illustrations.

Mr. Hennah then showed how, with the same kind of instrument, sections of wood or the stems of plants could be made by fixing them in the gun-metal blocks with paraffine wax before cutting.

Mr. Wonfor illustrated the making of sections of harder substances, such as the stones of the peach or the coquilla nut. A thin slice was first cut with a fine saw, then ground on a coarse stone, and finished off on a water of Ayr stone.

He then described and performed a process recently devised by Dr. Ormerod, for making and mounting sections of bone. A thin section of bone was first made with a fine saw ; this was roughly ground on a coarse stone, and then finished with a flat piece of pumice stone on a plate of ground glass with water.

After well washing, the superfluous moisture only was removed with blotting paper. Canada Balsam was then boiled on the glass slide, and also on the covering glass. When the balsam was nearly cold the bone was arranged on the slide, the covering glass put on, and the whole being gently warmed, the glass cover was pressed down. By this means the structure of bone was admirably shown. A hot knife having been run round the edge of the covering glass, the superfluous balsam was cleaned off under cold water, the whole process, viz., from cutting the slice until the slide was finished and labelled for the cabinet, occupied less than half an hour, a very great advantage over the ordinary methods to those wishing to study osseous structure.

Thin sections of different objects, made by the different methods described, were handed round as illustrations.

OCTOBER 13TH.

ORDINARY MEETING.—DR. BADCOCK ON THE GULF STREAM.

The mild winters enjoyed by England, together with its importance as a commercial nation, were mainly due to a river running between well-defined banks in the ocean, from the Gulf of Mexico; and which, possessing a higher temperature than the surrounding ocean, imparted a warmth to the western shores of Europe they would not otherwise enjoy. This stream, from the place of its source, was called the Gulf Stream.

It was a well-ascertained fact that from the Gulf of Mexico, out by the Bahama Straits, and along the American continent to the shores of Newfoundland, where it met a colder current setting from the Polar Seas, this current, with a velocity of about 100 miles per day, was constantly running. In about 30° West Longitude the stream divided: one portion travelling N.W., to the Arctic Sea; the other, S.E., to Africa.

Deep-sea soundings showed that, while its surface-temperature was higher than that of the Atlantic (about an average of 80°), the bottom temperature was as low as 35° in some places, showing the set of a cold current from the Pole. The colour differed from that of the Atlantic, being of a deeper shade of blue,—off the Carolinas presenting an indigo blue colour. The saltness, also, was greater—being as 4½ to 4. The specific gravity was also greater than that of the surrounding ocean. Several theories had been advanced respecting its origin, which probably arose from a combination of causes. Among those suggested were the influx of the waters of the Mississippi; the influence of solar heat in the Gulf of Mexico,—about the hottest part in the ocean; the greater density caused by evaporation; the effect of the equatorial current, together with the tendency of the warm water of the tropics to flow towards the Poles.

One feature all who had visited the Gulf Stream noticed,—one which he had seen in 1866 for days,—viz., the enormous accumulation of sea-weed, chiefly the *Sargassum bacciferum*, in which a variety of animal forms were found. Differences of opinion prevailed respecting the origin of the Sargossa weed: some holding that it was produced in the Stream; others maintaining that it was drifted from the low keys and islands of the Gulf.

October 27th.

MICROSCOPICAL MEETINGS.—"ILLUMINATION."

Mr. Hennah spoke of his experience of the facility with which sections of bone could be made and mounted by Dr. Ormerod's process, as explained by Mr. Wonfor at the previous Meeting.

Mr. Wonfor remarked that, since the last Microscopical Meeting, he had made experiments with other hard substances, such as the stones of fruits and the shells of nuts, and had found the process equally applicable. The great advantages over other methods might be expressed in two words: simplicity and rapidity.

Mr. Hennah then introduced the subject for the evening, "Illumination," by remarking that much more depended on illumination than on instruments or objectives. Good objectives, without proper illumination, failing to perform satisfactorily; while, with it, inferior objectives could be made to do a great deal. In the illumination of objects by transmitted light it was very important that the rays of light should be rendered parallel before they arrive at the illuminating apparatus, whether mirror, condenser, or prism. By a proper attention to this almost any structure could be fairly made out by the mirror alone, without expensive substage appliances. There should not be an excessive angle of illumination. It should not exceed 90°, or confusion instead of precision might be the result. In all substage appliances, the light should be exactly focussed on the object, a point to which sufficient attention was not always paid. For thick substances direct rays were necessary; but for thin and lined objects like diatoms oblique rays were essential. He then discussed the different modes employed for direct or oblique illumination, such as the ordinary or flat mirror, the Nachet, and Amici prism, the achromatic condenser, and the Reade's prism, among which he gave preference to the Amici prism when the substage admitted of its application.

Mr. Wonfor then described the different methods for illuminating opaque objects and for obtaining dark ground illumination, such as the bull's-eye condenser, the Leiberkuhn, parabolic illuminator, Wenham's paraboloid, &c., and called attention to a plan adopted by Mr. D'Alquen for enlarging the image by inserting within the tube a plano-concave or Barlow lens.

The Meeting then became a Conversazione, at which Mr. Hennah and Dr. Hallifax exhibited lined and other objects with the mirror, condenser, and different prisms as illuminators, and Mr. Wonfor exhibited objects with Wenham's paraboloid and different dark ground illuminators.

In connection with the November Meeting, it was remarked that one of the objects of having Microscopical Meetings was to encourage the Members to work at subjects which might from time to time be suggested, and that perhaps as good a subject as any would be "Bone and Allied Structures," in the preparation of which Dr. Ormerod's method could be put to a practical test, and Members might prepare specimens for exhibition.

November 10th.

ORDINARY MEETING.—MR. J. HOWELL, ON "EXCAVATIONS THROUGH THE POST-PLIOCENE FORMATION OF THE TEMPLE FIELD, BRIGHTON."

The Town of Brighton stands on five sections, four of which belong to the Post-Pliocene and one to the Cretaceous formation.

The Temple Field is situated at the eastern extremity of the Hampshire or Eocene Basin, scooped out of the chalk in which the Tertiary Beds were deposited. The rim of this Basin is the western side of Church Hill, and here, though the Tertiaries have been washed away on this side of Pagham, a Geologist might expect to find their lithological remains, and such is actually the case, as here they lie in promiscuous confusion to the height of 220 feet above the level of the Sea. The section at Clifton Hill gives a good idea of this Post-Pliocene deposit.

1.—Roads.

2.—Mould, with flints.

3.—Rich brown, dark grey, and ochraceous loam, with shivered flints.

4.—Clay, or brick-earth.

5.—Ironstone, breccia, or Druid sandstone, mingled with clay, chalk-rubble, rotten flints, and sub-sulphate and hydrate of alumina.

6.—Ferruginous chalk-rubble and ochraceous or chocolate-coloured loam, containing gypsum, brecciated masses of clay, gypsum and flints, spangled over and intercalated with crystals of selenite, and a kind of stone resembling veined marble.

7.—Stained chalk, with veins of flints.

Of these,—

No. 3. Is a very curious deposit, chiefly of a chocolate or ochraceous colour, though in Montpellier Crescent it assumes a dark grey tint, and contains immense quantities of shivered flints, resembling flake-knives fashioned by Nature. Seams of fine sand also occur in this deposit; one in Clifton Road, of a silver colour, was most probably bleached by the percolation of acids, derived from the vegetable soil.

No. 4. Considered by Godwin Austin as the wash of a terrestrial surface under a far greater amount of annual rain-fall than we have at present, and of the same age as the coombe-rock, can hardly be the case, as in these excavations the coombe-rock lies beneath it.

No. 5. At a depth of 16 to 26 feet in Clifton Hill lie hundreds of tons of breccia and ironstone, frosted over with crystals of selenite. The breccia consists of rolled and angular flints, sand, and iron, like the beds *in situ* at Seaford, ornamented with botryoidal and reniform crystallizations. The chalk is of a dirty yellow. The sub-sulphate of alumina is snowy white or cream-coloured. The hydrate of alumina is pure white, and crumbles into a substance resembling magnesia. Seams of aluminite also intercalate the flints, rendering them very friable. A curious variety of this substance was discovered in Powis Villas, much like the stem of a tree, with a ligneous appearance around it, as if its bark had been transformed into that substance. Tabulated masses of flint have also been found about $\frac{3}{4}$ of an inch in thickness, resembling silicate of iron, giving the idea that a stream of silica and iron had become solidified at the bottom of the cretaceous sea.

No. 6. Embedded in this deposit are brecciated masses of indurated clay, flints, and gypsum, with crystals of selenite, varying in form and colour, and which penetrate the whole mass. Some have undergone intense chemical action, leaving orifices upon the surface through which the gas has bubbled and escaped. Others, coated with a coaly substance, resemble honeycomb. In some specimens, crystals spangle the smooth surface of the flints, and are of a frosted appearance. Others have botryoidal and reniform crystallizations, coated with a delicate bloom, ranging from yellow to olive green. The prettiest variety of gypsum was found in Montpellier Crescent: it is variegated, the crystals being of a needle-like and cob-web form; others are flat and several inches in length. Some of these specimens sparkle as if diamond-dust had been scattered over their surfaces.

These excavations show that the heterogeneous mass was derived from the beds of the plastic clay; while the lithological character of the beds marked by the breccia, aluminite, hydrate of alumina, gypsum, and clays of the Lower Tertiary, determine its geological place.

Nature works by simple laws, and the results are truly wonderful. A great portion of the soil owes its origin to decomposed organisms. In this soil, therefore, there is sulphuric acid, which is conveyed by rain down to the clay, ironstone, and chalk, through which it percolates and metamorphoses the clay into *sub-sulphate* and *hydrate of alumina*, and the chalk into gypsum and crystals of selenite. In the chalk rubble lie breccia and ironstone, ornamented, by the marriage of sulphuric acid and chalk, with crystals of every variety, form, and colour. Such is the origin of the Temple Field Deposit, lying from 165 to 220 feet above the level of the sea.

NOVEMBER 24TH.

MICROSCOPICAL MEETING. "BONE AND ALLIED STRUCTURES."

Dr. HALLIFAX described the vertebrate skeleton and its structure: pointed out its power of repairing injury, its special purposes of leverage, &c., and discussed the Haversian system, the lacunæ, and canaliculi, all of which he considered subservient to the purposes of nutrition; and mentioned that, by the process of decalcification, he had been able to make thin sections with his cutting instrument, in which the Haversian system was well made out.

Mr. DENNANT spoke of the advantages of the water of Ayr stone in grinding bone, &c., over pumice stone, still using ground glass, as he thought it did the work quicker, and with fewer scratches.

A discussion ensued on the nature of bone, in which Messrs. PETO, HENNAH, DENNANT, WONFOR, and Dr. HALLIFAX took part. The meeting then became a Conversazione for the exhibition of sections of "Bone and Allied Structures" made by the members, when

Mr. HENNAH exhibited cartilage, dry and in gelatine, and sections of bone in balsam.

Mr. DENNANT exhibited sections of bone and of teeth, showing *caries*.

Mr. PETO exhibited sections of recent and fossil bone, and of teeth mounted in balsam.

Mr. SEWELL exhibited fœtal and other bone sections.

Mr. WONFOR exhibited sections of bone, bony scales, ivory, teeth, and palate teeth, dry and in balsam.

DECEMBER 8TH.

ORDINARY MEETING.—AN EVENING FOR THE EXHIBITION OF SPECIMENS.

The Rev. J. C. WALTER exhibited a curious flower, which had been in his possession since 1848, and to which the name of "The Rose of Jericho" had been given, and which, when placed in water for a short time, unfolded itself. He believed it came from Palestine, and had been informed by a Persian, to whom he some years since exhibited it, that the same plant was common in some parts of Persia. Was the opening of the flower to be considered dynamical,—*i.e.*, mechanical force,—or an example of lingering life?

Mr. WONFOR pointed out that this plant was not the true Rose of Jericho—the *Anastatica hierochuntica*—which belonged to the *Cruciferæ*, and in which the whole plant curled up, was torn up by its roots by the wind, and blown along the ground until it reached moisture, when it uncurled and scattered its seeds; but that this was the *Mesembryanthemum Trifolium*, and belonged to the ice-plant family. Most of the so-called Roses of Jericho came from the Cape or South Africa. When put into water for the first time the seeds might be seen arranged in the carpels. There was another plant, called the Resurrection Plant—*Lycopodium leptophyllum*—a dry specimen of which he exhibited, and which differed materially from any of the others, for, when placed in water for six hours, it might be planted, and would then grow like any other lycopod. This was a true case of lingering life, while the others were purely hygrometric action, of which there were plenty of examples among plants. Among seed-vessels might be mentioned the stork's bills, one of which—*Erodium moschatum*—was used by Mr. Mallett in 1836 as a hygroscope. Some of the Members would recollect seeing a very ingenious hygroscope, contrived by Mr. D'Alquen and Dr. Hallifax, in which the awn of a foreign *Erodium* formed the motive power. The so-called growing of seeds, as seen in thin slices of Collomia and Salvia, when placed in water, was caused by the uncoiling of spirals; while the action of the spores of Equisetum was known to all microscopists.

Mr. R. GLAISYER exhibited some pieces of lias, from Dudley, containing fossils, among which was a perfect trilobite.

Mr. NASH exhibited shale, from which the petroleum oil is extracted, showing fossil fish, the bones of which were distinctly seen ; crude petroleum ; petroleum scales, or the solid extract ; purified wax, and manufactured articles from the same, illustrating the petroleum from its crude to its manufactured form.

Mr. Hennah exhibited some very beautiful specimens of arsenite of copper, acicular or tiled copper, and velvet arsenite of copper, collected by his grandfather from Cornish mines.

Mr. Wonfor exhibited a specimen of *Deilephila Livornica*, striped hawk moth, caught at Brighton this year by Mr. Gates, and varieties of the poplar hawk moth. Also three birds, lent by Messrs. Pratt and Sons : the Iceland Gull, a very rare bird in Sussex, shot recently, off Brighton, by Mr. Goldsmid, of Brunswick Square ; the shore lark, an occasional visitor ; and the grey phalarope, which had been somewhat abundant in the south this year.

Mr. Sewell exhibited a bone, obtained at a depth of 14ft. in Norfolk-square, which resembled a human *tibia* more than the bone of any of the animals,—such as the horse, ox, elephant, or deer,—associated with the Post Pliocene.

Mr. C. Smith exhibited, and presented for the Society's Herbarium, two mosses new to Britain, recently discovered by Mr. Mitten in Sussex, viz. : *Pottia Littoralis*, found near Aldrington, and *Pottia asperulosa*, found near Hastings. They had not yet been described, but would be in the January number of the *Botanical Journal ;* nor had they been seen by the botanical world at present. He had been fortunate enough to find one of them since Mr. Mitten's discovery of them.

December 22nd.

MICROSCOPICAL MEETING. SUBJECT: "SHELL STRUCTURES."

Prior to the special business of the evening, Mr. Hennah called attention to a series of cheap lenses, by Gundlach, very kindly lent to him, for exhibition before the Society, by Mr. T. Curties, of the establishment of C. Baker, 244, High Holborn, the agent for England.

Since the last meeting, he had had an opportunity of carefully examining, through the courtesy of Mr Curties, a series of Gundlach's lenses, ranging from a $\frac{1}{2}$ to a 1-24th. The $\frac{1}{2}$ and $\frac{1}{4}$ were not good; the $\frac{1}{3}$ was a perfect lens; the same might be said of the 1-12th and 1-16th. The latter, which was on the immersion principle, was especially useful, as giving 600 diameters with a low eye-piece and working through thick glass and balsam. No recent additions to the microscope had equalled this lens as an instrument of research in minute Natural History. The 1-12th's, though very good, yet being *dry* lenses, approached nearer than the 1-16th's, and were in magnifying power equivalent to a Ross's 1-8th; they worked through thick glass, and were not inferior to any lenses he had seen, though Ross's 1-8th was superior on *P. Angulatum.* They would be very valuable to those who did not possess English lenses of this power, especially as in the whole series, the objectives are about *one-third* the price of English ones. Finding the first specimens so good, he had asked Mr. Curties to send others, so that they might be able to judge if the supply would be equal to the specimens first sent. As far as he had been able to judge, they were still of the first-class; but he would suggest that the objects to be shown should be seen with Gundlach's lenses, and comparison be made with other objectives by the Members present. He felt personally indebted to Mr. Curties for his kindness in allowing him time for a fair judgment, and thought the members, as microscopists, were under an obligation to him, for the opportunity he had afforded them.

Mr. Wonfor then introduced the subject for the evening, "Shell Structures," by describing the structure and component parts of the shells among the Mollusca, at one time supposed to be mere inorganic exudations, cemented together by animal glue. It is now known that their shells are composed of animal and calcareous matter, the former constituting a membranaceous basis, forming cells, with hexagonal walls or of laminæ, more or less wrinkled; some shells were traversed by tubes, others by canals, with trumpet-shaped orifices; in each case the calcareous matter gave solidity to the membranaceous tissue. The internal layer, of a nacreous nature, in many was very beautiful. Some of the porcellaneous shells were made up of three distinct layers of a similar structure. In the Crustacea, especially the crab, four layers could be distinctly made out, one of which strongly resembled *dentine*, except that the *tubuli* did not branch, but remained of the same size throughout their course. It was in the cellular layer where the pigmentary matter, which imparted the colour to the shell, was to be found.

The meeting then became a Conversazione, when

Mr. Hennah exhibited under Gundlach's 1-12th and 1-16th, sections of crab and cowrie shell, mounted with thick covers. The performance of the 1-16th was perfect. Afterwards, for lined objects *Pleurosigma Angulatum* and tasselled scales of white butterfly were shown. The 1-16th gave very good results; but the 1-12th did not equal a Beck's Popular ⅛th.

Mr. Sewell exhibited, under a ⅓, out of the first parcel and pronounced by Mr. Hennah a perfect lens, sections of pearl and crab shell. This lens was pronounced very good.

Mr. Peto, under a ½ and an inch with convex front, exhibited sections of pinna shell. Both these lenses were excellent.

Mr. Wonfor, under a couple of 1-3rds, exhibited egg-shell of garden snail, sections of terebratula, shells of prawn, shrimp, &c. These lenses were very good, and, when compared with Mr Sewell's ⅓ to test quality of performance, were so much alike that scarcely a difference could be detected.

Mr. R. Glaisyer exhibited shells of nautilus, &c., cut through to show their chambered character.

January 12th, 1871.

ORDINARY MEETING.—MR. J. HOWELL ON "THE BRIGHTON CLIFF FORMATION AND THE BRIGHTON VALLEY."

A section of the Brighton Cliff Formation is 1. Soil; 2. Weather-worn flints; 3. Chalk-rubble, locally termed coombe-rock; 4. Old sea beach; 5. Sand; 6. Chalk with veins of flints. This was described as the peculiar deposit upon which a large portion of Brighton stands, being essentially Post-Pliocene, and, probably, formed about the close of the Glacial epoch. In the west of Brighton the chalk is overlaid with sand and brick-earth ; a fact which may be accounted for by the Tertiary clays being so richly developed in the Hove level, while they were sparingly spread out over the surface of the eastern hills. Hence the chief constituents of "The Brighton Cliff Formation" are the ruins of the Cretaceous strata, while the brick-earth of Hove is that of the Tertiary.

The Brighton Cliffs, as they were 50 years since, are now hidden behind the magnificent sea wall ; but at Black Rock a fine section is presented. In descending the cliff, it will be noticed that the flints at the top are large and gradually decrease in size and number. The same with the chalk, it decreases from large rounded masses to small pieces ; the whole being of a yellowish buff appearance, with shades of a lighter or darker hue, according to the mixture of Tertiary and Wealden clays with the Cretaceous formation, while here and there, varying in size, lie blocks of granite, porphyry, quartz, slate, sandstone, ironstone, breccia, and lignite. A little further eastward, and, at the base of this heterogeneous mass, reposes an old sea beach upon an old sea-washed sand. That beach was once laved by the rough billows of an icy sea. The deposit everywhere, especially in the middle of the cliff, shows signs of stratification, and was not, as it had been described, a "confused mass." It had every appearance of having been washed down into a shallow estuary, when it was sinking, and there deposited, layer by layer, till it finally reached the surface. The water then gradually retired, bearing with it much of the finer sediment, while the flints, by virtue of their own gravity, remained near the surface, increasing century after century by pluviatile action, till they finally attained their present thickness. The same simple causes effected the vast flint accumulations lying beneath the turf of our Downs. It was the gradual work of ages, from causes still in active operation, and not the result of sudden and violent cataclysms, to which the older geologists ascribed the wondrous changes that have taken place in the organic and inorganic worlds, from the beginning of the unceasing revolutions of life and matter.

The elephant bed extended, more or less, along the line of cliffs from Rottingdean to Sompting. In digging a well in the Western-road the old sea-beach was passed through at the depth of 54 feet, overlaid by chalk-rubble and brick-earth. The same, through Hove and on to Copperas Gap, where, in the cutting for the road, the bed was well marked ; the sand being seen *in situ* lying under the chalk-rubble and gravel, with rolled portions of porphyry and granite, mingled with shells of existing species reposing upon the chalk. Mr. Samuel Evershed procured many of these shells, and the same gentleman discovered, in a layer of clay beneath the elephant bed at Black Rock, fragments of bone, which he considered to have belonged to the red deer ; also the pastern bone of the horse. A fossil tooth of the same animal, lent by Mr Lockwood, was found, when excavating for the main sewer in 1866, 15 feet below the Southern enclosure of the Steine, its matrix being coombe rock. A more recent discovery was the tusk of the *Elephas primigenius*, at Hove, when draining the Stanford Estate in the autumn of 1869. Teeth and tusks of the mammoth had been discovered in Rock Gardens and many other localities. Its remains were also found when digging the foundations of St. Mark's Church. There had also been found in the same formation the remains of the whale and ox, antlers and horns of the red deer in the Western-road, Lavender-street, and near the Barracks at Preston, and in a bank by the roadside at Patcham. The shells found in the old sea beach and the deposit above it were of an arctic type and in a very friable condition.

Brighton Valley was once the basin of a considerable estuary, into which two rivers poured. This was proved by the excavations. First there was a dark-coloured silt mingled with flints, which, in some places, reached a considerable depth. Beneath this lay the chalk-rubble, rounded by the action of water ; and, embedded in this deposit, were boulders of sandstone, some of immense size. Hundreds of these stones are preserved in the Pavilion Grounds, forming borders to the flower-beds along the pathways. Mr. Wonfor and himself had examined these silent historians of ages long buried in oblivion—of ages when the tumultuous waves of an Arctic Sea dashed with immense force up the Brighton Valley ; when the London and Lewes roads were the outlets of the waters that denuded the Weald, rolling its sandstones for miles along their channels into the estuary which then covered the Valley.

These stones were composed of grains of quartz, the wreck of paleozoic or plutonic rocks, brought down into the Wealden estuary by that mighty river, which, probably, flowed through an immense continent lying where the Atlantic now rolled her deep and mighty waters. Ninety-five of these stones in every hundred were, to the best of their judgment, composed of calcareous grit or sandstone. One, of immense size, was found in the Lewes-road, opposite Park Crescent.

Throughout the whole valley they were embedded at the depth of from 12ft. to 20ft. Opposite the Glo'ster Hotel, after passing through the silt, the workmen discovered, at the depth of 20 feet, small pieces of rounded chalk, the whole having the appearance of the bed of a stream. At the bottom of Cheapside, this bed was 11 feet beneath the surface, in which were pebbles like those lying among the shingle of our shore. At the junction of the Montpellier and London-road the same deposit was met with at the depth of seven feet, showing how, in the higher portion of the valley, the silt overlying the chalk thinned off. The deposit reached a considerable distance up the sloping part of the hill, even as high as Chatham-place in the Montpellier-road, but was nowhere found up the abrupt and steep ascents.

The high hills on each side of the valley plainly told a tale when they were cliffs, with sea-waves laving their bases; for even now, though rounded and worn down by the attrition of ages, their steepness revealed this fact.

Pool Valley pointed to a time when that locality was a pool indeed, and the Level a level of waters, fed by rivers issuing from the Weald. The thickness and quality of the silt indicated some remote era when the whole valley was one vast sheet of water. That this era was not antecedent to the Glacial epoch might be inferred from the fact of the silt reposing upon a Post-Pliocene formation. At first the valley was an estuary of the sea, into which flowed rivers through fissures in the Downs, bringing down the *debris* of the denuded Weald, mingled with the wrecks of the chalk and Tertiary strata, which, with the bones of the mammoth, the horse, the ox, and the deer, were deposited in an estuary, into which the sea also bore remains of the whale and shells of an arctic type, till the deposit rose, layer by layer, above the waves. Then the old sea-beach upon which it reposed, and which had also sunk to receive it some 50ft. or 60ft., with the atlas chalk beneath it, was bodily raised from 12ft. to 15ft. above their former level! Probably, previous to this upheaval of the Brighton cliffs was the elevation of the hills behind, thereby closing the flood-gates through which the Weald once poured its waters into our valley. Then commenced the drainage of the hills, the wearing-down of the cliffs, the silting up of the Brighton levels, the retiring of the sea, and the gain of fertile districts which ocean has once more claimed as its own.

It has been seen whence came the sandstones in our cliff deposit.

The breccia, ironstone, and lignite were also "natives, and to the *manor* born;" but not so the granite, quartz, and blocks of Silurian slate. Whence came they? Sir Charles Lyell suggested from Normandy and Brittany, brought hither by ice-action, when our old beach was laved by the Glacial sea. Nor was this at all improbable, when facts taught us that the eastern portion of the English Channel had subsided, since the great Pachyderm period, when those mammals browsed where the sea now rolled its waves. The whole area to the east of this, which had now an average depth of from 25 to 30 fathoms, was then dry land, while this coast-line from France to England was the highway along which pebbles of the paleozoic and plutonic rocks slowly travelled, till they found a resting-place in our old sea beach.

Since the commencement of the Tertiary epoch the South Downs had been continually sinking beneath and rising above the waves of their creative mother. These oscillations were not caused by violent cataclysms, but by that scarcely visible process still in operation along our coast line. This was clearly illustrated in the Isle of Wight, the northern portion of which had been gradually sinking for a century past, and yet the sea level was the same as when Fielding on his voyage to Lisbon landed at Ryde a century ago, for he described that place as being inaccessible by sea, except at high water, as the tide left a vast extent of mud, too soft to bear the lightest weight. This mud-bank was now covered with a stratum of sand many feet thick, especially to the east of Ryde, which, however, at low water was not bare to a greater extent than was the former mud-bank. This clearly proved a subsidence along that part of the coast: and that the Solent was sinking and receiving similar deposits as did the Wealden Estuary, in times of old, when it sank to the depth of 1,600, if not 2,000 feet! Yet, strange to say, the southern portion of the Garden Isle, from Dunnose to St. Catherine, had, during the same period, been visibly rising! These facts illustrated the upheaval and submergence of our Downs during the Post-Pliocene epoch.

JANUARY 26TH, 1871.

MICROSCOPICAL MEETING.—THE USE OF THE POLARISCOPE IN THE DETERMINATION OF STRUCTURE.

Mr. SEWELL, who had proposed the subject for the evening,--the use of the Polariscope in the determination of Structure,—remarked that with most microscopists the Polariscope was merely a toy to show pretty objects, whereas he believed it ought to be applied to the development of structure. Having enquired of Mr. Curties respecting Hislop's selenite stage, he was informed that Mr. Ackland had contrived a very simple one, which he thought he could borrow; but he had done better: for he had induced Mr. Ackland to come to exhibit and explain his selenite stage.

Mr. WONFOR considered that a large number of microscopists used the Polariscope as a scientific instrument in making out structures.

Mr. ACKLAND was sure the majority used it as a toy; he might say 15 out of 20. Scarcely any had a selenite plate, with the axis marked. He did not think he had been asked to mark the axis, once in 20 years.

Mr. WONFOR thought that a large amount of work was done by microscopists without using the selenite at all, and then only with objects possessing slight depolarizing power. They would all feel obliged by Mr. Ackland's pointing out the advantages of marking the axis.

Mr. ACKLAND said, if the axis of the selenite film was marked, it was possible to determine the tension of any object, especially, say, in the examination of muscular fibre, where it pointed out the direction of the tension. The Germans, who were generally in advance of us in minute anatomy, always used marked selenites. One of the few persons he knew using one in London was Mr. Stewart, of St. Bartholomew's Hospital.

Selenite films, giving the various tints, blue, green, yellow, red, and purple were commonly used; but all must have noticed, when examining an object which did not fill the field of view, that the colour of the background did not harmonize with the colours of the object.

It occurred to him that a *neutral* tint, corresponding to the tint occurring in Newton's rings, midway between the violet of the second wave and the indigo of the third wave, was the one required. In a parcel of 500 films he only found one giving this tint; upon using it with an object he was delighted with the effect. Happening to put in its place a duplicate object, which, with an ordinary film, gave exactly the same colours, he was struck with its comparative poorness. Trying the first slide again, he obtained the same good result. This difference, he thought, was either owing to the thin glass cover being at the right axis for the colour or to the glycerine in which it was mounted exerting an influence. As the neutral films were so difficult to obtain, he had tried a plan of rotating two films the one over the other, and thus obtained the neutral tint, so delicate in action that its colour varied by the slightest depolarizing influence of the object examined, and, at the same time, gave a display of colours more varied and gorgeous than could be obtained by any of the usual films employed. At the same time, the rotation of one or other of the films gave a succession of nearly all the prismatic colours, so that, if dissatisfied with the neutral tint, a multiplicity of others could be produced. He had brought with him several selenite stages, which could be tested by the gentlemen present.

Mr. Wonfor, in moving a vote of thanks, said they were not only deeply indebted to Mr. Ackland for coming among them, but also for the valuable information he had afforded them.

Mr. Sewell seconded the resolution, which was carried unanimously.

A very large number of polarizing objects of a varied character were then exhibited, with and without the selenite stages, by Messrs. Sewell, Turner, Ackland, Smith, Glaisyer, and Wonfor; and general satisfaction was experienced at the results and the increased beauty with the neutral back-ground.

Mr. Hennah also exhibited Dr. Piggott's "aplanatic searcher," kindly lent by Mr. Curties, and Dr. Maddocks' photo-casts of diatoms, ranging from 900 to 3,000 diameters, kindly lent by General Worcester.

Mr. Wonfor exhibited a searcher suggested by Mr. M'Intire, consisting of an objective arranged in the draw tube, with its observing end turned to the eye-piece, and a simple mode of mounting an objective under the stage, to be used as a condenser at any angle, as suggested by Dr. Mathews; the new slide with moveable cover for dry objects; and a "Barlow lens," to be used in the draw tube as an amplifier.

FEBRUARY 9TH.

ORDINARY MEETING.—MR. C. P. SMITH ON "LICHENS."

Lichens were a tribe of plants generally aerial as to habitat, and derived originally from an intricate mycelium, which gave rise to a more or less perfect plant according to situation. They were allied to fungi on the one hand and algae on the other. The earliest condition of Lichens which we are able to perceive was a myceloid or filamentous mass of threads, which, when occurring on trees or fabricated wood, penetrated into the wood. Externally there was developed a number of globular bodies filled with chlorophyll, called gonidia, which were subsequently covered by the cortical layer of the thallus.

Under the name Lichens were grouped together a vast mass of cryptogams, varying exceedingly in texture and form, but normally distinguished by a thallus. This thallus was in the most highly organized genera, composed of four layers or strata, named respectively the cortical, gonidiac, medullary, and hypothalline strata. The external form of the thallus was exceedingly varied, and in texture might be foliaceous, coriaceous, cartilaginous, membranaceous, or gelatinous. There were several species without any thallus; these athalline species were generally parasites on other Lichens.

The fructification of Lichens appeared to be of a three-fold character, consisting of apothecia, spermogonia, and pycnidia. In the former spores were contained, either embedded in gelatine or in little sacs, called asci. These spores were discharged from the apothecia under the influence of moisture. The spermogonia and pycnidia also contained small bodies (spermatia), whose functions were probably reproductive.

The uses of Lichens were several, and, in fact, scarcely any tribe of cryptogams was of so much importance to mankind. As dye stuffs they had fetched nearly £400 per ton, and the colouring matter, called Litmus, could be obtained from any Lichen which yielded Orchil. Iceland moss contained a nutritious, starchy mucilage. Various species were used by the Canadian hunters as a diet, under the name of Tripe de Roche ; but if long used as food it occasioned diarrhœa. The reindeer moss, which was so valuable to the Laplanders, was abundant on our moors. Besides these uses of Lichens, one lichen might be named which occasionally appeared in enormous quantities in Persia and Tartary, and was eagerly eaten by the natives who imagined that, like the manna of the Israelites, it had fallen from heaven. At times it had been known to cover the ground to the depth of five or six inches.

The Paper was illustrated by admirable drawings and specimens.

Mr. H. Goss exhibited several British moths whose larvæ fed on different species of Lichens, which they resembled in colour and markings.

Mr. T. Hennah exhibited and presented photographs of parallel cylindrical glass rods, rotated over similar rods, to illustrate the effects of illumination. The results were very curious, some exactly resembling the hemispherical markings ascribed to some diatoms and the note of admiration marks on the Podura scale.

February 23rd.

MICROSCOPICAL MEETING.

Mr. Hennah, alluding to the photographs presented by him at the last meeting, of cylindrical rods rotated over each other, remarked that they were intended to show how careful we must be in referring markings to objects themselves, and not to the method of illumination employed in microscopical investigation, as he believed was the case with some of the "spectral" dots seen and described by Dr. Piggott.

Mr. Wonfor exhibited Beck's illusive photographs of a small tumbler partly covered with hemispheres, and which appeared, according to the way in which the light fell on them, either hemispherical elevations or hexagonal depressions. In illustration of Mr. Hennah's remarks, he would show that fibres in plants crossing each other sometimes produced the illusion of hemispherical dots.

Mr. Hennah, enquiring whether any gentleman had any special object to exhibit, said he had brought down a number of slides, prepared by Dr. Addison, to illustrate the absorption vessels in the leaves of plants, referred to by Herbert Spencer in the Linnæan Society's transactions, and 18 slides of vegetable hairs prepared from specimens supplied to him by Mr. D'Alquen.

Mr. C. P. Smith had brought slides to show the difference between the moniliform form of the gonidiac layers found in some algae as well as lichens.

Mr. Wonfor was prepared to illustrate fibro-cellular tissue and vegetable scales and hairs, and called attention to a method of preparing coal sections, described in the last number of the *Quekett Club Journal.*

The meeting then became a Conversazione, when, in addition to the objects described above,

Mr. Glaisyer exhibited *raphides* in American aloe and cuticle of pea, and potato starch *in situ*.

Mr. R. Glaisyer exhibited fern scales and sections of coal showing woody tissues.

Mr. Hennah also showed a ready way of making a cell for dry objects with a brass ring and electric cement.

A brass ring was held by a pair of forceps in the flame of a spirit lamp until hot: then worked into a piece of electric cement, until covered with a moderate amount of the cement. It was now placed on a glass slide and held over a spirit lamp, and then put on one side to get cool. The object being arranged in the cell, and a thin glass cover warmed and laid on, the slide was ready for the cabinet.

March 9th.

ORDINARY MEETING.—MR. F. MERRIFIELD, THE PRESIDENT, ON "TREE PLANTING IN BRIGHTON." —SUGGESTED IMPROVEMENTS.

Mr. Merrifield observed that there was very little variety in the trees found in Brighton. They were nearly all of one sort, and that sort by no means always well selected. The elm tree, and generally a very scrubby form of it, was so exclusively planted as almost to lead to the conclusion that a desire to save the poor rates, having regard to the uses to which elm-boards were devoted, had been the prevailing motive with the authorities. The elm was by no means the best of town trees. This was conceded by Shirley Hibberd, by Mr Robinson in his recent work on the parks and gardens of Paris, and by most other authorities. Accordingly, it was found that in London and elsewhere it was being extensively supplanted by other trees, such as the plane and the ailanthus. Still, it might be said that the elm tree answered in Brighton. That was a very good reason for keeping to the elm where no other tree could be got to succeed; but it was no reason for not sometimes planting other trees that would succeed in place of the elm.

The choice of trees suitable for Brighton was necessarily very much restricted. The exposure to the wind of most localities, and the sea air pervading the whole district, excluded many species, while the chalky sub-soil and thinness of the stratum of vegetable mould in nearly all parts of the town excluded many more. Nearly all the firs and pines were thus excluded.

The trees he desired to commend to the notice of the authorities were the following:—

1. Better varieties of elms. Few trees varied so much in beauty of appearance as the elm. There were several species and varieties of elm well-known to endure without injury the sea breezes.

The Cornish elm might be mentioned as one of these, and by consulting experienced arboriculturists, several varieties of elm, greatly superior in appearance to any of those we now had growing in our streets, might be safely planted.

In selecting these new varieties, it might be hoped that some of the larger leaved ones would be tried. Some of these would do well, and those that only succeeded tolerably would afford a pleasing contrast to the small-leaved kinds.

2. The Occidental Plane. There was much confusion among nurserymen between the occidental and the oriental; but he used Loudon's name. He should like to see this fairly tried in Brighton. It was considered by competent authorities the best of all town trees, and no doubt in many parts of the town it would do exceedingly well. There was an oriental plane standing by itself on the lawn near the north gate of the Pavilion. Now, this kind of plane was very inferior for town purposes to the occidental plane. The occidental plane was the tree now most extensively planted in London, and there were, consequently, abundant opportunities for judging of the claims which its beautiful foliage and its graceful branches gave it for consideration. It was cheap, grew rapidly, and afforded a most grateful shade.

3. The Ailanthus. This was an excellent town tree, stood the wind well, and grew very rapidly. Its foliage resembling that of a sumach tree, although on a larger scale, was very beautiful, and formed a striking contrast to that of ordinary trees. This effect might be observed in the well-arranged garden of Park-crescent.

The Paulownia, a fast growing tree, with immense light green leaves, now extensively planted in the Paris streets, and the catalpa, much resembling the former in appearance, and which did well in London and Paris and at St. Leonard's, should be tried in sheltered places. The scarlet-flowered horse chestnut, the double peach, the sophora japonica, the American scarlet oak, the negundo or ash-leaved maple, especially the white variety, were worth trying, with some of the purple beech. The tulip tree, which withstood the wind extremely well and the foliage of which was so magnificent both in summer and in autumn, should certainly be tried. Some of the species would doubtless require careful preparation cf the soil.

The sycamore, lime, birch, mountain ash, Spanish chestnut, and robinia (acacia), should be more freely planted. The first-named made an admirable screen from the wind for other trees, and all of them, as was known from experience, would live in Brighton. Even where they could not be said to flourish, they afforded a most pleasing contrast to other trees.

The poplars did as well as most trees, and a group here and there of the abele or white poplar, and of the great black Italian poplar,—which grew with great rapidity and resisted the wind, but had the disadvantage of not putting forth its leaves till very late,—would chequer advantageously the masses of elm.

With due attention to situation and soil, nearly all the trees mentioned would grow fairly and much improve the general appearance of our streets and public places.

In the matter of grouping there was great room for improvement.

In shrubs there was room for most extensive improvement. A shrubbery should consist of a mass of beautiful shrubs, clothed with branches down to the ground, and presenting great variety of foliage and flowers—most effectively so when the same kinds were massed together, the taller shrubs being in the background, and the smaller ones in front. Many shrubs were apt, especially in a town, to run up "spindly"; the lower branches dying off in an unsightly manner. When this happened they should be cut down to the ground. The arbutus and rhododendrons might, in this manner, be very advantageously treated.

Happily, in Brighton, there was no limit in the choice of shrubs as in that of trees. But here a great reform was wanted, not only in grouping and treatment, but in the introduction of the many species of late years ascertained to bear our climate. Among deciduous shrubs, the lilac, guelder rose, and flowering ribes flourished; the syringa (mock orange), the deutzia scabra, some of the spirœas, the forsythia viridissima, the buddlœa globosa, the viburnum plicatum, and, above all, the very beautiful weigelia rosea and its several varieties, should be added. Among evergreens none did better than the euonymus and the aucuba; but the hardy gold-striped variety of the former, one of the most beautiful shrubs that could be seen, and several other varieties much more beautiful than the one most commonly seen in Brighton and quite as hardy, should be freely planted; as also some of the new unblotched varieties of the aucuba, and some of the recently introduced males, so that the aucubas in our shrubberies might some day be covered with the great red coral-like berries that rendered these plants such choice ornaments of the conservatory. Some of the berberis, especially the exquisite B. Darwinii, should be tried; and there could be little question that the attractive Chinese privet, almost an evergreen and flowering so profusely in autumn, and the equally beautiful Japan privet, would flourish here with due care. On the lawns of the Pavilion and in the Steyne Enclosures a few tufts of the magnificent Pampas grass, and some groups of Yuccas, might be introduced with striking effect. In places not adapted for grass plots or shrubs, the ivy borders and screens so extensively used in Paris, and beginning to be resorted to in London, might be usefully employed to cover or hide unsightly objects.

In the enumeration of trees and shrubs, those had been mentioned which might be obtained at cheap rates, and, being thoroughly hardy, could be cultivated at as moderate an expense as those already in Brighton. Probably some contributions from our country neighbours might be looked for in aid of a real effort to improve the town. The cost of the improvement would be very trifling. Even a five pound note now and then, if coupled with good instructions to those who had the care of the town trees and grounds, would do something; and private persons could do a great deal by setting in order their own house plots and the squares and crescents bordering on the thoroughfares. To go in for tropical plants and expensive beds of shrubs requiring an imported soil, as they did in London, would involve great, and not justifiable outlay.

March 23rd.

MICROSCOPICAL MEETING.—SUBJECT, "SPORES."

Dr. Dawson, in introducing the subject for the evening, "Spores," said he considered the spore of a fern was really a seed, and wished the members would pay a little attention to the determining a point not yet sufficiently made out, viz., "What a Spore really was?" If this were settled it would materially help in unravelling the assumed extraordinary generation of ferns, as held by some authorities.

A seed contained all that was necessary for the development of the future plant, except air and water. With this idea he boiled powdered asbestos in fuming nitric acid and then washed it carefully with distilled water until all trace of acid was removed. In this he planted mustard seed, which was excluded from the surrounding air by placing it in a closed glass vessel. The seed, it would be observed, had grown and produced cotyledons, from what he called the innate power of growth.

The size of a seed was immaterial; for, however small, it contained within itself material to sustain the plant until it could derive nutriment by the root and plumule. He believed the same held true of the spore, and that it was this active innate principle which gave rise to the prothallus.

As from the axis of the cotyledons the plant grew, so always from one point on the prothallus the fern grew. It would, therefore, be seen that the great point to be determined was the relative position of the spore to the seed. The spore he conceived had sufficient innate power to start a prothallus, from which, when formed, the future plant grew, and not by a generation on the surface of the prothallus.

Mr. C. P. Smith considered the spore simply a cell containing plasma, which formed a chain of cells, from which sprang the future plant.

Mr. Wonfor thought the accepted generation of ferns so contrary to everything else in Nature, that it required more than the mere authority of names to be believed, because, by this theory, the sexual organs were described as being developed in the earliest, and not, as in the rest of Nature, in the highest state of the individual.

Dr. Dawson wished the members would grow and observe fern spores during the next few weeks, and intimated that he would read a paper in May, on the fern spore and seed compared.

The meeting then became a Conversazione, at which

Mr. C. P. Smith exhibited *Ephemerum serratum* with prothallus, and germinating spores of *Pteris serrulata* and *funaria*, 12 and 21 days old.

Mr. Ardley exhibited spores of ferns and elaters of equisetum.

Mr. Wonfor exhibited spores of leaf fungi, ferns, and seaweeds, spores and elaters of equisetum and marchantia, prothallus of fern and the potato fungus.

Mr. Davies exhibited specimens of the rare lichen, *Collema dermatinum*, which appears to be a form of *C. furvum*; a fertile specimen of the little understood *Collema Ceranoides*, from West Sussex; *Leptogium Schraderi* from Woolstonbury Hill; and a fertile *Bryum Donianum* from near Chichester. This latter plant is seldom found fertile in this country. It is common in Italy, and appears to wander along the shores of the Atlantic, always being found near the coast.

April 13th.

ORDINARY MEETING.—MR. T. W. WONFOR ON "WHAT IS COAL?"

The word *coal* appeared to have been applied to any burning or glowing substance; thence to the substance from which a glowing heat could be obtained—such as wood or peat. When this glowing had died out of the *live coal*, the term charcoal,—*charred* or *burnt* coal,—was applied. In course of time, the mineral substance we designate as coal came into use, and the terms sea-coal, or "sea-borne coal," stone coal, and pit coal were used to distinguish it from other coal or heat-producing substances. In process of time the original idea or distinction was lost, and the term coal was applied only to some one or other form of the black substances dug out of the bowels of the earth, thus leading to the now opposite ideas, *wood* fire and *coal* fire, while coal, acted upon by heat to drive off its volatile products, was called *cooked coal* or "coke."

Though some had suggested the use of coal by the Romans in Britain, the only connection existing between them and coal was the fact that our Wallsend coal took its name from that mine being near the termination of the Roman Wall,—hence *Wall's End Mine.* We had certain evidence of coal being worked at Newcastle early in the 13th century; of its being prohibited as an article of fuel in and near London in 1306; of its becoming an article of commerce about 1381; of its limited use in the time of Henry VIII., when it was allowed only in the apartments of "the King, Queen, and Lady Mary;" and of its coming into general use about the time of Charles I., 1625. The story that a citizen of London was executed for using coal contrary to statute had no foundation in fact; the nearest approach being the pains and penalties incurred in Edward I.'s reign (1306), "when all who burnt sea-coals, against the proclamation, within the City or part adjoining thereto it, were to be punished for their first offence by great fines and ransoms, and for their second by the demolition of their furnaces and kilns wherein they burnt sea-coals."

The true vegetable origin of coal was not only determined by observing the conditions under which it occurred, but by the fossil remains associated with it and by the results of microscopic examination. These showed that coal was simply vegetable matter, altered and compressed—in other words, vast accumulations of trees and various plants, which either grew on the spot where the coal was now found or were brought down by vast rivers to a great estuary, where it accumulated. Some idea of the enormous amount of vegetation necessary to produce the coal measures might be inferred from the fact, that a square mile of forest land covered by 20,000 trees, each containing on an average two cubic yards of solid firewood, would only be equivalent to about an acre of coal 6ft. thick (10,000 tons), or to three acres of turf of the same thickness.

In connection with the vegetation which helped to form the coal one thing was most striking: the almost absence of that kind of wood which was characteristic of the forest trees of the present day, and the enormous preponderance of ferns and allied plants, such as clubmosses and calamites. Very few, if any, of these plants retained their form sufficiently to admit of a satisfactory demonstration of what they were absolutely like; but fronds of ferns more or less mutilated, detached roots and stems, with here and there cones or nuts, fragments of flowers, and fructification, helped to determine some of the orders of plants constituting our stores of coal.

No very safe conclusions respecting the climate of the coal period could be deduced, for, while the ferns would imply a moist atmosphere, the conifers were found in hot and dry and cold and dry climates as well as hot and moist and cold and moist climates; but, by a comparison of the relative proportion of ferns and conifers, with the other orders of plants in any known district, it was found that New Zealand presented the appearance of a country where the vegetation approached in its conifers, gigantic lycopods and ferns (especially the tree-like) to the vegetation of the coal measures. Hence we might infer a temperature not generally higher than the present one.

In addition to the occasional evidence of the vegetable origin in sections of coal and in the coal shales, the researches of Professors Morris and Huxley, Mr. Carruthers, and Dr. Dawson, of Canada, pointed to the fact that the great bulk of the bituminous coal consisted of sporangia and spores of plants allied to our existing club-mosses ; in fact, Huxley went further, and said, " The great mass of coal we burn is the result of the accumulation of the spores and spore cases of plants, other portions of which have furnished the carbonized stems and the mineral charcoal, or have left their impressions on the surface of the layer."

It appeared that thin sections of English coals from different localities revealed the fact that the chief elements in their composition were the said spores and spore cases ; the latter about 1-23rd of an inch in diameter, looking like little bags or sacs, more or less flattened, and containing the former irregularly rounded bodies, about 1-700th of an inch in diameter. At the next microscopical meeting he would exhibit slices of coal showing vegetable structure and spores.

Looking to the spores of existing club mosses, they were found to contain in their coats a quantity of resinous matter, which not only rendered them unalterable by air and water, but caused them to be used for the apparently opposite purposes of artificial lightning and the coating of pills ! In each case the resinous matter played the conspicuous part : in the former, giving the instantaneous flash when blown through a flame ; in the latter, the resinous matter prevented the pill being wetted by the saliva, and shut out the flavour of the drug from the sensitive papillæ of the tongue.

The thickness of the beds of coal varied from the 10th of an inch to 100 feet. The thickest beds in England were no where more than 40 feet thick. In east Germany and Styria lignite was met with over a hundred feet thick ; and true coal had been found in the department of Aveyron, Central France, over 150 feet thick. These beds generally rested on fine clay, penetrated in every direction by the roots of plants, while the beds above the coal exhibited broken leaves, twigs, and tree trunks. Continuous beds were very seldom found ; they were generally broken across, or exhibited bands of clay or sands, at times so impregnated with bituminous matter as to render them capable of being burnt.

The changes, by which wood, leaves, moss, and other vegetable substances were converted into coal required a long period of time, under chemical action of a peculiar nature. As many were aware, the chief constituents of all vegetable matter were the three substances, carbon, oxygen, and hydrogen ; the greater portion of the two latter occurring in the form of water.

Besides these substances, a certain proportion of earthy and alkaline matter was also present. In some vegetables the proportion of water was so great as to reach as much as 90 per cent. of the whole plant, while the proportion of woody matter varied from 18 to 50 per cent. Pressure and exclusion from atmospheric air would get rid of the greater proportion of the water, while the carbon, if unable in the process of decay to combine with oxygen, would, with the alkaline and earthy matter, be preserved for an almost indefinite period. In time, the external appearance of the component vegetation would be lost and the texture be confused, though, in this condition, as was seen in the case of lignite, it would often retain the woody form for a very long time without alteration. A continuance of the chemical action would result in a change of the proportions of the gases and the mineral ingredients.

Coal differed from wood, peat, lignite, &c., in that it had parted with nearly all the other ingredients of vegetation except carbon, and it might be said to differ from all other minerals of which carbon was an essential element, by retaining in part and at intervals manifest indications of its organic origin, in the presence of tissues and organs, which proved it to be composed of vegetable substances. It had sometimes been difficult to draw the line between organic matter impregnated with mud and other impurities, and clay charged with organic matter derived from vegetation, by which it was rendered combustible. In the celebrated Scotch case, where permission to mine for coal was granted, an action was brought to restrain from working bituminous shale. It having transpired that the lessor considered it as coal, the case was decided in favour of the lessee. About the same time bituminous shale was allowed to pass the German Customs Union without paying duty, because, though inflammable, it was not *real coal.*

The essential peculiarities of coal as a mineral varied very much; not merely in colour, weight, texture, hardness, fracture, &c., but also in its positive composition, in regard both to the amount of carbon it contained, and whether this was associated with gas capable of entering into combination with carbon, or whether the amount of earthy and other impurities was so great that the heating powers were lost before they could be applied to the getting up steam in a boiler. While all true coal was almost entirely free from water, oxygen and hydrogen (originally derived from the water contained in these vegetables) were at times present in such quantities as to interfere with the use of coal as a heat-producing agent.

Coal, according to its quality and peculiarities, was generally classed as *bituminous*, *steam*, and *anthracite*. At the head of the first stood *cannel* (candle); next the Scotch *parrot* and *splint*. One variety of the *cannel* approximated closely to *jet*, but was more brittle and not so hard. These varieties were almost pure, and yielded large quantities of gas. Next stood the *caking* or Northumberland and Durham coals, succeeded by the *cubic* and what were called inland coals, which did not cake, contained less bitumen, and were considered inferior for household purposes.

Steam coals, especially the Welsh coals, contained more carbon and less bitumen than the bituminous, and burnt freely without smoke where there was a great draught: hence their adaptability to steam purposes.

The anthracite consisted almost entirely of carbon, and had been termed non-bituminous; while the steam coal had been called semi-bituminous. They were heavier than either of the others, took fire with difficulty, but gave off great heat with a strong draught.

There were many points that might be considered, such as the position of coal in the geological series; the different fossil remains other than vegetable associated with it; its probable age; rate of accumulation; great areas of existence; possible time to which our British coal would last, at the present or increased rate of consumption; the various purposes to which coal was applied; as well as the almost endless products derived from coal. He had simply endeavoured to answer, to the best of his ability, the question, "What is coal?" leaving the answer, and any one or more of the suggested topics, as subjects for discussion.

An interesting communication was read from Dr. STEVENS, of St. Mary Bourne, on certain types of Flint Implements found in Hampshire, which led to a discussion, and a vote of thanks to Dr. Stevens.

APRIL 27TH.

MICROSCOPICAL MEETING.—DR. ADDISON ON THE "MOULTING OF *DAPHNIA PULEX*."

On April 14th, observing a flock of *Daphnia Pulex* in his Nitella jar, he removed two and placed them in a live box, so adjusting the cover as to allow the creatures a limited movement. In one there were four well developed embryos, in each of which could be seen the large compound eye and the single eye close beside; in the other there was one fully formed embryo and a mass of dark yolk matter with the usual large oil globules. At the end of five or six hours they were again examined, when it was found the one with the single embryo had given birth to its offspring, which was moving with the jerking motion of the antennæ peculiar to its race and seemed vigorous for so young an animal. On examining the mother flea it was found she had moulted her carapace, which was discovered in the box and exhibited not only casts and hairs of the antennæ, but also a perfect cast of the combwork and claws which characterized the tail of the creature, as well as representations of the delicate ciliated paddles.

In the mother flea the mass of yolk matter had experienced a change, being distinctly moulded into the form of two fresh eggs or embryos, one of which had approached towards the chamber at the back of the creature.

At this time—the first day of observation—the other flea presented the same appearance as when first observed, viz., the young visible in the chamber of the carapace.

On the following morning both fleas were living, but the last mentioned had discharged her four embryos, which were alive in the box. She also had moulted. Though he had not witnessed it, he was inclined to think that the birth of the embryos and the moulting of the carapace were simultaneous acts. It was well known, the Daphnia exhibited two distinct kinds of eggs, the agamic and ephippial, which were easily distinguished, the latter by their darker colour and absence of oil globules ; moreover, the carapace enclosing the ephippial eggs was much thickened and otherwise modified in structure, so that when the creature shed its carapace the ephippial eggs were cast away with it. The agamic eggs were much more transparent and showed an abundance of oil or yolk globules congregated in their centres. They never became dark or opaque as did the ephippial eggs, and there was no thickening or other modification of the egg chamber of the carapace, nor could a limiting membrane be detected in some agamic eggs. At a very early period the yolk mass termed the egg began to divide, and the members of the nascent embryo were easily observed moving without any limiting membrane, long before the time of birth. If the ephippial eggs were known to be cast with the moulting, it was not improbable that the young derived from agamic eggs were born quite or nearly simultaneously with the moultings of the parent.

Mr. Marshall Hall exhibited a new pocket lamp by Moginie of London, which appeared to be a very compact and portable apparatus.

Mr. Wonfor exhibited a fresh specimen of the Morel *Morchella esculenta* obtained near Brighton.

The meeting then became a Conversazione, when

Mr. Marshall Hall exhibited spicules of the new sponge, *Pheronema Grayii*, dredged up by him off the coast of Spain.

Mr. Sewell exhibited scalariform tissue of fern, sections of cocoanut wood, whalebone, &c.

Mr. Hennah, under one of Beck's new one-tenth immersion lenses, exhibited living diatoms : the performance of this lens was pronounced very perfect, the definition being very precise, while the distance at which it worked was so great that an ordinary live box was used, the cover of which was of ordinary thin glass. The same objects were also shown with a Gundlach's one-sixteenth, which gave very good definition.

Mr. Wonfor exhibited sections of the Morel, showing the spores in their receptacles; sections of coal fossils, by Norman, of City-road, London; sections of coal, made by Mr. Slade, and described in the January part of the *Quekett Club Journal*, and a series of sections of coal and lignite, made by himself, in which not only woody fibre but also spores and sporangia were distinctly made out; these were in illustration of his paper on Coal, read at the last ordinary meeting.

In the course of the evening, Mr. Wonfor illustrated his method of making and mounting sections of coal, which was a modification of the published methods.

May 11th.

ORDINARY MEETING—"AN EVENING FOR THE EXHIBITION OF SPECIMENS."

The Rev. J. H. Cross exhibited and presented for the Society's Album sketches he had made on the occasion of the Field Excursion to Barcombe.

Mr. J. Dennant exhibited a series of marbles from the Pyrennees and large acorn cups of the Smyrna oak *(Quercus Œgyolops)*, the Valonia of commerce.

Mr. J. Howell exhibited fossil silurian corals, vertebra of Plesiosaurus, from the Bone Bed of Aust, and shells from the Lias at Bristol and the Upper Eocene, Isle of Wight.

Mr. Saunders exhibited red organ coral, and other recent corals; pottery from the Tombs at Bengazi and Pompeii; and sands from the bays of Valentia, Malta, and Taranaki.

Mr. Elphick exhibited a couple of piebald mice, taken from a rick, and supposed to be a cross between the common and white mouse.

Mr. Wonfor exhibited a specimen of the silicious sponge (*Euplectella mirabilis*), or Venus' flower-basket; specimens of yellow wagtail, grey-headed ditto, and a state either intermediate between the two or in the immature plumage of the second. While the first is common, the second is uncommon, and the last very rare. These birds were kindly lent by Messrs. Pratt and Sons, and had been obtained in the neighbourhood of Brighton; also a very dark variety of the northern oak eggar moth.

May 25th.

ANNIVERSARY MICROSCOPICAL MEETING.

Mr. R. Glaisyer reported that 122 slides and a Möller's diatom type slide had been added to the Cabinet during the year.

Mr. Wonfor gave a brief abstract of the proceedings, with an account of the Papers read and the work done, which, he said, had exceeded their anticipations when it was determined twelve months previously to hold monthly microscopical meetings. Judging from what they had done in advancing microscopical enquiry among the members during the past year, it augured well for increased exertions in the forthcoming year.

Mr. Wonfor then gave an account of a method for obtaining thin sections of soft rocks, and illustrated it by making and mounting sections. He first cut with a saw (the one used was the common fret saw) slices of oolite, &c., ground down one surface on glass paper of different degrees of fineness, and then fastened them to a glass slide, with moderately-stiff heated Canada balsam. As soon as cold, the other surface was ground down on glass paper to as thin a degree as required, always finishing on *very* fine glass paper. The superfluous balsam was then cleared away and the powdery matter cleaned off with spirits of wine, when the slide was ready for the cabinet, or could be covered with thin cold balsam and glass cover, and left to harden. The specimens of oolite which were used to illustrate were part of the stone being used in making the Brighton Aquarium.

He had only worked on different oolites, Portland stone, dolomite, and nummilites from Egypt. By the same process he had made very thin sections of different coals,—in fact, all the examples of coal shown at the last meeting were made by this process. It was at the suggestion of Mr. Marshall Hall, who asked him to try how it would act on oolitic limestone and dolomite, that he was led to attempt the process. In the case of Portland stone, he had found it advisable to rub it down roughly first on a piece of paving stone, and finish it off on glass-paper. With some things, he had cut, ground, and finished a slide in twenty minutes.

The meeting then became a Conversazione, when

Mr. J. Dennant exhibited deep-sea Atlantic soundings, fossil and recent diatoms, antennæ of drinker moth, &c.

Mr. T. Cooper exhibited crystals of hematoxylin, tartrate of soda, and other salts.

Mr. R. Glaisyer exhibited sections of Eozoon Canadense, Purbeck, and Encrinital limestone.

Mr. Turner exhibited sections of Indian rice paper, root of Osmunda Regalis, and spores of morel.

Mr. Wonfor exhibited sections of different oolites, dolomite, Portland stone, nummulites from Ben Hassan, and crystals of salicine in silicate of soda, and crystals of silicate of soda mounted in the same. These formed very beautiful polariscope objects, and with one of Ackland's selenite stages, gave a wonderful variety of colour.

June 10th.

ORDINARY MEETING.—MR. G. SCOTT ON "RUDE FLINT IMPLEMENTS."

The immediate occasion of the Paper was the receipt by the Hon. Secretary, Mr. Wonfor, of a parcel of such implements from Dr. Stevens, of St. Mary Bourne,—a gentleman who was exploring that district of Hampshire with the greatest diligence and intelligence; and Mr. G. Scott explained that their Hon. Secretary wishing to bring the subject before the Society for discussion, had selected him (Mr. S.) for a task for which he (Mr. Wonfor) would have been himself admirably qualified.

First glancing at the doubts which had arisen as to the genuineness of these implements, owing both to the fraudulent fabrication of them and to the production of fracture in flint by natural causes, Mr. Scott said, "No one questions the human origin and use of the highly finished stone weapons of latter ages; and the acutest minds have for years been devoting the most careful research, and the most critical attention to those of ruder times; with the result, which it would be presumptuous to question, that, in far remote ages, men made the rudely chipped weapons which are found in cave and den, embedded in gravel, or strewn in places on the surface, and used them, to the exclusion of metal and of polished weapons, in war, in the chase, and in all the various needs of domestic life."

For a moment the thought might arise, "Was this a subject for the Natural History Society to take up at all?" But they saw at once that it was when they considered that Flint was one of the most important substances in Nature, and one of the most interesting with which the naturalist had to do; and when they remembered further that these rude weapons lead them back to that point at which Geology and Archœology touched and then diverged. Indeed, these implements formed the legitimate starting-point of enquiry into the earliest condition of man upon the earth, as apart from the Darwinian speculation, for which there was no fragment of proof; and to abandon this enquiry was to lose the only chance they had of knowing anything of the earliest races of Europe and of the evidences that man was living along with the mammoth, the cave bear, and the woolly-haired rhinoceros.

Adopting the division of the early human period into the Age of Stone, the Age of Bronze, and the Age of Iron, the first age might be divided into the period of the Drift (or Palœolithic period), when man shared the possession of Europe with the later extinct animals, and the Neolithic period, when beautifully-formed and polished weapons,—some of them bored as if by the lathe,—were found, but with no trace of the use of metals, except occasionally gold for ornaments.

"The Palœolithic Period" must be taken as a truly geological period, including the age of the gravel beds and the caves. The Neolithic must not be taken as including only polished weapons, for chipped weapons were in use at the same time, and chipped arrow-heads extended into the Bronze period, probably the best examples belonging to it, and the Neolithic period merged by slow degrees into that of Bronze; for stone weapons, we are told by William of Poitiers, were used by some of the Saxons at the battle of Hastings. Dr. Stevens' view might therefore be accepted, that his surface weapons were Neolithic, and we may also look favourably at Colonel Lane Fox's idea that those found by him at Cissbury were taken as forming a link between Palœolithic and Neolithic periods.

The first discovery of rudely-chipped implements (embedded in gravel) was made by a correspondent of his old Society, the Suffolk Archæological Institute, Mons. De Perthès, in the valley of the Somme, in the gravel at Abbeville, &c. By and bye, they were found in the gravel at Hoxne, in Suffolk, or rather Mr. Evans, after his return from Abbeville, found specimens from Hoxne in the British Museum, which had been found and recognized as of human workmanship by Mr. Frere in 1800—36 years before the announcement of the Abbeville discovery. They were now proved to exist in the districts round and in Bury, as well as in many other districts, such as the old gravels of the Itchen and Avon. Then they were found in caves, such as Kent's Hole and Wookey Hole, near Wells, and other caves in this country, associated with the remains of hyæna, &c.; also, in the Dordogne and other caves in France. In the latter, all the marrow bones of the ox, &c., were found, smashed to pieces, evidently with the rude flint weapons found with them. Here, also, were found rude figures of animals, &c., engraved on fragments of stone and on reindeer antlers. This might be taken as closing the first period. Then flint chipped implements were found associated with human remains in barrows, and in such instances as the nicely-chipped little arrow-head from our Museum, which was found at the left side of a skeleton in County Dublin. A curious instance was discovered in the upper part of the fen at Wisbeach, where a *Bos Primogenius* was found which had been killed with a large chipped flint, which was driven into the brain. The skeleton of a Northern chief was also found in a rude stone coffin in a large cairn on a moor in Scotland, with one arm almost cut from the shoulder by the stroke of a stone axe, a fragment of which remained in the bone. Lastly, they were found turned up by the plough on the surface of the ground in such numbers, and mixed with such multitudes of flakes and half-finished specimens, as to point to the likelihood that such spots were really great manufactories of such weapons. Possibly, some peculiarity of texture or toughness in the flint of particular localities, or some extra skill of the inhabitants, might have led to the choice of such districts for the purpose, and from such a spot, which Dr. Stevens was now exploring, had come the specimens for which they were indebted to him that night. Mr. Prigg, of Bury St. Edmunds, who had been at work on this subject for many years in conjunction with the greatest authorities in England and France, wrote "Your friend may have hit upon the site of a village of the old folk who wrought and used flint implements. At Icklingham, near this, a field or two adjoining have yielded more worked flints than the whole parish besides, and I have no doubt it was the site of a factory." He then spoke of the great care with which savage man evidently *selected* flints suitable to his purpose, and stated that the Brandon flint-workers of the present day obtained their best flints from a layer 40 feet deep, whereas the upper layers, termed "wall flints," were of little use to the knapper. These men said "flint has no grain," and a flint that will "run" or flake well was a very tractable subject in the hands of a fairly-skilled workman.

To obtain suitable flints, Canon Greenwell had proved that the early races dug, in some instances, to the depth of 40 feet. He had cleared out such pits 20 feet in diameter which were found partially filled up, and existing as basin-shaped hollows at Grimes Graves, near Brandon, in Norfolk (the Saxons give the place the name of the Grimes or Witches' Graves), and had found that they were used for this purpose, burrows even extending laterally at the bottom. In clearing the shaft, Canon Greenwell found no less than 70 antlers of the red-deer, and these were so cut into shape as to show that they were used as tools for the excavations. In one of the burrows which remained not filled up, lay a large nodule half extracted from the chalk, and by it two stag antlers, bearing, in the plastic material adhering to them, the imprint of the workman's grasp just as he left it. Who can say how many ages ago? He mentioned this at some length, both for its very great interest and because it was in examining similar pits (25 of them) within the old ramparts at Cissbury Camp, that Colonel Lane

Fox found no less than 350 worked flints, exclusive of flakes. This and other evidence proved that flint implements cannot be rare in our County of Sussex.

A correspondent wrote to the *Brighton Herald* in 1869, that he had found specimens on Newmarket-hill and other places, and also a very fine spear-head at Aldrington. This direction ought to be followed up, for a friend of his had found good specimens in the neighbourhood of Portslade. Mr. Whitley, the Hon. Sec. of the Royal Institution of Cornwall, found, on the top of the chalk cliff, two miles west of Beachy Head, four celts. The marks of design on the whole were unmistakable, but one of superior workmanship had been broken by a blow from a finer pointed implement. "I could not," he says, "resist the conviction that it, and two other *broken* celts found near it, had probably been broken in battle." Near Birling Gap, Eastbourne, he found very perfect flint knives. On other parts of the South Downs he found three polished celts and a large flake ground to a cutting edge. Mr. Whitley's testimony is the more remarkable that his article in the *Popular Science Review* was chiefly devoted to show the prevalence of naturally-fractured flints in certain localities, chiefly in the North of Ireland, where the chalk had been disturbed by volcanic action, and lies buried under masses of basalt. But, whilst he went on telling of natural fracture, which we quite admit, but only deny that it could be mistaken for human work, he at the same time kept finding specimens which he gladly admitted to be true implements. This very point referring to the North of Ireland was noticed by his (Mr. Scott's) poor friend, Dr. Gedge, who died some months ago whilst acting as physician and naturalist to Sir Samuel Baker's African expedition, some time before Mr. Whitley's paper appeared. In a letter to him when corresponding about Mr. Wonfor's paper on "Flint," Dr. Gedge wrote—"Talking of fracture and cleavage, I am reminded of the columnar fracture of flints occasionally met with. When I was examining the chalk in the North of Ireland, between the Giant's Causeway and Londonderry, I noticed that all the flints had passed into this allotropic state, furnishing an endless number of flint knives to the Belfast folk."

The existence of local manufactories of flint-implements was confirmed by the discovery at Wookey Hole, where worked flints were found, whilst there was no flint to be met with within thirty miles of that cave. The discoveries at Kent's Hole, near Torquay, also showed that the use of chipped weapons by no means ceased when those of polished stone, or even of metal, came into use; and although this cave had evidently been occupied by man up through the bronze period to the time when Roman pottery began to find its way into it, yet there was evidence that chipped flint implements, of much the same degree of merit, continued in use during the whole period of its occupation.

Not only the great antiquity, but the widely-extended use of stone weapons, both chipped and polished, was next pointed out; and a comparison was made of such as are now used in Africa, in the South Sea Islands, in Australia, New Zealand, in the arctic regions, &c., with those formerly used in this country. "Mr. Willett (said Mr. Scott) has kindly sent a New Zealand weapon, to show the mode of fixing it into the wooden handle. In the Bury Museum is one where a flat blade of jade, very much like one from St. Mary Bourne, was fixed sidewise into a handle split at one side, and then secured with string. These showed the way in which many flint weapons were fixed in wooden and bone handles, although many were used in the hand. Mr. Willett's specimen further illustrated the enormous amount of time and patient labour which a savage could afford to bestow upon his stone and wooden weapons, and the great skill which they acquired by practice in their production."

Returning to our country, Mr. Scott quoted a passage in which Dr. Stevens recorded the discovery of a spot "which," as he said, "had evidently been the scene of flint working during a long period," in a field known as Breach Field, situated on a hill about a quarter of a mile N.E. of the village of St. Mary Bourne, and specimens of which he now forwarded, "that," he wrote, "you may see the kind of humanly-wrought flint commonly found here," and so "observe the more common form of flint objects likely to be found on the Sussex hills." They should not, however, feel disappointed if they found no better, after considerable search. "Perhaps," adds Dr. Stevens, "some of your members will dispute that the stones are humanly wrought. They should, however, look attentively at the specimens. They had better study an inferior specimen than a good one, as well as others they may happen to find, as the eye requires instructing, as in the use of the microscope." This matter of the education of the eye was granted in all other branches of research, and in this too we came back to it as the grand point after all.

Well, Mr. Wonfor and he (Mr Scott) together examined the specimens carefully, with the determination to reject any about which they were doubtful; and they fully satisfied themselves that all before the meeting were of human workmanship. Of course, in such a case as this, the specimens having been found on the spot by Dr. Stevens, all suspicion of recent chipping (independently of the means we possessed of testing that point), must be dismissed, and so, having no element of fraud to deal with, they simply had to determine whether they were to attribute the specimens to natural causes or to human agency. Everything unmistakably indicated the latter. But as he did not wish to come before them with his own opinion only, even in support of the experience of Dr. Stevens, he took the whole of the specimens (with others carefully selected) to one of the best judges he had ever known, the son of a first-rate antiquary,—a Doctor, too, by the way, and who had been judging critically, and with almost instinctive knowledge of such things since he was a child. He took other specimens carefully selected, that is to say, some which he knew to be forgeries,—for he bought them with that knowledge,—and others of a very ambitious character, belonging to a friend, but in which he never believed, partly because nothing was known as to their original locality and for various other marks and failings which he need not stop to name. He at once pronounced these to be forgeries, and would not even look at others; but the moment he saw Dr. Stevens's specimens he said, "These are right: they are very early and rude, but there is no question about one of them."

Mr. Scott then pointed out, with great clearness and minuteness, the points of difference between the genuine and the fabricated or the naturally-formed implements, and concluded his Paper by referring to some of the difficulties he had had to contend with in executing the task assigned to him. Having for many years been accustomed to the advantages of an Archæological and Natural History Library, accessible at all times, he had felt, ever since he had been in Brighton, like a workman without his tools, especially when anything like a paper or lecture had to be put together. In the present instance, he had had to trust almost entirely to memory on a subject which had never been his particular line of archæological study. Such works as he wanted were not to be had in the town. Professor Rupert Jones wrote to him suggesting six or seven works on the subject, some of which were out of print, and recommending him to ask our eminent townsman, Mr Davidson, F.R.S., for some of them.

One other remark before closing. We heard constantly of such discoveries as a large collection of coins of Harold in Sussex; of 300 or 400 weapons at Cissbury, and so on. Why was it that so few of them found their way to the Brighton Museum? Might it not be that people were constantly saying it was the best and largest collection in any provincial town, and so on—when, that evening, he could only show from its cases a single imperfect polished implement belonging to Britain, and one other night he failed to show a single specimen of British Pottery. Let all help to make it known that good as our collections were, in some departments, there was plenty of room for presentations in all. He made these remarks not to find fault, but because the Rev. Mr. Beck had lately renewed his promise to him that, as soon as his collection of polished weapons from Norway, Denmark, Gothland, and Ireland, came back from the Society of Antiquaries, he would make a selection to be deposited in our Museum, and, also, because he was able to close with the following extract from a letter written some time ago by Dr. Stevens:—"I may be permitted to say that I have the largest collection of flint implements, and perhaps the most complete in England from one locality; and I have often thought that, at some time when they will be no longer of use to me, I would give them to the Brighton Museum."

June 22nd.

MICROSCOPICAL MEETING.—SUBJECT, "VEGETABLE HAIRS AND SCALES."

Mr. Wonfor announced that one of their honorary members, Mr. Curties, of Holborn, had kindly sent down for exhibition a large number of slides of hairs and scales of plants, from his private collection, as his contribution towards the evening's business, with a promise that at all times he should be pleased to help in the way of specimens.

In the course of a discussion on the nature and uses of hairs and scales in the economy of plants, Mr. Hennah mentioned that most plants possessing hairs, if properly manipulated, showed the circulation or rotation of the cell contents, a state of things admirably seen also in the rootlets of the frog-bit, *Hydrocharis morsus-ranæ*, and suggested, as the Society, on the occasion of its annual excursion, next Friday, to Arundel, would be in a district especially rich in pond life, that, if the next meeting were on that subject, many interesting things might be obtained for exhibition.

Mr. WONFOR considered the suggestion a very good one, because, in addition to Arundel, they would, before their next Microscopical meeting, visit Plumpton, a locality very fertile in pond life.

The meeting afterwards became a Conversazione, when

Mr. HENNAH exhibited the specimens sent by Mr. Curties, the most noticeable among which were hairs of different species of *Alyssum*, *Tillandsia*, *Zonata*, *Loasa*, *onosma taurica*, and sections of stems of different solanums, &c.

Mr. R. GLAISYER exhibited some very beautiful scales of different ferns *in situ* and as transparent objects, and the siliceous scales of *Deutzia scabra* and *gracilis*.

Mr. WONFOR exhibited various scales and hairs, chiefly of a stellate character, some of which, from different ferns, such as the *Niphobolus hastatus* and *Lingua*, the stagshorn *Acrostichum Alcicorne* and *Rhododendron ferruginum*, were much admired, as were also some of the same scales seen under polarized light. Later in the evening he showed the circulation of the cell contents in the beaded hairs on the stamens of Tradescantia, the blue spider wort, and eggs of *Sialis lutuarius*, obtained on the occasion of the Field Excursion to Barcombe.

JULY 13TH.

ORDINARY MEETING.

Mr. H. C. MALDEN gave an account of the great difficulties he had encountered in killing a female puss moth, until she had laid her eggs. Apparently killed on a Friday, after laying 175 eggs, she recovered, and though repeatedly, to all appearance, killed on that and the three following days, she did not die until she had laid 298 eggs. Many examples were given by the gentlemen present of the extrusion of eggs by moths, not only before death but even *in articulo mortis* and when the thorax was stiff, and to all intents dead ; so great was the effort of nature to propagate the species. There was also a curious circumstance connected with the eggs themselves, the first 175 had changed to the ordinary chocolate colour, while the rest had remained pink ; this in nowise affected their vitality, because many of them, equally with the others, had hatched.

Mr. Wonfor then read a paper on the Annual Excursion to Arundel, on June 30th, in which the chief incidents of the day, and the various objects seen and obtained, were very graphically and happily described, and especial reference made to the courtesy and hospitality of the Mayor of Arundel (W. W. Mitchell, Esq.,) and of His Grace the Duke of Norfolk, for granting permission to see the gardens and private grounds attached to the Castle.

Votes of thanks were given to His Grace the Duke of Norfolk and the Mayor of Arundel.

July 27th.

MICROSCOPICAL MEETING.—SUBJECT: POND LIFE.

Mr. Robertson announced that he had obtained at Plumpton Place, on *Anacharis Alsinastrum*, *Cristatella mucedo*, besides several mollusks, larvæ of Ephemera and caddis, four species of Planaria, two species of water beetles, and from a pond at Lindfield, Daphnia, *Cyclotella operculata*, &c.

Mr. Wonfor remarked that, though there was not time to go to the marshes, when at Arundel, he had made a dip in the lake at Swanbourne, and obtained various Desmideae, including *Euastrum*, *Micrasteria* and *Closterium*, several of the commoner diatoms, rotatoriae flosculariae, &c., and globules of *Chara Vulgaris*, containing spermatozoids, some of which he had mounted for the cabinet. From a pond near the Hassock's Gate Station, in addition to various forms of *Daphnia, Cyclops*, &c., he had obtained young tritons, which exhibited the circulation of the blood very beautifully, plenty of *Hydra Viridis*, some of which showed developed young hydra attached to the parent and *planaria;* on Monday, Mr Sewell and he, upon the occasion of going to Lewes to assist at a Conversazione of the Lewes Natural History Society, had obtained in the marshes, at Southover, plenty of *Volvox globator;* on the frog-bit egg masses of different mollusks, some of which were so advanced that the young mollusks might be seen through the jelly-like substance enclosing them; a few specimens of *Hydra fusca* and *vulgaris*, red and other water spiders, &c.; and that afternoon, from a pond in Furze-hill, he had obtained plenty of *Volvox globator* in all stages, several varieties of *Daphnia, Cyclops, Pleuroxus, Alona, Rotatoriae*, &c., as well as *Spirogyra* and many other minute organisms which he had not had time to identify. He had never seen a pond so rich in Volvox as the one he had visited that afternoon.

After a discussion on the nature and generation of Hydra and Volvox, in which Messrs. Sewell, Wonfor, Robertson, and Dr. Hallifax took part, the meeting became a Conversazione, when

Mr. Glaisyer exhibited various *entomostraca*, including *Daphnia pulex*, and *D. vetula, planaria*, and *anguillula*.

Mr. Sewell exhibited *volvox globator, cyclops quadricornis*, &c.

Mr Wonfor exhibited *Hydra Viridis* in different conditions, *volvox globator* in different stages, *spirogyra*, Hydrachna, &c.

August 10th.

ORDINARY MEETING.—MR. WONFOR ON "IS *BOMBYX CULLUNAE* A DISTINCT SPECIES, OR ONLY A VARIETY OF *BOMBYX QUERCUS?*"

After describing the differences between moths and butterflies, pointing out the peculiarities of the Bombycidae, and minutely describing the life-history of the two insects, *Bombyx Callunœ* and *B. Quercus*, Mr. Wonfor classified the distinctions drawn by entomologists between the two: as of size, the first-named insect being considered larger; of time in coming to maturity, the one taking two years, the other only one; of the difference in food; of the difference in the markings of the young larvae, the one having orange triangles, the other orange and white lozenges; and of the different colorations and markings of the perfect insect.

On the point of size, an average of either showed great diversity in size, colour, and markings. Difference of time was of little account, for undoubted southern insects had taken two years to complete their life-history, and all entomologists knew that insects of the same brood, in this and other families, would stay one, two, three, or even five years in chrysalis. Even in the difference of markings among larvae, the greatest variety was noticed in larvae from the same hedge-row; in fact, all the points only tended to show a *climatic* variety. In the case of colour, the tendency with insects, like other animals, was to acquire darker and duller hues as they advanced north, and lighter and brighter as they went south. This was well seen in French and Spanish specimens of *B. Quercus*, which were lighter and brighter in colour.

But a stronger point than all was the fact that he had succeeded in drawing up southern males with northern female. Taking advantage of the wonderful power possessed by the females of some groups of attracting the males from long distances and in great numbers, he had, by retarding, in a cold room, the time of emergence, got a female out on the 20th of July. This female, taken to Hassock's Gate that same afternoon, about four o'clock, when there was little sun and wind, had attracted males of the southern insect. On the principle that, among the insect tribe, the same species only was attracted by the female, he considered this went far to prove the point of *B. Callunae* being only a *climatic* variety of *B. Quercus*, and not a distinct species.

Other insects, at one time believed to be distinct species, were now acknowledged to be only varieties, and there was too great a tendency with some to increase the number of species, and to make minute differences which only constituted varieties the great feature in classifying. Though occasionally hybrids were found in Nature, the rule was for members of the *same species only* to pair. Had he been able to keep a female back a fortnight later, he doubted not he might have brought up nearly a hundred males of *B. Quercus*, drawn by a sense either of smell of a very acute character, the organ of which had not yet been satisfactorily pointed out, or by some sense, not yet localized or named by the naturalist.

The point had not been cleared up earlier simply, because, relying on some of the points of difference before mentioned, no one, as far as he knew, had kept back northern females and tried the experiment of seeing whether they would attract southern males.

The Paper was illustrated by specimens of both insects.

In the discussion which ensued, in which Messrs. Hollis, Hennah, Sewell, Nichols, and Dr. Hallifax took part, it was considered that the slight differences were not sufficient to constitute a species, while examples where given showing far greater variation in some of the supposed distinctions, and which were owing to climate or food.

Mr. Sewell brought forward, at the request of Mr. Robertson, some specimens found by that gentleman the preceding Saturday. He went to Rottingdean to get specimens of pholades on which to make experiments and observations, but found they were nearly exterminated. He was informed that they were taken out with pickaxes for bait.

Mr. Elphick exhibited a specimen of calcareous spar, from Berwick, obtained near the top of the hill in the chalk.

August 24th.

MICROSCOPICAL MEETING.—DR. HALLIFAX ON "POLYZOA."

The term Polyzoa was applied to certain animal forms (mostly microscopic) which, from their zoophytic external character and mode of growth, were formerly grouped indiscriminately with the zoophytes; from a better knowledge, however, of their internal structure, they were now placed at the bottom of the Molluscan series.

By close observation and attentive study during the last 40 years, Thompson, Farre, Milne Edwards, Ehrenberg, Grant, and others had removed them from the radiata in which they were placed by Cuvier, and elevated them to the mollusca; from the fact of their being proved to possess a higher organization.

It was known that they possessed a mouth and retractile tentacles, but no anal aperture could be detected, hence it was thought the one opening served both purposes. It had now clearly been made out that the alimentary canal, or stomach, folded on itself, and was terminated by a second orifice close by, but distinct from the mouth, thus proving they were of a higher organization than the lower zoophytes, which had but one orifice.

In the Bowerbankia, which possessed a very transparent envelope, a muscular structure, nervous ganglia, a representative of the liver, and a circulation of the nutritive fluid through the whole body had been made out, thus bringing them in connection with the mollusca; the more interesting, because, in external character and mode of growth, they were considered identical with the zoophytes; but microscopical examination had proved that the sea-mats of our shore were closely allied to the oyster and mussel. The tentacles, too, in which circulation could be detected were ciliated, while the Polyps were without ciliated tentacles.

The mode of reproduction was threefold, by gemmation, *i.e.*, by buds, by ova or eggs, and by fissure or division, the last the most rare, the first method the most common.

To the microscopist they were an exceedingly interesting class, for while the mere skeleton exhibited great variety of form and beauty, scientifically they possessed a higher value, as showing what patient and enduring observation and skill might accomplish.

The Black Rock was a good hunting ground, but the masses of sea-weed washed up from deep water after stormy weather would supply many forms.

Mr. Wonfor mentioned that two methods were adopted for procuring and preserving specimens with their tentacles expanded, one was by plunging the specimen in cold fresh water which killed and often caused them to exsert their tentacles, the other was to watch for the protruding of the tentacles in salt water, and to add spirits of wine drop by drop, this had the effect of killing the creatures with the tentacles expanded.

A discussion ensued on the nature and purpose of the bird's head processes, in which several gentlemen present took part, and the meeting became a Conversazione, at which some very beautiful examples of Polyzoa and Anthozoa were exhibited by Dr. Hallifax and Messrs. Sewell, R. Glaisyer, and Wonfor.

Mr. Wonfor also exhibited specimens of Polyzoa and Anthozoa mounted on paper, to show the form of the Polypidom.

Dr. Hallifax exhibited a very ingenious hygroscope, which registered the slightest difference of moisture in the atmosphere, constructed out of an awn of an *Erodium*, stork's-bill.

Treasurer's Account.

For the Year ending September 1st, 1871.

Cr.	£	s.	d.
By one year's Subscription to the Dispensary	2	2	0
" One year's Subscription to the Ray Society	1	1	0
" One year's Subscription to the Palæontographical Society	1	1	0
" Contribution to the Medico-Chirurgical Society towards expenses of room	1	1	0
" Fire Insurance of Books to 29th September, 1871	0	10	0
" Printing	12	12	0
" Stationery and Bookbinding	5	4	2
" Salary to Assistant Secretary	1	10	0
" Tea and Coffee	3	1	0
" Commission on Subscriptions received by Collector	1	16	6
" Messenger, for delivering Notices	1	19	0
" New Books and Periodicals	19	5	11
" Postage Stamps, Lamp Oil, and Sundries	2	5	4
Balance	12	0	1
	£65	9	0

Dr.	£	s.	d.
To Balance from 1869-70	1	19	0
" Subscriptions in arrear on 1st September, 1870, since received	13	0	0
" Subscriptions due on 1st September, 1870, since received	45	0	0
" Entrance Fees	5	10	0
	£65	9	0

Examined and found correct,

GEO. D. SAWYER,
ROBERT GLAISYER, } Auditors.

S. 19.

THE NINETEENTH

ANNUAL REPORT

AND

ABSTRACT OF PROCEEDINGS

OF THE

BRIGHTON AND SUSSEX NATURAL HISTORY SOCIETY,

ADOPTED AT A MEETING HELD

THURSDAY, SEPTEMBER 12TH, 1872.

BRIGHTON:
PRINTED BY FLEET AND CO., "HERALD"-OFFICE.

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President.

MR. GEORGE SCOTT.

Vice-Presidents.

MR. HOLLIS,
MR. BIGGE,
DR. HALLIFAX,
MR. SIMONDS,
MR. PENLEY,
MR. GWATKIN,
MR. W. E. C. NOURSE,
MR. J. CORDY BURROWS,
DR. HALL,
MR. SEWELL,
MR. T. GLAISYER,
MR. T. H. HENNAH,
MR. F. MERRIFIELD.

Treasurer.

MR. T. B. HORNE.

Committee.

MR. G. D. SAWYER,
MR. HASELWOOD.
DR. BADCOCK,
MR. C. P. SMITH,
MR. R. GLAISYER,
MR. BENJAMIN LOMAX.

Honorary Secretaries.

MR. T. W. WONFOR,
38, Buckingham-place.

MR J. C. ONIONS,
56, Middle-street.

Honorary Librarian.

MR. GWATKIN,
49, Grand-parade.

At the Nineteenth Annual Meeting of the BRIGHTON AND SUSSEX NATURAL HISTORY SOCIETY, held at the Dispensary, September 12th, 1872,

IT WAS RESOLVED,—

That the Report, Abstract of Proceedings, and Treasurer's Account now brought in be received, adopted, and entered on the minutes, and printed for circulation as usual.

That the cordial thanks of this Meeting be given to the Honorary Secretaries and Honorary Librarian for their labours in preparing the same.

That the following gentlemen be elected as Officers of the Society for the ensuing year:—President: Mr. G. Scott: Treasurer: Mr. T. B. Horne; Committee: Dr. Badcock, Mr. Haselwood, Mr. G. D. Sawyer, Mr. C. P. Smith, Mr. R. Glaisyer, and Mr. B. Lomax; Honorary Secretaries: Mr T. W. Wonfor, 38, Buckingham Place, and Mr. J. C. Onions, 56, Middle Street; Honorary Librarian, Mr. Gwatkin, 49, Grand Parade.

That the sincere thanks of this Meeting be given to the Vice Presidents, Treasurer, Committee, Honorary Secretaries, and Honorary Librarian, for their services during the past year.

SPECIAL BUSINESS.

The following new Rule, recommended by the Committee, was passed:—"That the Committee be empowered to exchange Publications and Reports, and to extend the privilege of attending the Meetings and Excursions of the Brighton and Sussex Natural History Society to the Members of kindred Societies, on similar privileges being accorded to its Members by such other Societies."

(Signed),

W. M. HOLLIS,

PRESIDENT.

IT WAS ALSO RESOLVED,—

That the thanks of this Meeting be presented to Mr W. M. Hollis, for his able conduct as President during the past year.

REPORT.

In presenting the Nineteenth Annual Report, your Committee have the pleasure of recording the continued prosperity of the Society, which has considerably increased in numbers during the past year; but regret the loss sustained by the deaths of Mr. Lowdell (a Vice-President, and one of the founders of the Society) and Mr. Allfree, an old Member.

The state of the finances continues to be satisfactory: there being a balance of £19 11s. 2d. in the hands of the Treasurer, after an expenditure of £23 16s. 1d. in the purchase of New Books and Periodicals.

The following Books have been presented to the Society during the year, viz.: Flowering Plants of Tunbridge Wells and Neighbourhood (Dr. Deakin); The Climate of Uckfield, in the Weald of Sussex (C. Leeson Prince, Esq.); Cruise of the Norna—pamphlet (Captain Marshall Hall); Journals of the Quekett Microscopical Club; Sixth Report of the Quekett Microscopical Club; Journal of the Linnæan Society,—No. 53, Zoology; Additions to the Library of the Linnæan Society (Dr. Addison); Climate of Brighton—pamphlet (Mr. F. E. Sawyer); Transactions of the Maidstone and Mid-Kent Natural History and Philosophical Society (from the Society); the Fourth Annual Report of the Eastbourne Natural History Society (from the Society); Notes on the Species of Hepaticæ, found in the Eastbourne District (from F. C. R. Roper, Esq.); Catalogue of Fossils in the Brighton Museum (H. Willett, Esq.); Eighth Annual Report of the Belfast Naturalists' Field Club, 1870-71; Geological Notices of North Hampshire (pamphlet), 1872 (Dr. Stevens, Esq.); Slickensides on Rubbed Rocks in Various Situations (from the Eastbourne Natural History Society); E. S. Dewick, on the Hydroid Zoophytes of this Coast—Eastbourne (from the Natural History Society); Boring Mollusks, Worms, and Sponges; Crustacea; Podothalmata, and the Histology of their Shells (from E. Parfitt, Esq.); Evelyn's Sylva, and Rea's Flora, in three books, bound in one (Mr. R. Glaisyer); Report of the Sub-Wealden Exploration; Flint Works at Cissbury (Dr. Stevens).

The following Books have been purchased during the year:—Journal of the Linnæan Society from the commencement—14 vols.; Geology of Oxford and the Valley of the Thames (Phillips); Sowerby's English Botany—11th Vol.; Manual of Geology (Jukes and Geikie); Transactions of the Palæontographical Society; Transactions of the Linnæan Society—Part 2, Vol. 18—Part 1, Vol. 19; Evans's Stone Implements; Bastian's Beginnings of Life, 2 Vols.; Jefferies' British Conchology, 5 Vols.

The number of volumes in the Library, which at the date of the last Report was 700, has been increased to about 760. The circulation of the Books continues to increase. The Library, having received very numerous additions since the last Catalogue was printed, your Committee have issued a new edition.

During the year the Society's Microscopical Cabinet, which now contains 205 Slides, has received donations from the following gentlemen:—

Mr. J. Beck	1	Mr. Hennah	1
Mr. Curties	8	Mr. Wonfor	3
Captain Marshall Hall	1	Mr. W. H. Smith	5

Donations of Water-colour Drawings, Sketches, Photographs, and Microphotographs, have been made by Mr. Penley, the Rev. J. H. Cross, Mr. T. H. Hennah, Dr. Hallifax, and Mr. O'Bryen Lomax, and of Lichens and Mosses, by Mr. G. Davies.

Your Committee have much pleasure in reporting that the Monthly Microscopical Meetings have been decidedly successful, and have added very materially to the usefulness of the Society.

The Conversazione given in the month of January proved so successful, that your Committee recommend that it be made annual.

The thanks of the Society are due to the Brighton and Hove Dispensary, and to the Medico-Chirurgical Society, for the use of the Room at the Dispensary in which the meetings of the Society are held, and to those gentlemen who have read Papers, exhibited Microscopes and Specimens, and contributed to the Library, Album, and Cabinet.

Your Committee hope the recent visit of the British Association to Brighton may not only stimulate the Members to increased exertions, but that it may have a permanent effect on the pursuit of Science in the Town and County.

The Field Excursions since the last Report have been as follows:—October, 1871, to Bramber. 1872: May, to Balcombe; June, to Isfield; July, to Findon (by invitation from Mr. H.

Willett); August, to Henfield; September, to Hassock's Gate.

The Annual Excursion took place on the 6th July, to Parham, by water from Ford, where, by the kindness of Lord Zouche, the Members visited Parham House, Park, and Heronry. A Coloured Drawing of Parham House, taken on the occasion by Mr. Penley, has been presented by that gentleman for the Album.

In concluding their Report, your Committee beg to request the Members to endeavour to promote the prosperity of the Society, by bringing its merits under the notice of their friends; by contributions of Works of Natural History to the Library, of Photographs or Drawings of objects of Natural History for the Album, and of Slides for the Microscopical Cabinet; and particularly by reading Papers during the ensuing year.

ABSTRACT OF PROCEEDINGS.

1871–2.

SEPTEMBER 9TH.

AN EVENING FOR THE EXHIBITION OF SPECIMENS.

Mr. SAUNDERS exhibited pavement from Pompeii and Carthagena, section of ammonite, fossil wood from Antigua, red porphyry, a magnificent specimen of hyperstine, portion of elephant's tusk, from Coombe rock in Rock-gardens, &c.

Mr. PENLEY laid on the table a collection of sea-weeds, sponges, and corallines from New Zealand.

Mr. GOSS exhibited a species of *zygœna* (one of the Burnet moths), new to Britain, *zygœna exulans.*

Mr. HENNAH exhibited a very fine live chameleon, which attracted considerable attention, especially by the fact of its moving each eye independently of the other.

Mr. NOURSE exhibited some very curious stones brought by him from the valley of the Kings' Tombs, Thebes, and which some considered to be nummulites.

Mr. HOWELL exhibited fossil elytron of beetle in a pebble of indurated clay, picked up on the beach in Whitecliffe Bay, Isle of Wight.

Mr. SEWELL exhibited specimens of ventriculites and alcyonites from Hurstpierpoint.

Mr. ARDLEY exhibited fluor spar, crystals of lime, lead ore, and calcareous *tufa*, from Matlock, Derbyshire.

Mr. WONFOR exhibited varieties of moths and butterflies taken this year, a specimen of *Deilephila Galii* (bedstraw hawk moth), bred by him this year, and a very rare moth, *Deiopeia pulchella* (crimson speckled footman), taken by him on September the 4th, at Hove. It was in such beautiful condition as to favour the idea of its being bred in this country. Mr. Wonfor mentioned that, on the last occasion when it appeared near Brighton, two were taken; and, curiously enough, another was taken on the Race Hill on September 11th, somewhat rubbed, by Mr. Gorringe, of Richmond-buildings.

September 28th.

MICROSCOPICAL MEETING.—MR. WONFOR ON "DIATOMS."

Mr. Wonfor remarked that he introduced his subject for the evening, "Diatoms," with some diffidence in the presence of some, especially of Mr Hennah, who had devoted much time to their study and who knew a great deal more about them than he did.

Diatoms, were unicellular algæ of a peculiar character, distinguished from other unicellular plants, and especially the Desmids, with which they had a great affinity, by the possession of a siliceous covering, which, while it rendered them exceedingly brittle—hence their name brittle-worts—also rendered them all but indestructible under ordinary circumstances. One great peculiarity was the fact that if the internal cell membrane became exposed to water, it secreted a siliceous covering; if the plates or valves forming the frustule even became separated, a plate of silex began to form and became what was termed the connecting membrane. The frustules were either free—*i.e.*—moved freely in the element in which they were found, from which circumstance they had been designated animals, adherent or attached to the substances on which they grew or aggregated ; in this last case, they cohered either by their angles, were provided with a gelatinous pedicel which united the frustules together, or they were enclosed in great numbers in a general thallus.

The separate frustules, when seen from a front or side view, presented very different appearances ; in fact, some, like the *coscinodisci*, were circular in a front and nearly rectangular in a side view, with a line down the centre ; this line showed the junction of the two valves which formed the frustule. The cell contents of the frustules were a viscid protoplasm called the *endochrome*, generally of a yellowish or brown colour, and contained globular and granular bodies ; of these the last had in some cases been seen to rotate within the cell, so forming a species of cell circulation.

The mode of increase was by self-division and by conjugation ; in the former, the valves separated, the cell contents aggregated on opposite sides of the frustules, the primordial utricle folded in, became contracted, and eventually separated, at the same time a new siliceous valve was secreted by each half, and the result was two diatoms in the place of one. This mode of growth was said to be very rapid.

In multiplication by conjugation, two frustules lying near each other opened at their sutures and exuded their cell contents, which coalesced, while the whole was involved in a gelatinous substance, from which sprung frustules of larger size than the parents, to which the name sporangial frustule was given.

The siliceous valves had, from their markings, always been favourites with miscroscopists, and, though some complained of too much time being devoted to them, yet the question of the nature of their markings had been the means of improving objectives, and had also led to the designing of various forms of illuminating apparatus more or less simple or complicated.

A very interesting discussion ensued, in which the President, Messrs. Horne, Robertson, Wonfor, and Hennah took part, the last named gentleman drawing especial attention to the researches of Dr. Maddox, which, when published, would throw great light on the life history of the diatoms.

The meeting then became a Conversazione, when living diatoms, and a great variety of siliceous valves from different localities, were exhibited by Dr. Hallifax, and Messrs. Hennah, R. Glaisyer, and Wonfor.

Mr. Hennah also exhibited some exquisite micro-photographs of diatoms taken by Dr. Maddox, some of them magnified 3,000 diameters.

OCTOBER 12TH.

ORDINARY MEETING.—DR. STEVENS ON "FLINT WORKS AT CISSBURY."

In the absence of Dr. Stevens, of St. Mary Bourne, his paper on "The Flint Works at Cissbury" was read by Mr. WONFOR, who explained that the paper owed its origin to a visit paid in company with Dr. Stevens and Mr. J. P. M. Smith, to Cissbury, in August, when Dr. Stevens promised to contribute a paper on what he had observed. This paper, dated September 15th, he had received on September 20th. It was as follows :—

"Of the many interesting features of Sussex, the broad and bold South Downs, extending from Beachy Head to the Hampshire border, might be considered as among the most attractive to the tourist and student of Nature ; for here the enquiring might find, according to predilection, an endless source of interest. The stunted wild flowers, the wild and solitary hill birds, the lepidoptera and the mountain mollusks, the wandering bees and the agile grasshoppers, furnished an abundant mental harvest ; some small items of their life history already gathered in, but by far the larger portion remaining undisclosed. Again, the solid hills themselves awaited only the mattock and shovel of the geologist to reveal their long-entombed relics of a world, more fluctuating, perhaps, although as largely populated with animal forms as the present.

The earthworks also crowning their summits had their page of instructive but misty history, respecting the early and rude tribes whose remains testified that they occupied for purposes of war these places, now, happily for ourselves, the scenes of peaceful industry.

Of these magnificent hills, Cissbury more particularly claimed attention, from the circumstance that much rude flint cutlery was found within its ramparts, and from which it might not inaptly be considered, in the long past, as the silicious Sheffield of Sussex. Subsequently it might have been a Roman *oppidum* ; and its fortifications in nature and period appeared to be in common with those of the neighbouring hills of Chanctonbury, Hollingbury, Highdown, and others, the series having evidently formed a guard to the inlets of the channel. Eminences so framed for defence would naturally have been used by any people resisting invasion from the sea, as they would have been subsequently retained and organised for purposes of subjugation by a successful invader. The earthworks, consisting of a single rampart, of varying depth, and ditch, enclosed about 60 acres, the entire work indicating considerable engineering skill, and must have been the work of a people possessed of the advanced appliances of labour ; and although attributed to the Romans, it would appear to have been formed anterior to, or at the same period as, the people who wrought the flint implements within the camp. He saw no reason why the work should not have resulted from the brave old Britons, who, with all their native ruggedness, sturdily resisted the best generals of Rome for 260 years, from *Cæsar* to *Severus*, a time equal to the period intervening between Queen Elizabeth's time and ours, besides the task of keeping them in subjection an additional 200 years, and which they surely could not have done had the Britons been as combined in their social and military organization as the Romans were ; but they were split up into sections and subdued in detail.

In much of the refuse lately thrown out of the pits the flints exhibited recent surface patination, whereas the implements scattered about the hill had evidently undergone long exposure to atmospheric agencies, the surface colour in some specimens penetrating to the depth of a quarter of an inch. He apprehended that over the general surface of the camp a mere film of wrought flints would be found, as without excavations extended operations could not have been carried on. He had had no opportunity of observing any section of the upper chalk of the hill ; but in the Hampshire chalk-with-flints, the flint layers ran in planes through the chalk, at distances varying from 3 to 6, and in some instances from 10 to 12 feet apart, so that, placing the Cissbury chalk on a similar footing, mining to some depth must have been necessary to prevent exhaustion of the material. It had further been found that newly dug flints were more easily wrought than those which had suffered exposure.

Evidences of Roman occupation had turned up in the shape of coins, found both on the hill and at the foot of it ; and he, himself, picked up Samian and terra cotta ware at Cissbury and Chanctonbury ; indeed, the soil in the centre of the fortification at the latter hill abounded in good Roman British pottery. An undoubted testimony to British occupation at Cissbury occurred in an almost incalculable amount of refuse chips, resulting from the manufacture of flint implements, with some rudely finished specimens strewed about the turf, and occupying pits on the west slope of the camp; and as similar chippings are scraped out of the rabbits' holes, it would appear that the entire subsoil abounded in such relics. Scraps of vessels, of an early hand-made type, also were frequent on the downs; and rolled pebbles, with small lumps of clay-iron-stone, indicated that the older tertiaries once formed a cap to the hill. Diligent search on Chanctonbury, Hollingbury, and Highdown, failed in detecting wrought flints; but at Chanctonbury this was explainable from the small amount of chalk-with-flints resting on the lower chalk, of which the hill is formed. Cissbury had the appearance of having been frequented for the purpose of forming instruments for the use of the inhabitants of the neighbouring districts; and the pits thought to be British dwellings were most likely holes sunk in the chalk for the purpose of obtaining the material; and they might have been used for dwellings as well (*vide Archæologia*, 1868). Around some of the pits hillocks of earth were present, thrown out during the excavations; but he had not had sufficient opportunity to determine whether the pits were connected by shafts.

Excavations of greater magnitude, connected by shafts, were found not long since by Mr. Greenwell, in Norfolk. They were known as Grime's graves, and were evidently dug for the purpose of obtaining flint from the upper chalk. They were about 250 in number, circular in outline, varying from 20 to 60 feet in diameter, placed irregularly at about 25 feet apart, the whole covering a space of about 20 acres. The tools used as picks were antlers of deer; and in other parts of Norfolk similar holes had been discovered, known as Dane's holes, which were further found to have been occupied as habitations. They were from 20 feet to 50 feet in depth, connected by passages at the bottom, and in them were found heaps of chipped flints, besides bones of *bos longifrons*, *deer*, and *wolves*.

At Cissbury, Colonel Fox unearthed from 500 to 600 instruments of different kinds, in every instance chipped; and from the presence of traces of *Bos longifrons*, *Capra hircus*, and *Sus*, he considered they were later than the drift, although they might all be classified as belonging to the Neolithic or later stone age, as in the case of the Norfolk tools, no trace of metals had been found with them. Previous to this discovery it was thought that there was a difference in type between the valley and surface implements; but among the Cissbury hatchets, some specimens appeared corresponding with the Palæolithic types, thereby rendering it difficult to determine where the drift form ends and the Neolithic type begins. Colonel Fox further found similar wrought flints in the trench at the base of the rampart, lying on the original floor of the ditch, under about 3 feet of earth ; and from this circumstance he was enabled to conclude that those who wrought them must have occupied the hill at the same period, or subsequent to the construction of the earthworks.

At a late visit to the hill, in company with Mr. J. P. M. Smith, who had previously met with well-formed implements there, and Mr. Wonfor, who would show some rude specimens picked up by himself on the occasion, he took away as many as 100 wrought flints of different forms, most of them very rude, yet all exhibiting considerable design, and evidently not mere waste. Among them he recognized the pointed and oval drift types, similar to those already mentioned as obtained by Colonel Fox. Of better shaped specimens, three well-wrought lance heads were worth mention, of similar form to one obtained by Mr. Wonfor. The rest consisted of roughly-worked celts, and picks pointed at one end and broad at the other, others pointed at both ends ; besides several tools, edged on one side, the other blunt for use in the hand, and similar to some implements taken from among the cave deposits of France. The heavy picks, it is likely, were hafted for better convenience in use. Flakes, suitable for knives, were almost beyond number, and some rudely cut circular stones, known as sling-stones, helped to fill the bag ; but the ubiquitous scraper, sufficiently good to be ranked as such, was not forthcoming.

There was a considerable difference in the types of some of these Cissbury "flints," when compared with those of North Hampshire. The drift type had not yet occurred among the Hampshire series ; and as rubbed implements are not rare here, there was room for the suggestion that those found at Cissbury belonged to a somewhat earlier period.

It occurred to him to enquire how an invaded people occupying these hills could have obtained water ? In peaceful times it was easily understood that the women, among uncivilised tribes always the hewers of wood and drawers of water, might have toiled up the winding inlets to the camp with water in skins or earthen bottles ; and he had lately been informed that hollows, floored with clay, which were evidently artificial tanks or ponds, had been found in places on the hills; but such a mode of collecting an essential so necessary to life must have been very irregular and precarious.

In arriving at some conclusion respecting the people who formed these early weapons and tools, we were in a position to infer that they occupied hut villages in convenient places, and in winter selected spots porous to water, in order to avoid being flooded, and there framed their simple subterranean habitations; and, under pressure from without, resorted to their defences on the hills. Their powerful entrenchments, extent of pasturage, and ready access to the coast for fishing, implied that they must have been both numerous and warlike. They hunted the wolves, hogs, and deer in the great forest of Anderedeswood, then occupying the whole of Central Sussex, and extending into Kent and Hampshire. In addition they had their short-horned ox *(bos longifrons)*, swine, goats, and sheep; the large, irregular shaped earthworks observable on the slopes of the Downs in many parts of the south of England, notably in Wiltshire, being considered as pens in which their cattle were herded *(vide Sir R. C. Hoare's Ancient Wilts)*.

Some of these ancient tribes were more advanced and warlike than others, and their implements of flint showed greater design and finish. We had evidence of a feeble race who inhabited a subterranean village at Fisherton, near Salisbury; their wigwams were both separate and in groups, sunk 10ft. in the gravel and resting on the chalk. They were reached by means of circular shafts, and had moveable covers of wattle and burnt clay. These poor people had an early knowledge of weaving, and cultivated some of the cereals, as testified by the presence of rude hand grain-rubbers. Their only implements were of bone and stone, and they used, besides, a primitive form of pottery, which bore no traces of the potter's wheel. Similar traces of the flint workers of Hampshire had lately come to his knowledge, in excavating a Roman building at Finkley. Here a deep cave in the earth, with its attendant passage, contained pottery of a similar description to that found in the pit dwellings of Wiltshire, while the flint implements from the trench corresponded with those picked up in the surrounding fields at Finkley. Articles of bone and wood, and spindle-wheels of chalk, with charred stones, known as "pot-boilers," further threw some light on the early state of civilization of the occupants of the trench. The above details, however, implied merely differences in degree, observable in all conditions of society. The "pot-boiler," or heating-stone, marked a very rude state of social life, as it was thought to have subserved the purpose of raising the temperature of water or for roasting food when, there being no metals, the simple pottery of the period was not sufficiently good to resist the action of fire. That the early inhabitants of Sussex used flints almost exclusively for purposes of war and the chase there could be no doubt, and, in the hands of a patriotic and powerful race, the heavy and sharp weapons formed with it must have been most formidable. Other materials, ready of access and easily recognised, such as wood, bone, and horn, were likely also in daily use ; and although confined probably to their leaders, their burial places bore testimony that some of the metals, at all events bronze, to a limited extent were not unknown ; but it was singular that at the flint-working sites, objects of metal were never found.

These few details, suggested by a recent visit to Sussex, were intended, not as containing anything very new or exhaustive, but with the hope of obtaining more extended investigations, by such of the members as might prefer such pursuits, concerning these interesting relics of the later stone period in Britain.

The paper was illustrated by specimens obtained from Cissbury and elsewhere. A very interesting discussion ensued, in the course of which many facts, confirmatory of Dr. Stevens' views, were advanced by the President, Messrs. Saunders, Haselwood, G. Scott, T. H. Hennah, Howell, Robertson, Horne, W. H. Hallett, Penley, and Wonfor, and Dr. Massy. A hope was also expressed that systematic explorations would be made to elucidate an obscure page in our early history.

Votes of thanks were given both to Dr. Stevens and Mr Wonfor.

Mr. C. P. Smith announced the discovery of an umbelliferous plant, new to Britain, near the Race Hill. It was not only a new plant, but a new genus and species as well.

OCTOBER 26th.

MICROSCOPICAL MEETING.—MR. WONFOR ON "THE SCALES OF INSECTS."

By the term, "the scales of insects," was understood those epidermal appendages found on the head, thorax, legs, and abdomen of some insects; on the wing-cases of some beetles; and on both surfaces of the wings of butterflies and moths: to whom they gave that wonderful beauty of colour which rendered them objects of admiration even to the non-entomologist.

In general terms (proceeded Mr. WONFOR) scales might be designated as being flattened hairs; though in examining the multitudinous forms and varieties met with among insects, every stage between the round hair and the purely flattened scales was to be found. The analogy to hairs was also seen in their horny character.

Taken as hairs, they seemed to present three different types: one very common form being an upper and lower surface, more or less rugous, striated, or wrinkled, with an inner structureless membrane between them, which seemed to act as a kind of foil to throw up the brilliant colours of the scales. In another type, the upper and under surfaces, without an inner membrane, were welded together; for, when the scales were broken or damaged, no trace of the intermediate membrane could be found. In a third type, the scales were more or less rounded, sometimes tasselled, and devoid of the structureless inner membrane. In these last—and, possibly, also in the first type—there seemed to be a power, on the part of the insect, of inflating, or puffing out the scales, so as, possibly, to render them more buoyant. Certainly, when taken from recently-caught specimens, these scales were rounded, but when pressed between glass they became flattened.

Each scale was inserted in the wing-membrane by a stalk, and here, especially among the butterflies, the creatures not only appeared able to inflate, but also to raise the rows of scales. Some of the "tasselled" scales, beside their points of insertion, had also a kind of ball-and-socket movement. When scales were taken from recently-caught specimens, a slight pressure of the covering glass caused an oily substance to ooze from the point of insertion; but whether this was pigmentary matter, or a circulating fluid, was doubtful.

Considerable difference of opinion prevailed as to the markings on the scales, and the learned were at issue on this point. It would seem that there were several types. In one, longitudinal striæ, or ridges, were crossed at intervals by transverse striæ; in others, there were longitudinal ridges, with puckerings, or wavings of the membrane, between them.

Some had urged that the longitudinal striæ were of a beaded character, and that, in some, the lower beads could be seen through the structureless membrane. He had found that, when the upper or under surface was torn or damaged, the so-called under beads were lost, leading to the opinion that the (so called) beads were spectral reflections of the upper. This, though difficult of demonstration among the Thysanuridæ, was seen in large and well-marked scales from some of the larger foreign and English butterflies and moths. Some markings were evidently due to colour pigment; this, in some cases, presented a granular appearance.

He had brought down for exhibition and illustration a large collection of scales, *in situ* and separated, and some larger ones broken up to show structure; and, by the kindness of some London microscopical friends, Messrs. T. Curties, McIntyre, and Marshall, he was also able to show some very choice test scales from Thysanuridæ, Poduridæ, &c.

The meeting then became a Conversazione, at which many very beautiful objects in illustration of the paper were exhibited by Dr. Hallifax, Messrs. Glaisyer, R. Glaisyer, Sewell, C. P. Smith, and Wonfor.

Mr. C. P. Smith exhibited a very compact and handy portable microscope by C. Baker, of Holborn. This instrument, which was much admired, possessed a revolving stage so contrived that the object under examination always remained in view during revolution. This was an important adjunct, and hitherto had only been applied to the more expensive forms.

Mr. J. Robertson exhibited wings of *Sirex gigas*, showing the spines.

NOVEMBER 9TH.

ORDINARY MEETING.—MR J. ROBERTSON ON SEPIOLA OCEANICA, PLACUNA PLACENTA, AND DENTALIUM ENTALIS. NOTE ON THOMAS GEERAN.

It was not his intention in these Notes on Shells to trouble them with general descriptions of the specimens submitted to them, but only to mention facts not generally known.

The *Sepiola* before them was called *atlantica* by D'Orbigny, but further knowledge proved it to be oceanic. The body was short and purselike, and supported by a band; there was also a ridge which fitted a groove in the funnel. Until recently, the reproductive processes of the cuttle-fishes were involved in great obscurity. The males of *Octopus* and *eledone* were rare, and only females of some species were known. No male argonaut, but hundreds of females had been found. Madame Power, who kept argonauts in floating cages, described the newly-hatched argonaut as looking like a little worm, having rows of suckers with a thread-like appendage at one end, and a small swelling at the other. "It might be supposed to represent an extremely small bronchial appendage, from which the other parts were subsequently developed." Madame Power, whom he knew in Paris, and who was largely endowed with the genius of observation, said that the worm-like creature was the young argonaut. Chiage, who seemed to be the first discoverer of this creature, described it as a parasitic worm. Dr. Albert Kölliker had suggested that these seemingly parasitic worms which had been called hectocotyles, might be the missing males. Kölliker found a hectocotyle adhering to the gill-chamber of a nemoctopus. Which, then, were they: the newly-hatched argonaut or the missing males? The permanently rudimentary condition of males prevailed among parasitic crustaceans, the males of which lived parasitically upon the females, from whom they differed in form and structure.

He would next direct attention to the Window shell *Placuna placenta*, which with *P. sella* (resembling a saddle), formed a group between *ostrea* and *anomia*, but nearer to *anomia*. These shells were nacreous and quite transparent, and had been long used in India as panes for windows. The shells had been known in Europe since the days of Solander, but the animal was still imperfectly known. It must evidently be very much compressed ; how it closed its shells was at present a mystery. The shell was free, irregular, and very flat, with thin valves; the hinge was internal, presenting two ridges meeting at a point and forming an angle, with corresponding channels on the other valve to which a ligament was attached. This hinge was the distinctive character of the genus.

The next interesting shell was *Dentalium entalis* (tooth shell), belonging to a group which Deshayes divided into four and Sander Rang into three groups, viz., those which are split, those which are not split, and those having a marginal collar. *D. entalis*, the only British species, belonged to the second group. The shell was a tubular, prolonged, and slightly curved cone, open at both ends, and tapering smaller at the posterior than at the anterior end. The tooth shells burrowed in sand and mud and devoured foraminifera and tiny bivalve shells. Their blood was red. The reproductive organs were unknown. It was not even certain whether they had eyes.

It was his lot, in 1851, when the learned world almost unanimously believed the Pholas made its crypts by a chemical solvent, to discover and make known its perforating machinery, but he was entirely ignorant, and, so far as he could learn, no one knew its reproductive apparatus. Here was a field for those who loved to observe living animals and for all who delighted in microscopical research.

The shells found in cabinets were, undoubtedly, beautiful and marvellous ; but when the animals which made them were known, and their forms, instruments, habitats, manners, and life history familiar to the coming generation as their shells now were to us, they would wonder we should have so long made more of the shells than of their inhabitants.

In 1851 and 1852 he offered the Zoological Gardens of London and the Jardin des Plantes of Paris to establish aquaria and exhibit Pholades at work, but it was not accepted. Now London and Paris had their aquaria, and soon Brighton would outvie them. Here, with the Library and the Sea, the younger members had the power of making the Natural History Society of Brighton take a rank among the learned Societies of the world unsurpassed by any other provincial Society.

Mr. R. Glaisyer exhibited Succinia Sutris and a bivalve shell from the rapids of a North American river, showing the difference of texture, as required by the circumstances under which it was found.

Prior to reading his notes on shells Mr. Robertson called attention to the death of Thomas Geeran, an old soldier often seen begging in the streets of Brighton, whose case he mentioned in a paper on Sussex Centenarians, a biography of whom had been published asserting he was in his 104th year. Inquiry did not confirm this statement. The Rev. A. A. Morgan had written to Geeran's native parish, Scariff, County Clare, and received a reply from a Roman Catholic clergyman. The reply was to the effect that Geeran might be as old as he said, but there was no register of his birth or baptism to prove it. He had read this letter to Geeran and asked him if it was likely he would have been such a fool as to enlist as a soldier in a drunken frolic at the age of thirty—twenty being the more likely age for such frolics. Geeran laughed ; he did not repeat the statement that he enlisted at thirty, but only added "even if I was only twenty, I must now be a pretty good age."

November 23rd.

MICROSCOPICAL MEETING.—MR. T. H. HENNAH ON "ANIMAL PARASITES."

Mr. Hennah, in introducing the subject for the evening, "Animal Parasites," remarked that they had been induced to select them as a subject for consideration and examination, because Dr. Cobbold, an authority on Entozoa, had recently lectured before the Medico-Chirurgical Society, and, by the courtesy of Mr J. J. Murray, the President of that Society, many members had had the privilege of hearing him, when a goodly number of new facts had been brought to their notice.

Speaking of the Entozoa, it must be borne in mind that they were a very numerous family, consisting of several genera and species, living within the bodies of those animals in which they took up their abode, some occupying one part of the system, others another, and most of them requiring to pass through more than one host or individual before completing their life-history.

One thing which they had learnt was their comparative harmlessness; for, though an individual might be attacked by them, and in some cases carry about in his body enormous numbers, it was only in a few, and under particular states of some Entozoa, that they proved fatal. In fact, people were often their hosts without either knowing it or feeling any inconvenience.

While tapeworms and ascarides were generally only sources of inconvenience, one stage of the former was likely to be dangerous, viz., the *hydatid*. The life-history of the common tape-worm was that of a long chain of joints, each of which was called a zooid, the anterior segment, forming the head, and a few following segments being barren, while the remainder became mature and capable of independently producing eggs containing embryos furnished with hooks; these embryos became metamorphosed into the cysticercal state, which, when aborted, formed the common *hydatid*.

The dog acted as a preparatory host, and handed over, as in Iceland, the dangerous guest to his master. A dog voided in the drawing-room of a house the tape-worm he had in a bottle, any eggs from which, introduced into the human system, might have produced the hydatid form and have caused fatal disease.

Hardly an animal he had ever examined but revealed the presence of entozoa. In examining animals for entozoa the coats of the stomach should be looked at, while hydatids would be found in the brain, liver, &c.

Mr. Wonfor remarked that Dr. Cobbold had also taught them the lesson that meat infected by entozoa was rendered harmless by being properly cooked. They had also learnt that beef and mutton were as liable to the presence of entozoa as the pig. In the case of *Trichina Spiralis*, which had been so fatal when producing the disease *trichiniasis*, it was almost unknown among us, with a prejudice in favour of well-cooked meat: but common among those who indulged in raw bacon and semi-cooked pork. That the temperature of boiling killed the entozoon was a great satisfaction.

He believed in all the cases where, after death, in this country, trichinæ had been detected, the individuals were unconscious through life of their presence, and the celebrated rabbit of Dr. Thudichum had flourished on trichinous muscle, though, after death, every part of the voluntary muscle, except the heart, was full of them.

As regarded the epizoa, their cabinet contained some very choice slides, among them the chigoe flea, or *Pulex infestans.*

He had, very fortunately, been able to verify the life history of the common flea. Mr. R. Glaisyer had obtained for him some fleas, and sent them to him in a bottle. On the sides of the bottle he noticed some white bodies, which, on examination, proved to be eggs. Keeping the bottle in his waistcoat pocket, at the end of a few days he saw some larvæ had hatched out. Some of these he exhibited at one of their meetings alive. After a time some of them formed cocoons, from which eventually came fleas, one of which he had mounted. As far as he could recollect, the time from the eggs to the perfect insects was about 25 days.

In answer to a question, Mr. Wonfor stated that at different times he had examined pork, ham, and bacon purchased in Brighton, and had never found trichinæ present, though some Hambro bacon given him by a friend in London, was so full, that many cists contained two or three individuals. He might say one ounce of the muscle contained thousands. Had any of this been eaten without proper cooking, to kill the entozoa, they would have become sexually mature in the stomach, and deposited their eggs, the young trichinæ from which would have commenced boring through the intestines to the muscular system. It was at this boring stage that they were so dangerous.

The meeting then became a Conversazione, when some very beautiful specimens were exhibited of ascarides, tape worm, hydatids, cysticerci, strongylus, and muscle from the pig, rabbit, and man, infested with trichina spiralis, by Messrs. Sewell, Hennah, Glaisyer, and Wonfor.

December 14th.

ORDINARY MEETING.—DR. STEVENS ON THE LATE DISCOVERY OF PIT-DWELLINGS IN HAMPSHIRE.

As a member of the Brighton and Sussex Natural History Society, he wished to introduce to the notice of the Society a short account of a cluster of hut-circles, evidently forming part of a considerable settlement of such, which were brought to his notice by one of the labourers engaged in digging a yard at a new Railway Station, situated on a hill about half-a-mile from St. Mary Bourne, immediately overlooking the Upper Test Valley. The man had been employed by him in investigating some Roman buildings at Finkley, near Andover, during the late summer, and had become quite an expert in the recognition of rude objects of antiquity; and finding that the subsoil of the yard contained calcined stones, broken pottery, and other evidence of past occupation, brought the matter to his notice, which led to the discovery of nine of these early habitations, of which, from their situation, two only could be completely investigated, and five others partially. There was no doubt they formed a portion of a large village, of, perhaps, the British period; and that, with favourable weather, further investigations would be made at the site of these interesting remains.

The pits occupied the space of about a quarter of an acre, and had all entrance shafts, sloping gradually downwards from their inlets, and widening as they approached the pits; but a description of the dwellings *seriatim* would, perhaps, be the means of rendering them more easily understood.

Pit 1 was oval or pear-shaped, having its entrance southwards. Its length was 22ft. from the end of the pit to the mouth of the alley; greatest diameter 12ft.; depth at the centre of the pit 5ft. It was the only circle that contained flints, of which 12 cart-loads were removed; and as some of the stones were arranged in courses, without mortar, around its circumference, and on each side of the alley, he had thought that the superstructure must have been of flint, and that it had fallen in. The relics found were chiefly at the centre, where the fire-place had evidently been; the smoke escaping probably through a hole in the centre of the roof. They consisted of about a bushel of calcined flints, bones of a small species of *bos*, probably *longifrons*, *cervus elephus*, *capra*, *sus*, and *canis*, besides broken vessels, chiefly of a very rude hand-made kind; although a few pieces, found about the yard, bore wheel-marks. The bones had mostly been split open in order to obtain their marrow; and had been exposed to fire, and bore impressions as if made by teeth and rude knives. Some of the smaller long bones had evidently been employed as marrow spoons; while other small splinters of bone had the appearance of having served the purpose of awls or needles.

In this circle also part of a rude sandstone, hand grain-rubber was found, besides some flint flakes, a scraper, and some cores; and, in addition, the outer lip of a large cowry, which had been carefully cut from the shell, and had been used as a rasp, the crenulations in the lip being considerably worn down. It had, further, been employed as a polisher, apparently, the enamel being worn away in places.

Pits 2 and 3 were only partially explored, as they extended beneath the Station-yard. One of them, however, was partly filled with calcined flints; and in it were found pottery and bones similar to those above described, and a portion of a grain-rubber.

Pits 4 and 5 had only their entrances explored, as the circles extended beneath the Station-road. In these were found a few flint-flakes, and some calcined stones.

Pit 6 contained no remains, as it was evidently the passage of a pit partly formed, and had not been occupied.

In digging a well in the Station garden similar relics were thrown out; and it was evident the shaft of the well passed through one of these pits; and as furnishing additional proof of British occupation, in clearing away the soil around the circles, one of the labourers picked up a British gold coin. Its *obverse* and *reverse* bore degraded representations of more perfect figures; in short, the coin was a slightly better copy of the lowermost of the three coins, depicted at *p.* 84, *first Ed. of "The Celt, the Roman, and the Saxon"* which was there stated as being a rude copy of a gold stater of Philip of Macedon. Similar British gold coins are engraved at *p.* 36 *of "Dixon's Geology of Sussex."*

Pit 7 was fully explored, and was found to be 42ft. in length, from the extremity of the pit to the mouth of the passage, which opened eastwards. Its widest diameter, 13ft. 6in., and depth 5ft. at its centre, while the passage, at 6ft. from its outlet, was 3ft. in width.

The fire-place had occupied the centre of the circle, as in No. 1, and around it were found bones similar to those found in Pit 1, with the addition of several teeth of a small species of horse and bones of the hare and rabbit. The bones were in most cases broken; and some were wrought for use as implements. Two flint arrow-heads were found in the alley, and the centre of the circle further contained flint-flakes, scrapers, cores, and various other instruments, a fragment of a rude grain-rubber, and a flint muller, showing use on one side. Here, also, occurred a whetstone, made from a piece of boulder sandstone, such as he had observed occurring in the drift of the Reading beds; and, evidently from the same drift, a lump of native ironstone, containing a large percentage of the metal, which had been picked up by some occupant of the pit, and used as a hammer. As throwing some light on their domestic economy, a chalk spindle-whorl was found, and with it a small disk of pottery, bored at the centre, the direction of the hole showing that it had been suspended with a string, perhaps around its owner's neck. The whole of the fictile ware found here was of a very rude, hand-made type; and some of the crocks were scored with irregular zigzag lines, made seemingly with a pointed stick.

At 9ft. south of Pit 7 was found a circular hole in the chalk, which, when cleared out, was found to be 5ft. in diameter and 3ft. in depth. It contained a quantity of bones of animals, similar to those already enumerated, and snail shells that had been exposed to fire; and beneath the bones a quantity of charred flints, mingled with charcoal and ashes. It was evident strong fire had been used here, as a good deal of the chalk surrounding the hole was burnt through to the depth of several inches, which led to the inference, coupled with its contiguity to Pit 7, that the place was a cooking-hole.

It was not unusual for uncivilized people to have their cooking places outside their dwellings; but, as far as he was aware, this was the first instance of a cooking hole of this kind having been found in this country; and the usage would rather seem suited to the inhabitants of a climate milder than that of Britain. Thus, the Negro conducted his culinary operations in the open air outside his hut; and the Navajoe Indian, who frequented caves and rock shelters, in like manner made his cooking fire at a short distance from his dwelling. (*Catlin's North American Indians*). The inhabitants of the Highfield Pits, near Salisbury, explored not long since, were thought to have conducted their cooking outside their habitations. (See *Flint Chips*, p. 59.)

At another point of the same yard, about 10ft. of well-built wall was removed. It was evidently Roman, as near it a better kind of pottery was found, including a scrap of Samian, besides a few roof nails, and a bronze buckle.

In discoveries of this kind every minute circumstance was of importance, as helping to some conclusion respecting the people who could have constructed dwellings so simple, and employed articles of domestic industry so rude as the spindle-whorl of chalk. Such a people could not have advanced beyond the dawn of civilization.

Hut-circles of a similar kind were not uncommon throughout England ; but their circularity was always an evidence of simplicity of design, and appeared to have been the method adopted by all uncivilised nations. Dr. Livingstone remarks that he found it impossible to teach the South African natives to build huts otherwise than round or oval ; the moment his supervision relaxed the builder at once went back to the circle. The Mandan lodges are circular, sunk to the depth of about 2ft. in the ground, and the walls are formed of poles, covered with earth to the depth of 2ft. or 3ft., which are rendered impervious to water by a coating of clay ; and the roof has a central hole, which serves the double purpose of a chimney and skylight. He had observed, by the waysides, rude outlines of houses, arranged by the village children, by placing flint stones in lines, and had been sometimes struck with the tendency to form circles.

Again, with regard to the calcined flints, which were everywhere present in such quantities. To what purpose could they have been applied ? Some of them, he observed, were faced on one side ; and a few had facets at right angles. These, he thought, might have been used in constructing earth-ovens or fire-places. A large number, however, were perfectly circular, and had bright, clean surfaces ; and he had no other method of appropriating these, excepting that they had been employed for the purpose of "stone-boiling." And that stone-boiling was practised the pottery appeared to imply.

A good many of the broken pieces were the sections of vessels, in size equal to bushel pans, and constructed of common reddish-brown clay, mingled with coarse flint-grit. These sections were further quite double the thickness of modern vessels of similar dimensions, implying that substance was intended to substitute quality ; and this coarse ware had the appearance of having undergone saturation with blackened water, a condition that would most likely result from the frequent use of heated stones with water contained in the vessels. The Highfield pit-dwellers were supposed to have resorted to stone-boiling in cooking food; and a similar method had been adopted by various uncivilized nations whose pottery was not sufficiently reliable to bear the direct contact with fire. To those interested in the various methods of "stone-boiling" resorted to by different races of savages, he begged to refer, for want of space, to *Tylor's Early History of Mankind.* pp. 262—269.

With traces of Roman occupation, we had, then, at this early settlement, rude remains, which showed residence by an earlier people, who, doubtless, lived on after the advent of the Romans. He had, as yet, observed no intrenchments in the field; but there was no doubt that similar circles occupied a large space of the upper slope of the valley. The flint implements stamped the remains as Neolithic, and they differed in no respect from the wrought flints occupying the subsoil of the yard, as well as occasionally occurring on the surface of the adjoining fields. The settlement was favourably situated to have enabled the occupants to obtain water from the river Test; and along the same side of the valley, within the distance of two miles, he had discovered more than one working site of flint implements, at which he had obtained a varied collection of tools and weapons; some of them polished, but by far the larger number shaped into form by chipping.

These huts must have been covered in, some with stones, others, perhaps, had a wooden or wattle superstructure plastered with clay or coated with sods of turf; and their poor inhabitants, as the remains testified, cultivated, to a small extent, some of the cereals, had an early knowledge of weaving, and lived domesticated with oxen, goats, and swine. The red deer were most likely obtained by hunting in the dense forest that then occupied the deep claylands of North Hampshire, as an extension of the ancient forests of Harewood, Chute, and Finkley. Further, these shallow pits might have been the summer residences of a people whose winter habitations were in some more sheltered situation.

DECEMBER 28TH.

MICROSCOPICAL MEETING.—ANIMAL PARASITES —EPIZOA.

Mr. WONFOR remarked that since their last meeting, when it was determined to have "Epizoa" as the evening's subject, he had put himself in communication with several friends who could help in supplying objects, and he was happy to say Dr. Ormerod had lent a series of parasites from his cabinet, among which he might mention the mole flea as a notable one; Mr. T. Curties, of Holborn, had very kindly sent, from his cabinet, a very choice collection of specimens, among which were the new elephant parasite, chigoes, a series of ticks, and picked specimens of parasites from man and other animals, as well as human and other acari; Mr. Hennah had brought a collection of bird parasites, &c.; Mr. Sewell and he had also a number of objects. He would, therefore, suggest that they should take the specimens in order, by which means the greatest number could be seen by those present, if the objects were simultaneously changed.

The suggestion being approved of, the meeting became a conversazione, when Messrs. Hennah, Glaisyer, R. Glaisyer, Marshall Hall, Sewell, Turner, and Wonfor exhibited the various objects. The first shown were "fleas," which included the common flea, and those from the cat, dog, mouse, squirrel, bat, hare, mole, chicken, the chigoe, or jigger,—the female of which inserted herself under the toe-nails, and then increased in size until she was as large as a pea, when she deposited her eggs,—and larvæ and eggs of fleas.

"Ticks" were then put under examination, and here a variety was seen from sheep, dog, ox, red-deer, hare, tortoise, ferret, and elephant, the last named, which was new to science, having quite a long proboscis.

Then followed acari from pig, horse, camel, bat, swift, water-rat (remarkably like their host in form), mole, a very curious fellow, and man. The last named produces that intolerable irritation, associated with a Scotch *musical instrument*. To these succeeded "lice" from man,—three forms, head, clothes, and crab lice,—mouse, pig, calf, dog, horse, spider-monkey, roach, canary, bee, &c. Next in order came bird parasites, the most notable among which were those from the swift, pigeon, moorhen, Australian crane, white goshawk, &c., and then eggs of bird parasites, the most peculiar and beautiful of which were from the pheasant, Bohemian pheasant, mallee bird, ground hornbill, and Indian peacock. In this display of objects, associated in the mind with filth and disease, the two thoughts which suggested themselves were the wonderful variety of form and the adaptation of parts for the proper fulfilling of their mission.

Mr. G. Davies presented to the Society's herbarium a lichen new to Sussex, *verrucaria salweii*, found by him in December of the present year, near Sheffield Park, (this lichen had previously been found at Oswestry and Shanklin by the Rev. T— Salwey,) and, on behalf of Mr. Birch Wolfe, *lichen esculentus*, manna of the desert, obtained in Algeria, in 1856, by Mr. Mumby, who read a paper on this lichen before the British Association at Liverpool, in which he attempted to prove that this plant was the same as the manna eaten by the Israelites in the desert, which he asserted was a natural production. Votes of thanks were given to the donors. Mr. Davies had another lichen, new to Sussex, *Lecidea holophœa* Montagne, the *Thalloidima sublurida* of Mudd's manual, gathered at Pulborough, also a denizen of the south of Ireland and Jersey.

Mr. Marshall Hall announced that How and Co., of Foster Lane, London, were preparing to supply an inodorous oil. This would be a great boon to microscopists.

Mr. Wonfor stated that, by an error on page 54 of the Annual Report, "Lindfield" instead of "Plumpton" was mentioned, as the habitat of cyclotella operculata.

January 11th.

ORDINARY MEETING.—A SOIREE.

This was the first attempt of the Society to give an Invitation Soirée, and, proving so successful, it has been determined to make it annual. By the kindness of the Dispensary Committee, the Board Room being placed at the disposal of the Society, it, together with the

Library of the Medico-Chirurgical Society, afforded space for the purpose.

The walls and tables of the rooms were covered with a large and interesting selection of specimens, drawings, and photographs illustrative of every branch of Natural History, in the hanging and classification of which most efficient service was rendered by Messrs. Saunders, Penley, Walsh, R. Glaisyer, G. Scott, C. P. Smith, and T. W. Wonfor.

On the central table in the Board Room was a series of microscopes, contributed and explained by Dr. Hallifax, and Messrs. Marshall Hall, Gwatkin, C. P. Smith, Sewell, Hennah, Wonfor, Glaisyer, Turner, and Nash.

Nearly all the objects contributed were illustrative of papers read before the Society during the past year. Notably so was a fine series of flint implements, collected by Dr. Stevens (of St. Mary Bourne), Mr. Wonfor, Mr. Saunders, jun., and Mr. J. Hilton, at St. Mary Bourne, Cissbury, Portslade, and the immediate neighbourhood of Brighton. Several of the collections were commenced in consequence of a paper read by Mr. George Scott upon the discoveries of Dr. Stevens and rude flint implements in general. These specimens, upon which the paper was read, were sent by Dr. Stevens to Mr. Wonfor, and, with others since collected by the latter gentleman, have been presented to the Town Museum. Carrying on the series to later periods, Mr. G. Scott exhibited a fine collection of polished stone weapons, found in England, Canada, and the West India Islands ; and a large number of beautifully-formed bronze celts, axes, &c., chiefly found in Sussex, including two bronze paalstabs, lent by Mr. R. Glaisyer.

A series of gold and silver coins, illustrative of the early British, Saxon, and Norman coinage, was exhibited by Mr. Scott. In this section, two interesting discoveries recently made were also shown ; a Roman vase, found in a garden on Round Hill, with an iron ball weighing $\frac{3}{4}$lb., which were exhibited by Mr. Wonfor ; and an ancient British sepulchral urn, found near Littlehampton, in a clay bank partially washed away by the sea, and exhibited by Mr. J. Hilton. This, Mr Scott shewed, by drawings and description, to be of the true type of Early British pottery.

Among the most striking objects exhibited in the Board Room were two fine collections of butterflies and moths, exhibited by Mr. Walter Wonfor and Mr. Wills,—the former consisting of English specimens, collected by Mr. Wonfor himself within the last three years; the latter a superb collection from India. A fine collection of wasps' nests and wasps, exhibited by Dr. Ormerod; large Tusks of Hippopotamus and Walrus, exhibited by Mr. E. Parkinson; 150 polished specimens of woods used in manufactures, exhibited by Mr. Saunders; a case of Japanese silkworms and coccons, exhibited by Dr. Badcock; Pheronema Grayi, a newly-discovered silicious sponge, dredged off the Portuguese coast by Mr. Marshall Hall; Sponge, Euplectella speciosa, exhibited by Mr. Sewell; specimens of saw fish, parrot fish, and cow fish, exhibited by Mr. Sewell; a double cocoa nut, exhibited by Mr. Hollis; series of photographs, illustrative of food products, exhibited by Mr. T. Curties (Holborn); series of micro-photographs, exhibited by Drs. Hallifax and Maddox, and Mr Hennah; flying fox (bat), from Australia, exhibited by Dr. Badcock; fine series of British lichens and mosses, exhibited by Mr. C. P. Smith; ores of copper from the Burra-Burra Mine, exhibited by Mr. Wonfor; case of saxicava and pholas, taken from burrows in hard limestone—the perforated rocks also shewn—exhibited by Mr. Charlesworth; New Zealand Ferns, exhibited by Mr. Penley; petroleum in all its forms, commencing with shale and crude black oil up to white wax, and manufactured articles, exhibited by Mr. Nash; curious illustration of the meeting of savage and civilized Art, viz., a Sheffield axe-head on a carved bone New Zealand handle, exhibited by Mr. Wonfor; magnificent specimen of emerald in quartz rock, from South America, and emerald butterfly, said to be found only in the neighbourhood of the mines, exhibited by Mr. J. Curtis; very exquisite and truthful drawings of microscopic objects, exhibited by Messrs. Beck, of London, made by Mr. A. T. Hollick, who was educated at the Deaf and Dumb Asylum, Brighton; a very ingenious hygroscope, made from the awn of one of the erodiums, which was delicately sensitive to variations in dryness of the atmosphere, exhibited by Dr. Hallifax; nearly 200 coloured plates from Hedwig's original drawings of mosses, lichens, and fungi, with enlargements of parts and organs, exhibited by Mr. Wonfor; a very fine collection of ferns and lycopodiums, by Mr. Walsh; photographs of eggs of bird parasites and of diatoms, the latter taken in U.S. Survey Office by Colonel Woodward, exhibited by Mr. Curties.

The leading objects exhibited in the Library were some very beautiful cases of British birds, collected and mounted by Mr H. H. J. Nicholls; a white cock pheasant and male and female little gull in mature plumage, by Mr. Pratt; a fine collection of foreign shells, by Mr R. Glaisyer; a very curious series of Brighton beach pebbles, containing choanites, by Mr. Glaisyer; chalk and other fossils, by Messrs. Saunders and Dennant; specimens illustrating the Post Pleiocene formation at Brighton, by Mr. J. Howell; vertebra of Iguanodon, from Isle of Wight, by Mr. J. Sewell; rubbings from Egyptian monuments, by Mr. Nourse; white ant, crocodile, &c., by Mr. E. Moore; drawings of volcanoes, mammalia, and other Natural History specimens, exhibited by Mr. Wonfor.

Tea and coffee were provided during the evening, and about 200 ladies and gentlemen availed themselves of the Society's invitation.

January 25th.

MICROSCOPICAL MEETING.—DR. HALLIFAX ON VEGETABLE PARASITES.

Dr. Hallifax remarked that a distinction must be drawn between those which simply attached themselves to organized beings and those which lived at the expense of and upon the juices of the plants or animals on or in which they grew, for they were both external and internal. The ivy was a good example of an Epiphyte. This plant attached itself by its suckers to a wall equally with a tree, and did not live on the juices of the plant; whereas the mistletoe, the best example of a true parasite, obtained its nutriment at the expense of the tree on which it grew, although it did not seem that the tree suffered.

The seeds of the mistletoe, surrounded by a viscous substance, were, it was believed, carried by birds, became attached to the branches or trunks of trees, and then germinated, sending their fibres through the bark into the sap wood, and continuing to grow at the same time as the tree. They penetrated deep into its substances and received from the plant its juices. With the exception of its not possessing true roots, it differed in no respect from any other perfect plant, for the crude juices obtained from its host were elaborated by the leaves into woody fibre, &c., of a different character from that of the tree at whose expense it grew. Thin sections, cut through both, showed that the cells lay side by side, different in character and not coalescing.

Of a more minute character were some of the fungi, for, though many grew on organisms, they did not make their appearance until death and decay had set in; but some, like the potato fungus, not only grew at the expense of but completely destroyed the plant, penetrating to all parts of its substance. Other parasitic plants were the orobanches; but lichens simply attached themselves to plants for support.

Mr. Wonfor remarked that to the pseudo-parasites might be added the bird's nest orchis *(listera ovata)*, which did not appear to grow upon the roots of the beech, but only under beech trees. He had never been able to trace any attachment to the roots. The dodders appeared to differ from some of the parasites mentioned, for their seeds germinated in the soil and then attached themselves to another plant, on which they grew, not only sending rootlets into the substance, but twisting and twining round it like the ivy. Hence they had been called stranglers.

Of fungi, which grew on and at the expense of animals, might be mentioned those which attacked living flies or moths and glued them to, say, a window-pane,—the caterpillar fungus of Australia, the fungus foot of India, ringworm, &c.

As regarded the mistletoe, there was no doubt the birds were the chief agents in its propagation, for it was generally found high up on trees and at considerable distances from each other. One very curious fact must have been noticed, viz., that its most active period of growth was during the winter months, when the trees were said to be dormant. Then it was that it flowered and ripened its fruit.

There had been great difference of opinion whether the mistletoe held sacred by the Druids was our *viscum album* or *loranthus Europæus*, commonly found on oaks in the south of Europe, whereas the former was now but rarely found on the oak; in fact, some, in ignorance of its existence, went so far as to deny that it did grow on the oak; but examples could be found in all oak-growing districts. People seemed to forget that it was not the mistletoe, but the oak-growing mistletoe, which was reverenced, and which, from its comparative rarity, was held sacred and searched for with great care. The greater portion of mistletoe sold at Christmas, came from the Channel Islands and France, where its berries were produced much earlier than in England. While it grew on a great number of trees, the apple, crab, poplar, and ash were the most common.

Mr G. Scott mentioned that he had seen it on the laburnum.

Mr. Sewell had seen it growing on fuschia trees in Jersey. One example of an internal parasite was the Sarcina Ventriculi.

The meeting then became a Conversazione, when Dr. Hallifax, Messrs. R. Glaisyer, Sewell, and Wonfor exhibited male flowers of mistletoe containing pollen, sections of the seed, leaf, stem, and of mistletoe and crab growing side by side, and caterpillar fungus, the potato fungus obtained in the autumn of 1865, and other interesting examples of parasitic plants.

Mr. Wonfor exhibited a very ingenious slide for opaque objects, consisting of a thin wooden slide with circular cell turned and blackened, and having two shallow grooves around, one for the covering glass and another for a circle of gummed paper to fasten the latter. He had obtained them from Mr. Baker, of Holborn, who supplied a dozen slides, with covers and patches to match, at 1s 6d per dozen.

February.

ORDINARY MEETING.—DR. ADDISON, F.R.S., ON THE NATURAL HISTORY OF CURES AND HEALING. —PRESENTATION OF A TESTIMONIAL TO MR. ONIONS.

Dr. Addison remarked that healing would be treated as a department of Natural History. The human body was a self-repairing structure. The wheels of a watch or of a locomotive must be stopped for works of repair. On the contrary, in living bodies, the more important the work of reparation, the more imperatively must every function go on with energy and regularity. The physical enquirer, dealing with inanimate things, could make any experiments he chose; but the physiologist must accept accidents and their history in determining the laws of healing.

The enquiry, "What is healing?" involved us in others. What is growth? especially as respects the first formation of blood vessels in the embryo. What is inflammation? If dust entered the eye, inflammation arose; if a thorn pierced the finger, and, breaking, left a piece behind, there would be inflammation and suppuration; if a dead part was to be thrown off, the phenomena were inflammation, suppuration, and granulation.

Granulations were characteristics of healing. They consisted of myriads of newly-formed blood vessels, and the coats of the vessels were composed of globules or cells, not distinguishable from the colourless cells of blood.

It was in a vast assemblage of globules or cells, not distinguishable from the globules in the blood, that new vascular tissue, new blood vessels, were formed. Exactly the same materials and phenomena as might be seen at the earliest period of growth.

Some years ago an American gentleman exhibited a Hydro-incubator in London. He allowed Dr. Addison to purchase eggs at every period of incubation and to examine them. On one occasion an egg was opened after 70 hours, and the parts were seen covered by innumerable embryonic vessels, which had nothing but globules in their structure. Without any further disturbance, a watch glass was placed over the broken part of the shell and the egg returned to the warmth of the incubator. Twenty hours after, a great number of new and collateral vessels, strangely divergent from the natural ones, had been formed, to meet, as it were, the damage done by the premature breaking of the shell. All these vessels had nothing but globules in their composition and were easily obliterated by moving the point of a needle in their midst.

Other facts of healing might be compared with embryo growth. If a tendon were ruptured, or a bone broken, great heat attended the first stages of reparation. In all parts the heat of the first stage of healing was above that of the neighbouring parts. These facts corresponded with the heat necessary for the growth of the first blood-vessels in the egg. Blood-vessels of the embryo were destroyed by the gentlest handling; so likewise the new vessels of a healing sore bled by the lightest touch.

In the embryo, colourless elements of blood constituted the first vessels; so, also, the new vessels of healing parts. All parts of the embryo were more vascular than afterwards when growth was further advanced; so with healing parts, granulations were, at first, more vascular than they were when turning into fibrous-tissue. It took a longer time to repair a broken bone than it did to repair a ruptured tendon, and longer to repair a ruptured tendon than a wound in the skin, because, in embryo growth, tendons were completed later than skin, and bones later than tendons. Thus, healing was shewn to be a department of Natural History.

It was well known that inflammation preceded granulation; what had it to do with healing? When fully formed, blood-vessels were called upon to contribute to healing; a change took place in their coats from elastic fibrous to fragile globular tissue—a kind of retrogression to the embryo state. The change might be said to do them violence, as it altered their state of cohesion and elasticity to one of fragility. Hence the pain of inflammation, demanding quiescence in parts preparing for healing. New blood vessels for reparation could not possibly partake of the circulation without this change in the coats of the existing vessels. At the commencement of inflammation blood had been seen depositing its colourless globules upon the interior of the vessels; these globules, or cells, gradually accummulating, at length interposed between the stream of red blood and the elastic coats of the vessels, and substituted a fragile globular tissue for the fibrous one. Vessels so altered were virtually embryonic, prepared to set off new vessels and new growths. Inflammation was the necessary preliminary to healing by granulation.

The two main constituents of the body were the solid parts of the blood. Injury to blood was just as fertile a source of inflammation as injury to the solid parts.

In external parts we could see the antecedents of injury, as dust in the eye, a thorn in the finger, a bullet in the side, &c.; and the form, magnitude, and extent of inflammatory action was measured by the triviality or gravity of the damage done. But in all that related to blood-poisoning, the antecedents and the amount of damage done were hidden from view, but inferences might be drawn conversely. When small-pox poison was passing away through a moderate number of kindly pustules, and scarlet fever through a series of cuticular exfoliations, and in other fevers, when the crisis was moderate in type and duration, we might infer that no great damage had been done to the blood, and that Nature had found a good outlet for disordered and disarranged elements—the antecedents or cause of the fever.

But, when great mortality attended fevers, or the dangerous ordeal of inflammatory abscess, suppuration and ulceration had to be passed through before recovery, much greater damage was implied—a greater augmentation of the fever poison, and a greater difficulty in eliminating it. There could not be a shadow of a doubt that blood was liable to as many accidents as the solid parts, and that inflammation was a struggle of Nature to set matters to rights—a struggle, which might be described as a more or less complete return of blood and blood-vessels within its area to the early stages of embryo growth. If an injury to a solid part were slight, no retrogression of blood-vessels took place; the blood rushed to the part, but there was nothing to be repaired; the injured parts recovered themselves, and there the matter stopped—this was simple inflammation. But if more damage had been done, then blood-vessels returned to the embryo state, and according to the gravity of the damage and the healing work to be done so was the need of surgical help urgent. Likewise, in trivial cases of blood disorder, if the morbid humour could be worked out without material change in the coats of the vessels, the action was comprehended under the term rashes, pimples, &c.,—examples of simple inflammation. But in graver examples of blood-poisoning, where blood-vessels must retrograde to satisfy the needs of the damaged blood, the action was comprised under other terms, all referring to different degrees of the physiological work designed for the cure of both local injuries and blood-poisoning—a physiological work which amply vindicated its place in Natural History, without in the least degree diminishing the need of the experienced superintendence of the physician in regulating, controlling, or diverting the various forms in which it appeared in blood disorders.

Previous to the reading of Dr. Addison's paper, a very pleasing diversion to the business of the evening took place in the presentation of a clock to Mr. J. C. Onions, one of the Honorary Secretaries.

Mr. Hollis, addressing Mr Onions, said he had a very pleasing duty to perform, having been deputed to beg his acceptance of the very handsome clock before him, as a slight token of the esteem and the regard entertained by the members for the services he had rendered to the Society as one of its Honorary Secretaries. All knew that his office was no sinecure, and they had witnessed the tact and judgment displayed by him on all occasions, and especially in the arrangement for many years of the annual Excursions, which had afforded very great satisfaction to all who had attended them. He felt great pleasure in being their mouth-piece. Might he, by the blessing of God, be spared for many years, and, whenever he looked at the clock, might he call to mind the regard entertained for him by his fellow-members.

Mr. Onions, whose rising was greeted with continued applause, said : He thanked them very much for their kind expressions of regard, and for this mark of their esteem for the small services he had rendered to the Society, and which, he felt, were far outweighed by the benefits he had received as one of its members. He had sometimes thought he was out of place, as he had not been able, from knowing little of science, to contribute anything to the Society ; but he had a colleague who helped in the scientific department and left him the business part only to perform. He need hardly say he should look upon the clock as a mark of the kindness of the Society, and should, as long as he could be of service to the Society, do all he could to further its interests. They would pardon him if words were too feeble to convey what he felt for this their great kindness.

Mr. Onions sat down amid loud applause.

The Clock, which bore the following inscription, "Presented to J. Colbatch Onions, Esq., by the Members of the Brighton and Sussex Natural History Society, as a mark of their esteem and gratitude for his services," was a dining-room clock, with visible escapement, striking the hours and half-hours, and furnished with perpetual calendar, including day of the week, date of the month, month of the year, phases of the moon, and equation of time, the whole mounted in solid black marble case, and constructed for great durability and accurate time-keeping, by T. Boxell, 43, King's Road, Brighton.

FEBRUARY 22ND.

MICROSCOPICAL MEETING.—MR. T. H. HENNAH ON THE PALATES OF MOLLUSKS.

Mr. HENNAH prefaced his remarks on the Palates of Mollusks by stating that he should chiefly consider them as objects especially calculated to foster a true spirit of microscopical enquiry. They (the palates) might be briefly described as membranes, studded more or less with teeth, found in the buccal cavity of univalve and shell-less mollusks. While the arrangement of the teeth was always symmetrical, the palates appeared to fulfil several functions : in some mollusks acting as a gizzard only, being supplemented with strong cutting mandibles, as in snails, cuttle-fish, &c.; in others acting both as a rasp and as a gizzard. In some, the provison for wear and tear was prodigious : the palates of the limpet and periwinkle being longer than the animals themselves ; while in other cases, they were comparatively small and out of proportion as contrasted with the animals. Thus, the palate of the cuttle-fish was about the same size as that of the common snail.

As elsewhere in the Animal kingdom, specially-adapted contrivances were found, so also was the palate of the mollusk adapted in its form, position, and arrangement, to the special habits of each species. In this variety—apart from its scientific interest—lay an inducement to go on with the examination, when it was once begun. He well remembered dissecting out a palate of a common snail—his first dissection and almost his first microscopical preparation—and he could safely say he was grateful for the influence on his pursuits still exercised by the silent tongue of the poor snail. Whelks, periwinkles, slugs, &c., were its successors, and although he found each had its palate covered with brilliant teeth, different methods of dissection were required with each ; and thus a foundation was laid for a knowledge of the comparative anatomy of different species of the same family.

He thought that nothing gave a sounder teaching in Natural History, than the thorough examination of any one organ, such as the palate, or, more correctly, the "lingual membrane" of the mollusca. The variety was very great, but yet there was a family likeness running through the palates of many allied species.

Attempts had been made to base a classification of the univalve mollusca on the form and disposition of the teeth on the lingual membrane. Other characters of greater prominence had, however, been found, to be inconsistent with its complete adoption, and, although of much value in assisting the definition of species having little external to indicate their difference, the dentition of the mollusca occupied a subordinate place in their classification. At the same time, it was so characteristic, that any definition of a species must be held to be imperfect, without a figure or formula expressing the arrangement of the teeth.

Instead of making excerpts from books, or merely quoting the systematic classification of lingual membranes, which had been adopted, he would mention some books in the library, containing the best information on the subject : "Microscopical Journal," vol. 1, page 170. 1853 ; "Teeth and Tongues of Mollusca," by Dr. J. E. Gray ; "Intellectual Observer," vol. 5, page 67. 1864 ; "Dentition of British Mollusca," by Rev. G. Rowe ; "Transactions of Royal Microscopical Society," July and October, 1868 ; "The Lingual Membrane in Mollusca and its Value in Classification," by Mr. Jabez Hogg.

He strongly advised *dissection* as the means of obtaining the palates, as the experience so gained would be valuable in other investigations ; but there was a shorter method, which he had been obliged to adopt with such animals as *Balea fragilis* (about $\frac{1}{8}$ inch long), or with larger, when many had to be prepared. It was simply to cut off the head—or even to take the entire animal and boil it in liquor potassæ, when all the soft parts would readily dissolve away, leaving the palate, easily to be recognised by its brilliant teeth, separate and entire, and requiring only to be well shaken with water in a test tube to free it from extraneous matter. After well washing, the palate should be placed in diluted glycerine before mounting in glycerine jelly, the best medium for the purpose. He had brought a good series of palates for examination, and would dissect for practical demonstration, the palates of such mollusks as he had been able to obtain.

Mr. Wonfor, while thanking Mr. Hennah for his paper, was glad he intended giving a practical lesson in dissection, for he was much indebted to him for a very valuable lesson in palate dissection some years ago,—in fact, an example dissected by Mr. Hennah of the common whelk, which he had brought down for exhibition, supported Darwin, for one tooth in each row had a double instead of a single crown. Some eight years ago he communicated Mr. Hennah's plan of boiling in potash to the *Intellectual Observer*, giving him credit for the simple plan of readily obtaining the palates, and was surprised some five years after to see it quoted from an American journal as a plan suggested in America as novel. It was now recommended in all the manuals. He mentioned this, for whatever credit was due for the suggestion belonged to Mr. Hennah.

The meeting then became a Conversazione, when Messrs. Hennah, Glaisyer, and Wonfor exhibited numerous palates, including those of the whelk, limpet, periwinkle, snail, black slug (a vegetable feeder), testacella (a carnivorous slug), trochus, haliotis, cuttle fish, aplysia, doris, *balea fragilis, cyclostoma elegans,* &c.

During the course of the evening Mr. Hennah gave practical instruction, by dissecting out the palates of whelks, snails, and periwinkles.

March 14th.

ORDINARY MEETING.—MR. F. E. SAWYER ON RAIN, WITH SPECIAL REFERENCE TO THE RAINFALL OF SUSSEX, AND HOW IT IS INFLUENCED BY THE SOUTH DOWNS.

Mr. Sawyer commenced by describing the causes of rain, as sudden changes of temperature, electrical agency, &c., the chief cause being a decrease in temperature. He next noticed falls of black and yellow rain and showers of insects and honey, and read a curious letter by the 3rd Earl of Pembroke respecting the burning of fern as a cause of rain. The supposed lunar influence on rainfall was then described, the second quarter of the moon being considered as having the greatest rainfall. Rainfall decreased by elevation, but the cause of this had never been satisfactorily explained. Trees affected the rainfall by greatly increasing the amount. In July, 1869, he commenced to record the duration of rain, and from these records several interesting facts had been deduced. Firstly, the relative hourly frequency of rain had been ascertained. In 1870 and 1871 rain fell most frequently from two to three in the afternoon, and least frequently from 11 p.m. to midnight. Mr. Glaisher had previously found that at Greenwich the period of maximum frequency was from two to three p.m., and observations made in Philadelphia also gave the same results. The frequency of rain in the early afternoon hours was probably occasioned by a condensation of vapour when the sun was beginning to descend, and when a diminution in its heating power had taken place ; a second maximum period occurred about the time of sun-rising, when the temperature was usually at its minimum. Secondly, the total duration of rain was 593 hours in 1870, and 538 hours in 1871, in both of which years the rainfall was below the average, so he thought it might fairly be assumed that in an average year rain fell for one month out of it. Thirdly, by dividing the total rainfall by the duration, the rate had been calculated. He was not aware that the rate of rainfall had ever been calculated for any length of time, and the results were therefore of special interest. In 1870 he found that the rate in the summer was exactly double that of the winter, while that of the autumn was within a fraction double that of the spring ; or, to put it more plainly, that rain falls twice as fast in the summer as in the winter, and twice as fast in the autumn as in the spring. In 1871 the first part of this rule was again verified, but, owing to the autumn drought, the rate then was not different from that of the spring.

The necessity fcr correct knowledge as to rainfall, which was required both for water companies and for drainage and other engineering works, had induced many persons to record the amount which fell, for which purpose several different forms of rain gauges had been designed, but observers had generally returned to the simple form used by Luke Howard, "The Father of English Meteorology."

The earliest English rainfall observer was Mr. Townley, of Townley, in Lancashire, whose register commenced in 1677 ; but now there were upwards of fifteen hundred observers in various parts of Great Britain. The subject of rainfall had received great attention from Mr. G. J. Symons, who published annually tables of the rainfall in all parts of this country, and also from the British Association, which had appointed a Rainfall Committee, the results of whose labours were most valuable. One of the most interesting and practical problems which had been discussed by the Rainfall Committee was "the secular variation of rainfall since 1725." The mean rainfall having been ascertained, the ratio of each year's rainfall in that period to that of the sixty years, ending with 1869, had been calculated, and this ratio was shewn as the per centage of the mean. From the tables published, the greatest per centage (138) was in 1852, and the least (58) in 1742. The most rainy decade was that of 1770 to 1779, and the least 1740 to 1749. In the mean of the last six decades there had been but little variation. In the decade 1850 to 1859 the rainfall was nearly five per cent. deficient, and this occasioned some fears as to whether the rainfall of the country was not decreasing, but, as the mean of the last decade, 1860 to 1869, was slightly above the average, there need be no apprehension on this point.

The distribution of rain in England was influenced chiefly by the prevailing winds, which were south-westerly. As we proceeded inland the rainfall gradually decreased, until we reached the eastern coast, where the smallest totals of rainfall were recorded, the average on the coast of Essex and Norfolk being about 22 to 23 inches. In the mountain districts of England and Wales the largest totals were registered. The wettest spot in Europe was the Stye, the mean rainfall there for five years being 192·8 inches. There were several stations in this neighbourhood were the rainfall exceeded 130 inches annually.

As regarded the distribution of rain in Europe, rainfall in Spain was small, the mean at Madrid being only 16 inches, and at Alicant 17 inches; the south of France was also dry, the rainfall at Toulouse being 19 inches; in Italy the amounts were greater, at Genoa, 51 inches; Milan and Rome, 38 inches; and Pisa, 49 inches. In Austria the rainfall was small, at Vienna only 15 inches; Russia was also dry, the mean at St. Petersburg being 16 inches. The rainfall in Asia was very varied; in Siberia it was said no rain falls; whilst Cherrapongee, in India, had a total of 610 inches, and is the most rainy place known in the world. Africa, which many people imagined a burning desert, had been badly observed, but Sierra Leone had a rainfall of 86 inches, and Algiers a mean of 35 inches. In North America the fall was 153 inches at Belize, in Honduras, and 285 inches at Matonba, Guadaloupe. The greatest amount in Australia was 70 inches at Port Macquarie, New South Wales. Of foreign rainfall, however, we had as yet no very definite knowledge, and must wait for it until accurate observations have been made for some years.

Turning to the consideration of the rainfall of Sussex, the South

Downs divide the county of Sussex into two meteorological districts of unequal sizes, and having perfectly distinct climates. Starting from Salisbury Plain, these hills ran in an easterly direction through Wiltshire and Hampshire, and, on reaching this county, were about 10 miles distant from the coast; they continued for a distance of about 45 miles, gradually approaching nearer to the sea, until they terminated in the bold headland of Beachy Head. Their average height was about five hundred feet, though some of the chief summits reached eight hundred feet. The first district formed by the Downs was that to their south, which might be termed the *coast district*, and over which the rain clouds passed, depositing only part of their moisture, but, being attracted by the Downs, their vapour was condensed, and falling in the second or *inland district*—the weald of Sussex—largely increased its fertility. So great indeed was the effect of the Downs that the rainfall was from 25 to 50 per cent. more on the north side than on the south. At West Thorney, near Emsworth, which was on the coast, the mean rainfall for the last ten years was 26·87 inches, while at West Dean, which is in the Downs, it was 37·08 inches, and at Bepton, a village more to the north, the amount was about three inches more. Lynch, near Midhurst, appeared to be the most rainy spot in the county, but as only two or three years' observations had been made there, the average could not be ascertained; but it might be remarked that last year, when the total at Brighton was 25·25 inches, at Lynch it was 37·72 inches, or somewhat over 50 per cent. more. Proceeding further eastward, on comparing the rainfall of Worthing, the influence of the Downs was found to be most marked. At Worthing the mean of the last three years was 23·88 inches, and at Steyning was 34·25, or very nearly 50 per cent. more. A gauge placed near the foot of Chanctonbury Hill would very probably record a very great rainfall.

At Brighton (Buckingham Place) the mean of the last three years was 25·39 inches, and at Glynde 30.69 inches, which is 20 per cent. more; and at Beachy Head the mean of three years was 21·82 inches, whilst at Eastbourne it was 27·40 inches. The influence of the Downs was thus distinctly shown, and it was found that the greatest influence was in the western part of the county. Whether this arose from the increased width of the Downs in that part, or whether the rainfall was increased by the rain cloud having a greater distance of land to traverse before reaching the Downs, was uncertain. The north-western part of the county was clearly the most rainy. It was doubtful whether the extreme influence of the Downs on the rainfall extended to a distance of more than five miles away from them, as at Petworth, Horsham, Hayward's Heath, and Uckfield the rainfall was not more than from 10 to 15 per cent. greater than on the coast, but there was nevertheless a distinct increase in the rainfall at these places, owing to the influence of the Downs. Pevensey was the driest spot in the county, as far as our present observations showed, and this was owing to the attraction by the Downs of rain clouds coming from the south-west, and by Fairlight Cliffs, of rain clouds coming from the east.

The greatest rainfall recorded in any year in the county was in 1852, which has been mentioned before as having the greatest fall of the last 150 years. In this year the total at Dale Park, Arundel, was 52.03 inches, at Chilgrove, near Chichester, 50.87 inches, and at Uckfield, 50.55 inches. The smallest amount registered was 13.11 inches at Pevensey in 1858. The earliest rainfall observations made in the county were at Brighton in 1790. No continuous records, however, began until 1834, since which year there were tolerably complete records. The following table gave the mean rainfall at those places where it had been longest observed :—

Chichester Infirmary,	30	years mean,	28.27	inches.
Chichester (Chilgrove)		"	32.95	"
Pevensey		"	24.07	"
Uckfield	28	"	29.38	"
Hastings	23	"	27.20	"
Brighton	21	"	26.20	"
Worthing	20	"	26.29	"
Arundel (Dale Park)	20	"	33.65	"
Maresfield (Forest Lodge)	15	"	30.12	"

Taking the rainfall of Brighton. The greatest amount was almost uniformly recorded at the Water Works, Lewes-road. This might, probably, be attributed to the fact that the south-west wind, which generally brought the rain, had to pass over two slight eminences in the Downs before reaching the Water Works. It seemed quite plain that the rainstorms travelled up the central valley, as the totals at St. James's-street, at the mouth of the valley, were less than at the Water Works. The portion of the town which had the least rainfall was that to the west of the central valley. The rainfall at Buckingham-place, Cambridge-road, and Goldstone-bottom, was almost exactly the same. Probably the fall all over the plain between Brighton and Shoreham varied but little. The rainfall at Kemp Town was greater than in the western district, but was still lower than in other parts of the town. As the result of 21 years observations it appeared that the most rainy month was October, which had a total of 3.83 inches; and the least rainy months April and February, in which the totals were respectively 1.43 and 1.44 inches. The greatest fall of rain recorded at Brighton was during the great storm, better known as the Pool Valley Flood, on July 17th, 1850, when 1.81 inches fell in an hour, from 6.50 to 7.50. In October, 1865, the great amount of 9.59 inches was measured at Lewes-road, Brighton, and at Uckfield the amount was 11.23 inches, at Worthing 10.60 inches, and at Dale Park, near Arundel, 12.23 *inches*! The mechanical force required for a fall of rain to the depth of an inch was very great, when it was considered that with that fall 101 tons, or 22,623 gallons of water were deposited on every acre. It was not at all remarkable, with such a quantity of water, that sewers became choked up, and low districts flooded, especially if the rain fell in a short period, as on June 14th, 1871, when a tenth of an inch fell in a minute, which was at the rate of six inches an hour.

Many proverbs and prognostications of rain exist. Only one proverb peculiar to the county had been found:—

"When Wolsonbury has a cap,
Hurstpierpoint will have a drap."

Wolsonbury Hill was a summit in the Downs near Clayton, and when it was enveloped in clouds rain might be expected to fall at Hurstpierpoint. When the Isle of Wight could be seen from the lower part of Brighton it was considered a sign of rain,—unusual visibility of distant objects being always a sign of wet, as a proverb said,—

"The farther the sight, the nearer the rain."

Another proverb, "February fill ditch," did not apply, as this month had, in Sussex, the smallest rainfall of any month in the year. In conclusion, it might be mentioned that this was the first time that any comparison of the rainfall in various parts of Sussex had been made, as the observations had only recently been collected. He was particularly indebted to Mr. G. J. Symons for much valuable information on this subject.

Mr. Sewell then exhibited a series of fossils, very kindly sent down for exhibition from Mr. Charlesworth, and forming part of the Whincopp collection. Among the most striking were teeth of different genera of sharks, scales of fish and reptiles, coprolites, ear bones of porpoise, dental palates, tusk of walrus, and an illustration of a novel method of mounting small Natural History objects.

The receipt was announced for the Society's herbarium, from Mr. G. Davies, of a lichen new to Sussex, *Bacidia muscorum*, obtained that month at Patcham by Mr. Davies; and a moss, new to Sussex, *Fissidens decipiens*, from the moist part of the Downs above Slindon. This moss was common in wet rocks in mountainous limestone districts, as Cumberland, Lancashire, Wales, Cornwall, &c. It had hitherto escaped detection in Sussex, being confused with *F. adiantoides*. *F. decipiens* had pale-margined, densely areolated leaves, widely differing from the lax large round cells of the leaves of *F. adiantoides*. This moss also was found that month by Mr. Davies.

March 28th.

MICROSCOPICAL MEETING.—A GENERAL EVENING.

Mr. Hennah, remarking on the minutes of the last meeting, said he wished to qualify what he had stated about the potash mode of obtaining palates, which was admirable, when comparison or identification was the object, but for palates which had to be mounted, no plan was better than dissection. In killing for dissection, the creatures should be placed in cold water, and, when they extended their heads, hot water should be added.

Mr. Wonfor announced that their friend, Mr. T. Curties, had very kindly sent down for examination a box of slides, including some very choice diatoms, mounted by Möller, and which were from a collection of Möller's, from Baker's, Holborn ; he had brought down for distribution a number of specimens of *cyclostoma elegans* and *clausilia nigricans ;* a couple of packets of loam, one taken from above and the other below the Wealden building stone, and sent to Mr. Onions by Mr. Grantham, who wished some of the microscopists to examine it for vegetable substance.

That afternoon he had received a letter from Mr. Gwatkin and a bottle of water containing living creatures, taken from the supply cistern of the kitchen boiler of Mr C. Buckwell's house. It appeared that, "since an alteration in the connecting pipe of the boiler and supply cistern, by which the temperature in the latter was reduced to luke warm, these creatures from time to time made their appearance. The cistern was of cast-iron, with tightly-fitting metal top. At first a little fine dust was seen on the surface, and, in a day or two after, the creatures themselves appeared."

Before coming down he had examined some and found they were a species of *Thysanuridæ* (spring-tails). He should fancy they were conveyed into the supply cistern from without. They belonged to a species which lived on the top of water. He did not consider they came from the Company's supply, but from the house itself. All the *Thysanuridæ* delighted in damp places and fed on decaying vegetable substances. If the members present would look at one under the microscope, they would see the peculiar spring under the tail, whence their name.

One evening of the previous week, while examining "battledore" scales, to see whether he could confirm Dr. Anthony's idea of the markings being elevations on the ribs, he fortunately got some scales to stand on end, when he was able to see the papillæ standing out clear from the ribs. He had made a cork model of what he had seen, and was satisfied Dr. Anthony was right in the main ; but scales taken from fresh-killed specimens should be examined, as, in drying, they had a tendency to become flattened.

Mr. F. E. Sawyer exhibited a block of indurated Portland stone, which was found by a mason in cutting a stone step, and pronounced by him to be flint. He showed it to Mr. Wonfor, who considered it only Portland stone altered possibly by igneous action. With a lens its oolitic nature could be easily made out. At Mr. Wonfor's suggestion he had prepared some of the loose particles which looked like chalk, and had obtained portions of corals and sponges from them.

Mr. Howell exhibited disintegrated granite, from the shores of Lake Erie, under the form of fine sand.

The meeting then became a Conversazione, when, in addition to the objects mentioned above, Mr. Sewell exhibited insects mounted whole, including house fly, wasp, hive bee, and saw-fly, sea soundings from the Cape of Good Hope, 80 fathoms deep, and foraminifera from Whitecliff Bay, Isle of Wight.

Mr. Hennah exhibited palate of Tritonia Hombergii, and a very curious insect from Norfolk, *Tingis crassicornis.*

Mr. F. E. Sawyer exhibited sponge spicules, &c., from Portland oolite, palates of slug and snail, jaw and skin of brown snail, scales of haddock, &c.

Mr. R. Glaisyer exhibited cruciform, biclavate, and other spicules from *Hyalonema mirabilis*; a slide illustrating the anatomy of the Ligurian bee, &c.

Mr. Wonfor exhibited scales and portion of jaw of fossil fish from a piece of chalk, section of *Alcyonium digitatum* (deadmen's fingers), shewing spicules *in situ*, scale of cow fish, foraminifera, &c.

Previous to the business of the evening, Mr. Wonfor announced the receipt, for the Society's Herbarium, from Mr. G. Davies,of another lichen, new to Sussex, *lecidea mœstula*, obtained by that gentleman that month, near Billinghurst, and previously found by the Rev. J. Crombie near Lyndhurst, New Forest; and, for the Cabinet, from Mr. T. H. Hennah, of the palate of *Tritonia Hombergii*, a nudibranche, said by Forbes and Hanley to be rare. A couple of the mollusks alive were taken to Mr. Hennah inside a scallop. He supposed they had been dredged up with the scallops, for they were said to be inhabitants of deep water, and to frequent scallop beds.

April 11.

ORDINARY MEETING.—MR. H. PRATT, F.R.A.S., ON THE PHYSICAL FEATURES OF THE MOON.

After stating that we know something of the usefulness of the Moon, very much of its motion, and a little about the strange markings on its disc, yet, to the question, "What is its real nature ?" he affirmed that at present we are unable to give a positive reply. The successive suppositions of observers (ancient and modern) were next referred to, and the growth of knowledge coincident with optical improvements traced out. The speculations on the habitability of the moon were glanced at, Mr. Pratt regarding it as impossible that even vegetation could be the cause of the changes of lunar tints, if it were true that neither water nor atmosphere existed there. But those questions were by no means so nearly disposed of as some writers assumed. The only atmosphere possible to the moon must be very small in quantity and limited, perhaps, in distribution, obviously increasing the difficulty of *proving* either its presence or absence. Writers of the day treated the subject in a most summary and inconclusive manner, yet certainly more delicate observations and more precise data were needed before it could be finally settled. Many speculations as to the *locale* of a lunar atmosphere had been made : some placed it on the farther side of the moon (which we never see) ; others had put it inside ; but we were really not able to say what might not be inside ; for as yet we could only deal with its exterior.

Let us *consider* (said Mr Pratt) one or two points. We knew that the proportion of oxygen in the earth's crust was at least one third, some said one half, by weight of the materials. And we knew oxygen united with nitrogen to form atmosphere, and combined with hydrogen and formed water, and with silicon, sulphur, carbon and the metals to form the varieties of earth and rocks which together constituted the solid matter of our globe. Then would it not be exceeding the bounds of probability to exclude oxygen from the Lunar crust ? Again, *here* we knew that combustion was the process of combination between oxygen and other substances. Then, if volcanoes are in any way proof that the Lunar crust is combustible, what could *we* suppose could have taken the place of oxygen in the process ? Or, if the Lunar crust was earthy in its nature, was it reasonable to suppose it could remain unaffected by intense heat ? Mr. W. R. Birt, our eminent British Selenologist, had considered the question with his characteristic care. With Herr Althaus, he estimated "that the Moon's hemisphere, which was turned towards the earth, attained at least a maximum temperature of 840 deg. Fah., upon the assumption that its power of absorbing heat equalled that of quartz. The heat thus attained would exceed the fusing points of tin and lead. On the other hand the minimum temperature of the Lunar night he estimated to be—92 deg. Fah., which would give a fall of 932 deg. in fifteen days, equal to daily increments and decrements of heat of about 63 deg. each." Mr. Birt had also alluded to the very considerable expansions and contractions of the gases (either present or liberated) which must attend this enormous variation, and suggested that if the heat exceeded the melting points of tin and lead it was quite possible that, long before the maximum temperature was attained, substances might be fused and vapours given off. The Rev. T. W. Webb, who had done more than any other person towards popularizing the real study of the Moon, had well said, "the action of heat is expansive and liquefacient, *but not explosive*, excepting through the sudden dilatation of some elastic material ; and if we find, as we do find, evidence of such upheaval and dislocation of heavy substances as cannot well be ascribed to mere expansion and pressure, it seems difficult to dispense with the presence of aeriform matter suddenly liberated from restraint and flashing out its almost irresistible power."

The kind of observation generally referred to by those hasty writers who assumed the question as long since settled, was that of occultations of stars by the moon. Yet, carefully considered, their value proved to be merely negative. There were three modes of observing them, which were described at length with their results. Of the first two, it was shown that there was not a coincidence between theory and observation, and it was maintained the discrepancy disqualified their decisiveness. The third, or spectroscopic, mode was especially dwelt upon, and the observations and conclusions of the careful and accurate Dr. Huggins shown to be at variance with the statements of writers who assumed his work to have disposed of the question ; for he had taken the precaution of warning others not to be too hasty in founding opinions upon it. And so the question remained open. And we were unable as yet to tell much of a Lunar atmosphere at least.

The surface of the Moon, or rather of the side we were able to see, was broadly divided into two very distinct classes of features: large, dark, comparatively smooth, and level patches; and bright, broken, irregular tracts of land. The darker parts were *the Maria*, so called by the old observers, from their supposed resemblance to seas and the beds of former oceans. They might be chiefly likened to our terrestrial plains, prairies, and steppes; were often bounded by hilly table-lands and extensive mountain chains. Their general appearance was diversified with small pits, sometimes considerable craters, and frequently long, low, and more or less sinuous banks. A description of their other features was given, and peculiarities traced in the various examples pointed out on a large map. *The Walled Plains*, as they were termed at first sight, seemed to resemble gigantic craters; but a closer acquaintance revealed considerable differences. They were of large extent, some being 100 miles in diameter. They presented the characteristics of upheaval rather than the explosive forces which formed true volcanoes. Some large drawings of notable walled plains were exhibited, one showing a fine example almost in profile; another giving an idea of an almost vertical view. *The Craters*, which had evidently played so lively and important a part in the formation of the Lunar surface, were next noticed. In many parts of the Moon they seemed crowded together in almost inextricable confusion, the walls of one crater encroaching on and often partially obliterating those of another, while, perhaps, in its own turn, it had received numerous shocks from smaller explosions, or been riven by deep fissures or clefts. The Lunar craters were on a gigantic scale compared with ours, many being from 40 to 60 miles in diameter, and their depth from summit of rim to bottom of cavity in some cases even exceeded three miles, while the height of rim from the surrounding land was often 1½ miles. The walls of these enormous bowls were sometimes split into almost concentric terraces divided by ravines and arranged like the seats of an amphitheatre. Several examples were referred to on the map, and a fine drawing of Copernicus, executed by Mr. W. W. Mitchell, was much appreciated.

An interesting account of Mr. W. R. Birt's discovery of a second cone in Tycho was next given

The Mountain Ranges graduated in all possible diversities of form. *Continuous Andes-like chains* of great altitude sloping in long gradients on the one side, and on the other presenting perpendicular cliffs quite terrific in character, where we could follow the arêtes to the summit, and cross or trace cols and couloirs in abundance up the face of the precipices without the least danger of meeting with a cannonade of boulders or of tumbling into some deep crevasse; in a word, where we might enjoy many of the pleasures of alpine wandering and surveying without meeting the dangers that beset Tyndall and Whymper in the Swiss mountains. And there were *Elevated Plateaus*, intersected by ravines and fissures, *extensive Groupings of Hills*, *solitary column-like Peaks*, *Hillocks*, and *blocks* of rock innumerable. The highest of the mountain ranges were the Döerfel mountains, reaching an altitude of 26,000 feet, and of which Mr. Pratt exhibited a large drawing, taken from his telescope on a scale of ten miles to the inch, showing this range in grand profile on the moon's limb, and giving an idea also of the serrated character of the edge of the lunar disc as seen in a powerful instrument. *Valleys*, *Passes*, and *Gorges*, of course abounded in such regions, as strangely varied in their aspect as the formations which encompassed them. The singular *Clefts* or rills were described; and the strange *White Rays*, which seem so mysteriously connected with many of the principal craters, received attention. One of them, which rises near Tycho, was afterwards traced on the photograph shown by the lime-light by Mr. Nash for a distance of over 1,700 miles. Yet we could not say what they were. At their junction they often enveloped objects in a luminous blaze under a mid-day sun, so that we could no longer make out their chief features. The Sun, however, had but to approach the horizon of the spot for them entirely to vanish and leave us in complete ignorance of their cause. And there were *Faults*, or breaks in the continuity of the strata, which had been caused by cracks and then filled up again from beneath. They had been chiefly recorded by Mr. Birt.

The endless variety of lunar formations already described and sketched were numbered by thousands, yet many thousands more were waiting their turn. Here a slight digression was made to urge that a large addition to our knowledge of the Lunar surface might still be made by means of ordinary telescopes, say 3 inches aperture. It was a common fallacy which supposed real work could not be done without monster telescopes. But it was very much as in microscopy, where more could be learned from quite a moderate instrument, combined with skilful manipulation of the object and the light, than from a more powerful one used in a desultory fashion.

This was followed by some considerations of lunar forces and probabilities of a chronological sequence to be detected amidst the overcrowded evidences of a wonderful activity. Our own ablest selenologist, Mr Birt, occupied the place of honour in this work. The Rev. T. W. Webb had done much in this direction also. Their opinions, as to the order of past activity, were mentioned, and several examples illustrating them were pointed out.

Then, the order of activity perceived, another question suggested itself. Had all activity ceased? or was it possible that it might be working still? Inexplicable differences between observations made at different times and places were adduced, and the recent case of Linné referred to, showing that past records were at variance with the present aspect of the object and proving, at the same time, that the maps and drawings of the older observers were not sufficiently accurate for modern purposes.

Mr. Pratt then explained that more than three years since, he determined to test the questions of a Lunar atmosphere and present activity, as far as his means would allow, and for this purpose selected some regions for study. As it seemed probable that the greatest opportunity of detecting change or activity would be in the very minutest of objects,—those but just included within the limits of vision,—his plan was to map these in certain regions, so as to produce standards of reference, and then to continue an unremitting watch on all possible opportunities, so as to test their stability or otherwise. He disclaimed all bias to either side at the commencement of his observations, and owned a complete indifference to their results, although to advance what was true in the matter was at once his object and ambition. One of his selections was the walled plain *Plato*, on the margin of the Mare Imbrium. Beer and Mädler, in their celebrated map, had only placed four little craterlets on its floor, and reported the presence of some light streaks. Mr. Webb had thrown doubt on their arrangement of the latter, and the craterlets had been scrutinised without much addition to their number. However, Mr. Pratt's observations quickly proved productive, and in February, 1869, he forwarded to Mr. Birt a plan of the floor, showing more than double the number of previously known objects. The work had since attained much importance in consequence of the intense interest taken in it by Mr. Birt, and the valuable co-operation of other observers which he secured. During the three years more than two thousand observations of the minute features of the floor of Plato had been made, and thirty-six of the small craterlets, and thirty light streaks discovered. A large number of interesting phenomena had been noted and a very complete knowledge of its varying states registered. The British Association voted a sum of money for computers' assistance to forward the work under Mr. Birt's direction, and among the results of his most elaborate discussion of the observations might be mentioned that *intermittent visibility* of the minute craterlets was proved; and, further, that this variation was *not* in accordance with the angles of illumination and vision. Another result was, that the varying tints of the floor were as the solar altitude at the spot.

It might be briefly stated that both the idea of a present Lunar activity in the smaller features, and the other idea of a possible lunar atmosphere seemed supported by the investigation so far as the floor of Plato is concerned. Whether what was true of one locality was true of the whole Lunar surface was a question requiring the aid of other observers. But, perhaps, enough had been adduced to prove the position assumed at the commencement of the lecture, that, whatever we did know of our satellite, there was too much left still unexplained to admit of our replying in a positive manner to the question "What is the Moon?"

A large plan of the floor of Plato, on the scale of four miles to the inch, from Mr Pratt's observations, was shown; also, some stereoscopic photographs of the moon, taken by Dr. De La Rue; and Mr. G. Nash exhibited some Lunar photographs by means of his oxy-hydrogen lantern.

April.

MICROSCOPICAL MEETING. — DR. HALLIFAX ON CERTAIN FACTS IN THE ANATOMY OF THE CUTTLE FISH.

Those present at the last meeting would (said Dr. H.) recollect that a difficulty arising respecting a subject, it was suggested that he should introduce the cuttle-fish, as there were several points in its anatomy iteresting to microscopists. During the interval he had been furnished by a friend with the head of a large cuttle *(Sepia Officinalis)*, to some points in the anatomy of which he should chiefly confine his remarks. Subsequently, Mr. Hennah had furnished him with specimens of *Sepiola Atlantica,* to which he would also allude.

The Cephalopods, to which the Cuttle belonged, were a vast tribe ; but, as before stated, by confining himself to one, he might better indicate points worthy of observation by the members. First, as regarded the organs of prehension, situated around the mouth. These varied from 8 to 10 in number, and were armed with most perfect suckers, cupping instruments, or air pumps of marvellous construction, and which consisted of cups having a hardened margin, in some cases toothed, and in others hooked as well, and supplied with pistons, which enabled the creatures to hold on or let go at will, as each sucker was supplied with its own particular nerve, so that the suckers could act separately or collectively. In the case of those having ten arms, two possessed very great power of elongation, so that the creature could approach any object of which it was suspicious by means of them, itself remaining at a distance. They also served to anchor it to the rocks in rough weather.

The next point to which Dr. Hallifax called attention was the eye, which, compared with the creature, was wonderfully large, and protected against injury by a transparent integument. The most curious fact in connection with it was, that the crystalline lens was a perfect Coddington lens, viz., a spherical lens with a deep groove filled with dark pigment.

In general the cephalopods were without external or internal skeleton, but the cuttle bone, a wonderful example of lightness and strength, and the sea-pen were well known. As was evident from an examination of the rocks constituting the earth's crust, the cephalopods, under a great variety of forms and names, played a very important part in the economy of past animal life. Shells of ammonites had been met with four feet in diameter. There were many other points worthy of notice, such as the ink-bag, muscular structure, &c.

Mr. HENNAH said there were some facts in the reproduction of some of the cephalopods of very great interest to microscopists. One point he might mention. While examining a common squid, *loligo vulgaris,* he obtained a number of spermatophores, each of which was full of thousands of spermatozora.

Dr. Hallifax remarked that he had forgotten to mention the beak of the cuttle, which was different from that of the parrot, in that the larger part was undermost. Their palates are armed with very formidable teeth.

Mr. Wonfor mentioned the fact of Dr. Buckland not only using fossil sepia, the ink being of extinct cephalopods, in making his drawings of the creatures, but puzzling an artist as to where he could obtain such fine pigment.

The meeting now became a Conversazione, when a number of objects illustrating the paper was exhibited by Dr. Hallifax and Messrs. R. Glaisyer, Hennah, and Wonfor.

Before Dr. Hallifax's paper was read, Mr. Hennah called attention to a statement by Dr. Pigott, in the *Monthly Microscopical Journal*, in which he ingeniously made it appear that the photographs of glass rods, copies of which he (Mr Hennah) had presented to the Society, were made from an arrangement of Dr. Pigott's. So far from such being the case, the arrangement was his own, perfectly original, and in no way borrowed or taken from any one else. He (Mr. Hennah) thought this statement necessary, lest some of his friends might think he had appeared before them under false colours.

May 9th.

ORDINARY MEETING.—MR. MITTEN ON THE DISTRIBUTION OF THE FLOWERING PLANTS IN THE VICINITY OF BRIGHTON.

In the few ideas which he was about to offer to their consideration respecting the vegetation now existing in this immediate neighbourhood, he did not intend to enter into any disquisition on the many rare and interesting plants which were or have been found near Brighton, but to ask their attention to the entirely artificial conditions under which a large number of common species were now in occupation of the soil.

In speaking of the neighbourhood, he should avail himself of the sharp lines afforded by Nature for its definition, and keep entirely to the chalk hills and the coast, by that means avoiding as much as possible any reference to the plants which belonged to the Weald beyond the abrupt northern ending of the Downs, or to those plants which were peculiar to rivers or marshes ; for, immediately we began to consider the state in which many of the commonest species were growing, it would become evident that, although they were truly indigenous, they were now in situations controlled by cultivation ; under which term he included pasturage as well as tillage. So great on every hand were the changes which cultivation had produced, that no trees would now be supposed to be growing in natural or primeval woods beyond the chalk ; and the rivers which came down to the sea on the east and west, instead of influencing a wide extent of surface and encouraging a dense vegetation by the deposit of fresh material after winter floods, were now confined between artificial embankments, and no longer able to affect the adjacent levels beyond furnishing an abundant supply of water ; hence large tracts formerly covered with phragmites and other coarse grasses were changed into valuable pasture, composed of grasses which originally could never have existed there.

It was entirely out of his province to venture upon any digression into the geological particulars appertaining to the chalk formation ; but there were some peculiarities relating to the surface that were at once conspicuous in taking a survey of the Down-land situate between the Adur and the Ouse : beautiful rounded outlines of hill and valley, without any projecting rocks or stones. The heaps of flints formerly existing in some valleys having been in recent times removed, and the few blocks of transported sandstone, like those once in Goldstone Bottom, having for the most part shared a similar fate, one moss which grew on these blocks had been lost to the district.

The surface had been left by Nature continuously clothed with a dense short turfy vegetation, consisting of perennial plants, so closely matted together that many annual or biennial plants could never rise through it, nor would they be able to obtain a foothold were it not for the breaking of the turf by the burrowing of the rabbit and the hillocks produced by the ant. These latter, although very numerous, rarely gave rise to any large plant ; but diminutive species, like *Draba* *verna, Aira prœcox,* and *A. caryophylla,* with small *Cerastia,* are frequent upon them. He must not omit to mention that one moss also grew on the ant-hills, for which no European locality was known nearer than the ruins of the Colisseum at Rome. On the earth thrown out by the rabbit, *Echium, Cynoglossum, Myosotis,* with thistles, the nettle, and the mullein, were enabled to grow. The plants which constituted the turf were very numerous, a very large proportion of *Festuca ovina,* with a number of other grasses, two species of carex, *C. glauca* and *C. praecox.* The remainder were generally common to upland pastures, excepting certain plants peculiar to the chalk, of which, *Phyteuma orbiculare* and the curiously parasitic *Thesium* were the most deserving of notice. Nearly all the orchids inhabiting the south of England found suitable conditions to meet their requirements in this turf.

The thickness of the chalky or ochraceous vegetable loam beneath the plants forming the turf, varied from a few inches in the more exposed situations, to nearly a foot where the wind had had less power. Of the very slow accumulation of this earth, intermixed with decayed vegetable matter, the earthworks and burrows on the higher Downs showed that only about an inch and a half had been deposited since their formation. In these situations, however, the power of the wind was so great that all loose particles were swept away into the valleys. He must not omit also to mention the circumstance that on all these Downs there was no spring or rill carrying water towards the sea, nor was there anywhere a place where water stagnated, and which would produce a variation in the turf. All the rain being immediately absorbed and washing through the turf might carry with it the requisite material to dissolve the permeable chalk, in company with which it rose in inconsiderable springs on the northern bases of the hills, thence to find its way by circuitous channels to the rivers.

The sea-coast furnished to a great many species of plants the conditions which appeared to be essential to their existence: the gradual crumbling away of the cliffs and the heaps of shingle, from which the sea had retreated, supplied the unoccupied space and broken earth upon which only could they establish themselves. Besides the plants which were peculiar to the coast, there were present a number of species which, although now everywhere common on inland cultivated ground, when near the sea, had always a more robust appearance.

Conceiving a time previous to the advent of cultivation, there would have been here, on one side, the unbroken turf of the Downs, with its crowded occupants, in possession of the soil from the remotest antiquity ; on the other side, the sea, with its continually shifting vegetation, ever seeking the new ground there supplied to it.

Turning now to the cultivated land, we found on every side a profusion of plants, which, in defiance of the most strenuous exertions, kept their footing in the soil, ready to become rampant with the least remission of human industry. Familiar examples of these plants were *Convolvulus arvensis*, all the poppies, *Sonchus*, *Sinapis alba*, and *S. arvensis*, *Euphorbia peplus*, *E. exigua*, *and E. helioscopia*, *Mercurialis annua*, and *Triticum repens*. That all these plants were now in occupation of the cultivated ground solely through the favourable conditions which cultivation supplied to them, seemed evident when we considered their requirements, which appeared to be moved or broken earth, and sufficient open space ; for none of these plants, not even the *Convolvulus* and the *Triticum*, were able to establish themselves in the turf of the Downs, and as they were not plants capable of existing in woods, or in marshes, he begged to submit to their consideration the hypothesis that all these plants had migrated inland from the sea coast, where alone the necessary conditions required for their growth were originally by nature provided for them.

Few papers read before the Society elicited so much information from the Lecturer, and from the gentlemen who took part in the discussion. Among the various topics discussed were: What is a species?—the vitality of seeds, the tendency of strong and robust plants to destroy the weak and feeble, springing from seeds from the same seed vessel ; the marvellous variety of the general characters often observable in plants of the same kind, grown from the same seed, and under the same conditions ; the curious and extraordinary growth of plants new to the locality, after drainage, breaking up the soil, or fires ; the alteration in some of the qualities of plants, by careful selection of seed and high cultivation ; the advantages derived from careful selection of seed, &c. These, as well as other points thrown down in the paper, were discussed by the President, and Messrs. Mitten, Glaisyer, C. P. Smith, G. Davies, Wonfor, Hennah, G. Scott, B, Lomax, Nourse, and Sewell ; and a hearty vote of thanks was given to Mr. Mitten for his paper.

MAY 23RD.

MICROSCOPICAL MEETING.—ANNIVERSARY MEETING.

As this was the anniversary of the Microscopical Meetings, Mr. Wonfor, Honorary Secretary, gave an abstract of the year's proceedings. During the second twelve months since the establishment of regular monthly microscopical meetings (he said) a very good amount of work of an interesting character had been done and many very suggestive subjects had been introduced and discussed, among which were Polyzoa, Parasitic Plants, and Certain Facts in the Anatomy of the Cuttle-fish, by Dr. Hallifax; Animal Parasites—Entozoa, and Palates of Mollusks, by Mr. Hennah; and Diatoms, the Scales of Insects and Animal Parasites—Epizoa—by Mr. Wonfor. One evening had been devoted to the Hairs and Scales of Plants; another to Pond Life; and two had been General Evenings, at one of which instruction in making sections of soft rocks had been given by Mr. Wonfor. The Society was also indebted to Mr Curties, who had not only presented some very choice slides, but had kindly sent down on several occasions many slides and novelties for exhibition.

The thanks of the Society were due to the various gentlemen who had, during the year, exhibited microscopic apparatus and appliances and interesting slides. The chief contributors were Messrs. R. Glaisyer, J. Dennant, T. Glaisyer, T. Cooper, T. Curties, Turner, T. H. Hennah, Sewell, Horne, Robertson, C. P. Smith, G. Davies, Gwatkin, F. E. Sawyer, Howell, Saunders, Marshall Hall, Wonfor, and Dr. Hallifax. The thanks of the Society were also due to those gentlemen who had enriched the cabinet by contributions.

Votes of thanks were given to the above gentlemen.

Mr. Sewell mentioned a curious circumstance in connection with a slide of *Pediculus*. He had killed and mounted a specimen in glycerine jelly. Some time after, he perceived that two small live ones were moving about under the covering glass. As they were air breathing animals, he wondered how they were engendered and maintained.

Mr. WONFOR mentioned several examples of moths which had been killed and set, from which larvæ had not only hatched out from the eggs, which had not been extruded, but had made their way out. Was this a similar case?

Mr. Hennah considered, as glycerine jelly contained carbolic acid, which destroyed animal life, that possibly the small pediculi had been overlooked and had not escaped from the parent.

A conversazione followed, when many very interesting objects were exhibited by Messrs. Sewell, Turner, R. Glaisyer, and Wonfor.

Mr. Wonfor announced that Lord Gage had granted permission for the Society to visit the Plashet Park and Woods on the occasion of the field excursion to Isfield. In the letter conveying the permission, His Lordship had communicated a very interesting fact which he had observed in connection with the harvest spider. One evening in August, while sitting with open windows, several tipulæ were attracted by his lamp. One of these was observed dragging something behind it. This went on for two hours, when, His Lordship's curiosity being roused, he caught the tipula, and found one of the harvest spiders with his legs interlaced with those of the tipula, which was about ten times his size, and which had been whisking it about for two hours. It then occurred to him that the animal, so unfitted apparently to take any prey, did so by the process of tiring out, as the wolverine and some African leopards are said to do, though they have weapons for shortening the process.

June 8th.

ORDINARY MEETING.—MR. G. SCOTT ON THE SUFFOLK TERTIARIES.

After pointing out the mistake which was apt to be made by students at a distance of confounding the Suffolk Crag with the Drift of Suffolk, the latter being a Post Tertiary deposit, due to ice and water agency, whereas the Crag belonged to the Tertiary deposit lying above the chalk, Mr. Scott said the formations locally known in

Suffolk as the Crag, and divided scientifically into the Coralline Crag and the Red Crag, were the only British representatives of the older Pliocene period.

When they occurred in the same district, the Coralline Crag lay beneath the Red Crag, and where the former was wanting the Red Crag rested upon the London Clay, which, being one of the beds of the Lower Eocene, was, of course, of much greater antiquity than the Crag. The White and Red Crags belonged to different periods, and there was sufficient evidence of the fact that the temperature of the sea was higher during the deposition of the Coralline Crag than it had become when the Red Crag was deposited, many of the species of shells and Polyzoa found in the former, which had not become extinct, existing now only in more southern seas. In the same way it was observed that the living species represented in the Red Crag, but not in the Coralline, had a more northern character, many of them still inhabiting our own coasts. These and other facts, together with the further evidence furnished by the Norwich Crag, were of great interest, as showing the gradual coming on of a more severe climate, which resulted in the Glacial Epoch extending all over the north of Europe and America.

The Coralline Crag was composed chiefly of soft marly sands, generally calcareous, often a mass of comminuted shells, passing occasionally into a soft building stone, which was quarried in the neighbourhood of Orford. In some places the softer mass was divided by thin bands of hard limestone. It was usually about twenty feet thick, though in some places it was said to reach fifty feet. But one of the most remarkable things about it, as one of the vestiges of creation, was its limited extent, the Coralline Crag being confined to a strip of country twenty miles long by three or four miles wide, between the river Alde and the river Stour.

The Red Crag occurred, with breaks, from Aldborough to Walton-on-the-Naze, and extended inland from some five to fifteen miles. It was generally from ten to twenty feet in thickness, though it occasionally reached forty feet, including beds of rough red sand at the top, without shells. It would be in vain (said Mr. Scott) to attempt any description of the shells of the Crag. They were well represented on the table, and were described and figured in Mr. Searles Wood's admirable "Monograph of the Crag Mollusca," in the Society's library. The important fact was, he thought, established by Mr.

Wood that the Red Crag was not derived from the destruction of the Coralline Crag, or of older formations, but that the animals whose remains were there deposited lived and died on the spot where they were found. In the Coralline Crag 350 species of mollusca had been found; of these 110, or 31 per cent., were extinct. In the Red Crag 256 species had been found; of these 65 or 25 per cent. were extinct.

After noticing the fact, that in the country round Antwerp, on the banks of the Scheldt, there were strata equivalent to the Red and Coralline Crag of Suffolk, and also a lower and more ancient division, known as the Black Crag, and which, probably, formed the first link of a downward passage from the Pliocene to the Eocene Period, Mr. Scott adverted to the Suffolk bone-bed, found below both the Coralline and Red Crag, and supposed by some to be the remains of a Black Crag which formerly existed on this island, equivalent to the Antwerp one. This bone-bed he described as consisting of vast quantities of brown phosphatic nodules, the so-called coprolites (from *copros* and *lithos*), often enclosing fossil crabs and fishes, with large numbers of the teeth of gigantic sharks. Under these were broken-up septarian nodules, and other so-called "rough stones," the *dêbris*, according to Professor Owen, of washed-off London Clay. Along with these were the sand-stone nodules called box stones, containing the remains of Mollusca, Sharks, and Cetacea, which were believed to be identical with the Black Crag of Antwerp.

Associated with these various forms of nodules, many of them containing no organic remains, were large numbers of separate bones and teeth of land and marine animals, forming altogether as strange a giants' burial ground as they could well conceive, and equally strange was the use to which man had turned it, as the principal element of a chemical manure. Amongst the most curious fossils in this bed were those which were recognized in 1843 by Professor Henslow, of Cambridge, as the tympanic bones of whales. These whale ear-bones, of which Professor Owen had determined several species, were to be found at times in such numbers that Professor Henslow told him, when he first set some people to collect them, he very soon had something like a market-basket full.

It was now quite established that the bone-bed contained bones or teeth of many terrestrial animals, including *Sus*, *Rhinoceros*, *Schliermacheri*, *Tapirus priscus*, *Mastodon*, *Arvernensis*, *Cervus*, *Ursus*, *Hyœna Antiqua*, *Hipparion* (a quadruped of the horse family), and many others; also, the remains of marine mammals, including the walrus, &c. The fossil bones were as hard and dense as stone, polished as if the waves had rolled and washed their surfaces for ages, many things proving that they were fossilized in some older formation, and afterwards washed out and rolled as the shingle on some primeval beach, just as they are now, by successive falls of the cliff and the encroachments of the sea, claimed once more by the waves of the German Ocean. For instance, the Crag at Harwich, described and carefully figured by Robert Dale, 1730, was all nearly washed away during his 40 years' observation, and all vestiges of it had long disappeared.

When (said Mr. Scott) we wondered where these great land animals could have lived, we must not forget Professor Huxley's conviction that during the Miocene epoch there was a continuity of dry land between Europe and North America. There had lately been a good deal said respecting certain perforations in some of the sharks' teeth found in the Crag, which it had been asserted might be attributed to human agency. They would soon hear the decision of those well qualified to judge. But, by whatever natural agency the perforations were made, possibly whilst the teeth were unfossilized, he had every confidence that they would not have to put the antiquity of man far enough back to require him as the perforating agent.

Reverting to the manufacture of chemical manure from the contents of the bone bed, which is extensively carried on in Suffolk, Mr. Scott said: This, I think, is one of the most curious unions of chemistry and geology that can be imagined: turning the relics of a former world to account, and, with the remains of animals which passed away ages ago, giving to our fields renewed beauty and fertility. Sowing, if not dragon's teeth, st least dragon and mammal remains, and, instead of the fabled crops, receiving the abundant fruits of the earth to fill the land with joy and plenty.

A very interesting discussion followed, in which Messrs. Wonfor, Sewell, Infield, Lomax, G. Scott, Hollis, and Charlesworth took part; when some very interesting matter respecting the link supplied by the Suffolk Tertiaries in regard to the existing Fauna was given by the last named gentleman, who detailed the history of the discovery of the true corprolites and of the phospatic deposits of the Suffolk Tertiaries and the Cambridge Green sand, which had not only resulted in great commercial success to the workers, but had added to the material wealth of the nation as fertilizers.

At the close of the discussion, Mr. Charlesworth called attention to some very interesting specimens of peculiar dental structure, one being the head of the narwhal, with tooth some 8ft. long *in situ*, and supplemental germ-tooth lying in the skull. Few examples of two developed teeth were known. Another was the jaw of the wart-hog of South Africa, a very abnormal structure, similar as regards the dentition to that of the elephant. He then drew attention to some very curious perforations in the teeth of sharks from the Red Crag, pronounced by Professor Owen as probably produced by human agency. The subject was under examination by a Committee of the Anthropological Society. Some of the boring creatures usually met with seemed not to have been the agents in perforation, and Mr Charlesworth thought they are only simulations of human workmanship.

Mr. Wonfor also stated that Mr. H. Willett had offered to place at the disposal of a Committee appointed by the Society the specimens obtained in the Wealden borings, for examination geologically, chemically, and microscopically, and to provide a room where the examination could be carried on. The Committee recommended that Mr. Willett's offer be accepted ; that Messrs. T. Glaisyer, T. H. Hennah, J. Howell, G. Scott, C. P. Smith, W. H. Smith, J. Schweitzer, Dr. Hallifax, Captain Marshall Hall, and the Hon. Secretaries (Messrs. T. W. Wonfor and J. C. Onions), with power to add to their number, do form the Committee ; and that the Society subscribe five guineas towards the expenses of the Ashburnham borings. It was also announced that the Executive Committee of the British Association had asked the co-operation of the Society in arranging a "Living Flora of the South Coast," and other objects of interest, including a scientific microscopic display, for the soirées and temporary museum, to be held in the month of August. The Committee recommended that the request be complied with, and that a Committee be appointed to carry out these objects.

JUNE 27TH.

MICROSCOPICAL MEETING.—MR. T. H. HENNAH ON MINUTE CRUSTACEANS.

He had hoped, he said, to have exhibited good living specimens, as they abounded at this time of the year; but the weather had been unfavourable for obtaining the specimens he required.

One of the most interesting was the Caprella, a living specimen of which, under a moderately high power, exhibited the circulation and action of the dorsal vessel, or heart, very beautifully. The corpuscles, of an oval form, were plainly seen rolling over and over as they permeated the whole body. The intestinal tube extended from the head through each segment of the body to the anal orifice, situated on the last segment between the articulation of the last pair of legs. Surrounding the anal orifice were several tubercles, very similar to those round the mouth.

The habits of the Caprellæ led them to keep among the marine plants and sponges. They walked like caterpillars, turned frequently and rapidly on themselves, or set up their bodies, holding on to the algæ merely by their posterior legs, vibrating their antennæ at the same time. Their food was small animalculæ, and they had been seen greedily devouring cyclops.

The Caprellæ had ten feet; the first pair were given off from the head and then a pair from each segment of the body, leaving out the second and third, which had each a pair of vesicular bodies, supposed to be respiratory organs. This he certainly believed to be the case. From their extreme transparency and the liveliness and peculiarity of their action, the caprellæ were among the most interesting of microscopic objects. The rapid course of the blood, the striated muscles ever in motion, and the coloured pigment cells were well seen under a very moderate power, while a 3-inch objective took in the whole animal.

Another minute wonder was one of the Pycnogonids, the *Amathea*, which was found in numbers crawling over the smaller sea-weeds at low-water. Without entering into details of the general structure, he would proceed to the very interesting arrangement of the digestive organs. The orifice of the mouth was prolonged backwards, forming an œsophagus, and opened into the stomach at the level of the second pair of thoracic claws. The stomach was very short, and to it belonged the digestive cœca of Milne Edwards ; they were ten in number ; the first two penetrated into the foot jaws and the other eight into the legs, extending to the last joint but one. After the cœca were given off, the digestive tube narrowed and entered the intestine which reached to the cloaca. When the cœca were distended by fluid, we could see at each joint an elongated enlargement and corresponding contraction. The cœca were composed of a slender transparent membrane, and were full of a light yellow transparent granular substance.

The portion of the digestive tube between the æsophagus and the intestine was free and floated in a cavity or lacuna formed by the walls of the thorax, and extended into the feet as far as the termination of the cœcum. The lacuna was full of clear fluid, in which could be distinguished a number of transparent irregular corpuscles, and it was agitated incessantly by irregular movements, and to them all the circulation was limited, The *heart* and *vessels* were all represented by the cœcum, and the fluid within it was the blood. No organs of respiration existed, this function being altogether cutaneous,---as had been remarked, they carried their stomachs in their legs.

Such was a brief introduction to two members of a very interesting family, which numbered many more of great interest ; but his careful observation had been devoted to these only. Dr. Humby first drew his attention to the interest attaching to the study of Caprella and Amathea, and to him he was indebted for all that was good in these introductory remarks, which were almost verbatim notes of a paper read by Dr. Humby before the Microscopical Club in 1864. He ought to mention that the female Caprella was shorter than the male, and had a peculiar sac, in which she held her eggs until mature. Last year he found both by hundreds in the pools among the debris of sea weeds. The circulation was well seen in the appendages of amathea, which seemed to occupy the place of legs. Mr. Robertson had left with him a bottle containing some minute crustaceans, but he had not had time to examine them.

A discussion followed the reading of the paper, when it was proposed that the subject be adjourned till the next meeting, and members were advised to hunt for minute crustaceans, and also to use the simple tow-net for surface fishing.

After a vote of thanks to Mr. Hennah, the meeting became a conversazione, when Messrs. Hennah, Sewell, R. Glaisyer, and Wonfor exhibited some interesting specimens, including Zoea of Crab, living crustaceans, and specimens of *melicerta ringens*, whose movements were much admired.

Mr. Wonfor called attention to the necessity of appointing the Committee to organise the microscopic displays at the forthcoming soirées of the British Association, and stated that he had received from the Secretaries of kindred Societies, favourable replies to enquiries, asking their aid and co-operation, and proposed that Dr. Hallifax, Messrs. Hennah, Sewell, C. P. Smith, Haselwood, W. H. Smith, G. Scott, F. E. Sawyer, the President (Mr. Hollis), and the Hon. Secretaries (Messrs. Wonfor and Onions), with power to add to their number, form the Microscopical Committee. It was resolved that these gentlemen be requested to make the necessary arrangements.

July 11th.

ORDINARY MEETING.—A SPECIMEN EVENING.

Mr. Simonds exhibited specimens of Cornish serpentine from Portesco, where it was worked; a waterworn pebble, picked up near the Lizard Point; and ladies' ornaments made of serpentine. He was struck with seeing pulpits, screens, and other ornamental work in the Cornish Churches of polished serpentine; also brown rape from the Lizard, found on thyme; two rare trefoils (*Trifolium Bocconi and T. Molinerii*), dodder, parasitic on furze near Penzance, and wild asparagus, a very rare plant.

Mr. H. J. H. Nicholls exhibited a vertebra from the Norfolk bone bed and a specimen of the shrike, or butcher bird.

Mr. Elphick exhibited and read portions from an inventory of the house of Cornelius Humphrey, of Newhaven, dated 1697, to show the difference in the value of corn and stock then and in 1872. It appeared that the prices were: malt, 24s per qr.; oats, 12s; barley, 19s;

wheat, 56s ; oxen, £7 each ; a horse, £4 10s ; sheep, 9s. Present prices : malt, 64s per qr. ; oats, 24s ; barley, 38s. ; wheat, 60s ; oxen, £20 each ; horses, £25 to £50 ; sheep, 50s to 60s each.

Mr. Penley exhibited flexible sand stone from Delhi, pudding stone, blood stone, and gems from Agra.

Mr. G. Davies exhibited about 40 specimens of lichens recently obtained in the New Forest, principally from the genera *Calicium* and the *Graphideæ*, some of which were representatives of the rarest in England, the south of which, he stated, was the head-quarters of the *Graphideæ*, a section of lichens but litttle understood by many.

Mr. W. Saunders exhibited two very curious fossil echinoderms from Egypt, and flint implements, worked on one side, from the tombs at Memphis, almost identical with those found in this county.

Mr. Shillingford exhibited a fine collection of Indian ferns and several cases of very beautiful Indian moths, butterflies, and beetles.

Mr. Nash exhibited a rosary made of olive berries from the garden of Gethsemane, fruit of the butternut, nests of humming birds, walking sticks of coffee tree, black aloe, &c., a wonderful example of patience, in the shape of a stick carved by a sailor, showing all the knots made aboard ship, and shells of pholas from chalk employed in the building of Heene Church.

Mr. G. Scott showed pholas shells he had extracted from sand-stone forming a part of the walls of Old Shoreham Church. He should like to know how the pholas got into the sandstone ; the specimen was taken from a block 8ft. from the ground.

Mr. Wonfor exhibited specimens of white crystalline limestone from beneath the Falls of Niagara ; a curious specimen of crystalline deposit of carbonate of lime, on leaves, from a stream flowing from the Himalayas, in which not only the outline and veinage of the leaves were well shown, but when the specimen was broken, the leaves also were seen to be preserved. Also a number of moths of this year, among which were a curious variety of the cream spot tiger, *C. Villica*, bred by Mr. A. Gates, of Belgrave-street, in which the upper wings were almost black ; *P. Globulariæ, P. Geryon, M. Fuciformis, and D. Orion,* which had been freely taken in the County of Sussex this year.

On the recommendation of the Committee, the following gentlemen, with power to add to their number, were appointed a Committee to arrange the "Flora of the South Coast," at the Soirées of the British Association, viz. :---Messrs. W. Mitten, Nourse, Simonds, C. P. Smith, W. H. Smith, Benjamin Lomax, D'Alquen, W. H. Hallett, H. J. H. Nicholls, and the Officers of the Society ; Mr G. Davies being asked to assist the Committee in carrying out the above object.

JULY 27.

MICROSCOPICAL MEETING.—GENERAL EVENING

In answer to an enquiry from the Chairman, Mr Wonfor stated that the Committee had decided that, at the first Soiree of the British Association, the display of objects under the microscope should be illustrative of Marine Life, while, at the second, the objects would be of general interest, either from their novelty or scientific value. Promises of assistance had been received from the Lewes and Eastbourne Natural History Societies and from members of the Royal Microscopical Society of London and the Quekett Club.

That afternoon he had had an interview, at Lewes, with the Secretary and some of the members of the Lewes Society, in reference both to the microscopic displays and also in regard to the exhibition of the flora of Sussex. Partly at their suggestion, it was intended to issue a circular, to their own members and botanists generally in the County, describing the character of the flora to be displayed and asking for co-operation. After a conversation upon both topics, the meeting became a conversazione, when many interesting objects were exhibited by Dr. Badcock and Messrs. Sewell, F. E. Sawyer, R. Glaisyer, and Wonfor.

August 8th.

MR. BENJAMIN LOMAX ON THE COLOURS OF PLANTS.

It had always appeared to him very remarkable that the colours of flowers, which formed their chief attraction to the unscientific eye, and which had been the lure by which so many had been induced to enter on the study of Botany, should be entirely neglected in systematic treatises. That they possessed salient points of great interest, he trusted to be able to convince them ; and if there appeared, at first sight, considerable difficulty in reducing them to a system, that difficulty should form an additional incentive to industry on the part of those who, like himself, believed that Nature did nothing capriciously. The first fact with relation to the distribution of colour in plants was its profuse variety. Not only was every tint of the Prismatic Spectrum represented, but the greatest disparity of colour was found to exist between plants otherwise closely related, and frequently the most vivid contrasts were presented on the petals of the same flower.

Thus the common butter-cup *(ranunculus bulbosus)* was of a clear yellow, while the *adonis*, a plant of similar form, habit, and internal structure, was of a deep crimson. The two English species of Chrysanthemum presented, the one a white, the other a yellow "ray." The different varieties of *vicia* (our wild vetch) reflected almost every colour of the rainbow, and the little milkwort *(polygala vulgaris)* presented the phenomenon of flowers growing on the same spot, and almost from the same root, but differing widely from each other in colour, and colour alone. Yet underlying all this variety was another law—that of persistency. Centuries passed away—hills sank to valleys, and rivers changed their beds—but still the primrose repeated its pale tint of yellow, still the violet reflected the azure of the sky. Geological and artificial changes might cause species to become apparently extinct, or favour the production of others hitherto unknown, but they could not remove the stripes from the ribbon grass, nor alter one spot upon the petals of the orchis. It was true that the horticulturist might, by his art, develop the insignificant *matthiola* into the gorgeous double stock, or the small and uniform *dianthus* into the large and richly variegated carnation, but when his careful hand was withdrawn they returned to the wild state from which he took them, and resumed their original colours, spot for spot, stripe for stripe, tint for tint.

The whole analogy of Nature must convince us that properties so carefully guarded must have an object, and our business, as naturalists, was to try and find out what that object was. There were some who said in explanation of the brilliant colouring of flowers, that they were adorned simply to please the eye of man and gratify his inborn love of beauty. With all deference to those who thought so, he could only say that such an explanation might satisfy them, but would not satisfy him. If the eye of man was pleased with the colours of flowers, it was not, he thought, because they were fitted to his eye, but because his eye was constructed to enjoy them. He admired them because they were in Nature, and they were in Nature because they were required there. Nevertheless, we might gain some help in our investigation by enquiring into the proximate effect of harmony of colour on the eye. It was hardly now necessary to explain that colour was produced by the reflection of a portion of the luminous rays, the remainder being absorbed by the surface on which the colour appeared. The solar light was composed of fixed proportions of blue, yellow, and red, from a mixture of which all other tints were produced. The combination of all the rays was white, their entire absence black. Wherever the reflected colours from objects blended together in the proportions requisite to produce white light, the effect on the eye was what we called harmony, and wherever Nature was allowed to reign undisturbed, this harmony prevailed.

Thus the blue hyacinth grew beside the orange coloured cowslip; the purple violet with the pale primrose. Thus, too, the deep crimson of the foxglove (*digitalis purpurea*) and the delicate pink of the dog-rose were each contrasted with appropriate shades of green in their foliage. But still further to secure the balance a power was placed in the eye of rejecting a superfluity of any one colour, and admitting only those rays which formed its complement, so that when the observer had gazed for some time on a vividly red object, everything appeared tinged with green, and *vice versa*.

But while provision was thus made for a supply of the component part of white light, it did not appear that it was immaterial whether the rays be received separately or in combination. White light, as such, was very rare in Nature, and seemed to be injurious in excess. The blindness caused to the inhabitants of Alpine regions by the dazzling whiteness of the snow, and the injurious effect of white-washed walls upon patients suffering from ophthalmia, were well known instances. We were, therefore, led to the conclusion that while white light, as a whole, was necessary to the human system, its division into coloured rays performed some part in the animal economy which could not safely be dispensed with, and this conviction was yet more forcibly impressed upon us, when we had to deal with the vegetable creation.

That light was necessary to the growth of plants, we had abundant proof. Their respiration and consequent absorption of carbon were in direct proportion to the amount of light received, and ceased entirely during the hours of darkness. The slow and straggling growth of a potato in a dark cellar, and the change of properties caused by tying endive, or earthing up celery, were additional instances of the important part which white light played in vegetable economy ; but it was with coloured light we had to deal at present. A careful examination would probably prove that the proportions of different tints received by a plant amounted in the aggregate to white light ; but setting this aside as "not proven," it was remarked that the colour of a plant might be considered with reference to its distribution amongst various parts of that plant, and also with regard to its local surroundings.

A very cursory observation would show that different localities had their favourite floral colour ; nay, that whole countries manifested a predilection for some partlcular hue. It was probable that five sixths of the wild flowers growing in England were yellow, though the proportion was different at different times of the year, varying from blue in the cold spring (when the harebells, violets, and hyacinths bloomed) to red in the hot autumn, when every stubble field was covered with poppies, knapweed, pimpernel, and bartsia. But as we approached the colder regions of Scotland, Norway, and Lapland, blue flowers were far more frequent, while in the tropics we found every shade of red, from the delicate bloom of the cactus, growing under a forest shade, to the intense scarlet of "Sturt's Desert Pea," found in the burning and exposed regions of central Australia.

And now a natural law seemed to dawn through the apparent confusion. It was well-known that the heat of the solar rays was almost entirely concentrated in the red rays of the spectrum, diminishing in the orange and yellow, and almost or quite disappearing in the blue. Hence a surface which was intended to receive as much heat as possible should be constructed to absorb the whole of the red and yellow light, reflecting only the blue, like the plants of northern countries; one intended to remain cold, even at high temperatures, should reflect the red, or red and yellow rays, as in the case of the gorgeous tropical plants; while those which, reflecting only yellow, absorbed a judicious mixture of warm red and cold blue, were eminently fitted for a temperature such as ours. It was then, by design, and not by chance, that the flowers of different climates were coloured in exact proportion to the amount of heat to which they were likely to be exposed, and, as he had already hinted, the rule held good with regard to the monthly succession of flowers. It would at once be observed that there were numberless apparent exceptions to the rule thus broadly stated, but it would also be noticed that these exceptions were highly significant. The crouching violet, sheltered by hanging leaves from the sun's rays, the wild hyacinth, growing beneath a thick and shady hedge, were virtually in a colder climate, and wore the Arctic garb of blue. The tall foxglove, standing perhaps six feet above the ground, the corn poppy, exposed to the full glare of an autumn sun, these had to endure heat, and must wear the livery of the tropics; while the countless flowers of average height and average exposure were coloured with the characteristic yellow of our average climate.

Another, and even more difficult subject must be noticed, the distrition of colour in the parts of an individual plant. We at once noticed that the stem, branches, and leaves—the circulatory and respiratory organs—were of a uniform green. This large absorbtion of red rays seemed to indicate that the circulation of sap, like that of blood, required a certain amount of heat for its maintenance, but we were at any rate safe in ascribing to the operation of these rays the decomposition of carbonic acid, which constituted the respiration of plants. The colours of the perianth had been, perhaps, sufficiently accounted for, but an item of some importance yet remained.

He had hitherto spoken of light only with regard to its calorific qualities. It must not be forgotten that in the paler rays of the spectrum, but especially in the violet, there resided powerful chemica agencies, capable, as every photographer knew of decomposing the various salts of silver, and precipitating that element in a metallic form. This decomposing effect was so strikingly similar to that of the electrotype process, that we were not surprised to find that electrical powers resided in the violet ray. It had long been known that a magnetic needle lost its power when exposed to violet light, and the fact was not without significance that the electric "brush" and "star," the sparks exhibited in vacuo, and the zigzag coruscation "chain" lightning were always of this colour.

There was so close a relation between electricity, chemical action, and vital energy, that he should expect the reproductive organs of plants to absorb violet light, and such was generally the case. The pistils and stamens, but more especially the anthers were usually of a yellow colour, and it was seldom indeed that this colour was entirely absent from the flowering part of plants. He did not record his further observations on this difficult subject, not deeming them sufficiently reliable. He did not claim to have establised any point of importance, and he was aware that many and grave objections stood in the way of the theory which he had ventured to indicate; but if some should be convinced, from anything he had said, that the subject of floral colour was not altogether devoid of interest, he should have done something, however slight, to extend the field of botanical research.

At the conclusion of the meeting, Mr. G. Nash exhibited a curious figure in iron, found about 20 years ago under a stone in Aldrington Church. The figure was provided with a large apron, and it was suggested that it might be the effigy of a blacksmith, or, indeed, of St. Dunstan.

August 15th and 20th.

SOIREES OF THE BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

The Committee appointed to carry out the Microscopical displays at the Soirèes of the British Aesociation, finding the space at their disposal did not admit of the exhibition of more than about 80 microscopes, arranged that the members of Societies' should be placed at one long table capable of accommodating about 50 microscopes, while the opticians had a table to themselves at another part of the room, thus enabling the Society to carry out the following programme as arranged by the Committee :—

THURSDAY, August 15.—OBJECTS ILLUSTRATIVE OF MARINE LIFE.

ALGÆ—Seaweeds, &c., fructification.

DIATOMACEÆ—Living and prepared valves.

RHIZOPODA—Foraminifera—porcellanous, arenaceous, &c.

Polycystina—recent and fossil.

Spongiadæ—Calcareous, siliceous, &c.

Spicules, gemmules, skeleton, &c.

HYDROZOA—Coryne, sertularia, acalepha, &c.

ACTINOZOA—Alcyonium, gorgonia, helianthoida, &c.

ECHINODERMATA—Star fishes, ophiocoma, spatagnus, cidaris. comatula.

Echinus (shell, spines, Ambulacra) &c.

Holothuria, synapta, &c.

POLYZOA—Lepralia, flustra, halodactylus, bugula, avicularia, &c.

Ascidia, salpidæ, &c.

MOLLUSCA—Shells, palates, cilia, eyes (cuttle), &c.

ANNELIDA—Serpula, aphrodita, &c.

CRUSTACEA—Zoea of crab ; eye, shell, &c., of shrimp, prawn, lobster, &c.

Pycnogonidæ, caprella, balanus, &c.

PISCES—Teeth, scales, dermal skeleton, &c.

REPTILIA—Turtle, &c.

MAMMALS.—Teeth, bone, hair, whalebone, &c.

TUESDAY, August 20.— OBJECTS OF GENERAL INTEREST either from their novelty or scientific value.

At both Soirées full opportunity was given for the display and inspection of Microscopes and other Optical Instruments, with their latest improvements and additions.

A number of living objects had been got together by Dr. Badcock and other gentlemen, but, to guard against accidents, some 300 objects (all illustrative of Marine life) and classified in accordance with the before-mentioned memorandum, had been provided for exhibition by Drs. Ormerod and Hallifax, Messrs. T. Curties, Hennah, and Wonfor.

The different Societies which co-operated with the Society, and were represented by deputations, were the Royal Microsopical, the Quekett Club, the Lewes Natural History Society, the Croydon Club, the West Brighton Club, and the Brighton Medico-Chirurgical Society; while the gentlemen who exhibited were Drs. Badcock, Carpenter, F.R.S. (the President of the Association), Hall, Hallifax, Kebbell, Ormerod, F.R.S., and Sim; General Worster; Captains Marshall Hall, and Noble; Revs. J. H. Cross and W. Payne; Messrs. Ardley, Aylen, S. Burrows, T. Cooper, T. Curties, J. Dennant, T. Glaisyer, R. Glaisyer, T. Gwatkin, Gwatkin, jun., Hilman, Histed, T. H. Hennah, McIntire, Mitchell, Nash, W. D. Savage, F. E. Sawyer, J. Sewell, Shaft, C. P. Smith, W. H. Smith, Tatham, Turner, Unwin, Upton, Wells, Williams, T. W. Wonfor, and Wonfor, jun. About a dozen microscopes belonging to different members of the Society were placed at the disposal of Dr. Carpenter, for the purpose of exhibiting his deep-sea dredgings.

At the second Soirée many very choice and interesting objects, many of them living, were exhibited by the same gentlemen.

A number of original microphotographs were exhibited by Dr. Hallifax; a large supply of lamps was lent by Mr. Fowler; and Mr. Wells exhibited and made drawings of microscopic objects by a special adaptation of a Beale's neutral tint reflector.

The opticians who responded to the Society's invitation and exhibited microscopes were Messrs. Ross, who exhibited their new patent 1-15th and 1-10th objectives, and their tank microscope, &c.; Murray and Heath, who exhibited Dr. Gladstone's crystals; Ladd, who exhibited spectroscope, &c.; Horne and Thornthwaite, How, who exhibited hand microscopes; Swift, Moginie, who also exhibited revolving stereoscope, with very beautiful slides; C. Baker, who placed a number of microscopes, lamps, and objects at the Society's disposal; Norman, who exhibited frames of very choice microscopic objects; and Wheeler, who exhibited book-folding cases, containing 1,000 objects.

In three of the upstair rooms of the New Museum and Library the Botanical display was arranged.

Two rooms were devoted to the plants obtainable in the County during the month of August. These, to the number of nearly 500, were arranged in two tiers, in long narrow boxes, filled with damp sand, and as some of the plants withered they were replaced from day to day by fresh ones.

In the third room dried plants were exhibited in three rows on the walls; while mosses, lichens, &c., were placed on tables running round the room, as well as "Sowerby's Wild Flowers" and other botanical works from the Society's Library.

The management of the living Flora was undertaken by Mr. B. Lomax, who admirably carried out the views of the Committee; while that of the dried plants were under the charge of Mr C. P. Smith, who got together some very choice plants.

The following ladies and gentlemen contributed to the living flora:—Misses A. Woodhouse (Eastbourne) and Robinson (Sedlescombe), Mrs Hodgson, Mrs. Hancock, Rev. — Brewer (Worthing), Messrs. Griffith, Boyes, Hadlow, T. H. Hennah, A. Bigge, H. J. H. Nicholls, F. Merrifield, W. Mitten (Hurst), H. Willett, G. D. Roper (Eastbourne), Nourse, Nourse, jun., Hall, G. D. Sawyer, W. H. Smith, C. P. Smith, B. Lomax, Helmsley (Hassock's Gate), C. Hill (Rockhurst).

Among the exhibitors of dried plants, Miss Hall (Eastbourne) exhibited a fine collection of flowering plants, chiefly Sussex. Mr. Mitten, mosses and hepaticæ, all Sussex, including some unique species. Mr. C. P. Smith, Sussex grasses and marine and fresh water algæ. Mr. G. Davies, Sussex Lichens, including the rare V. Garovaglii and V. Microcarpa. Mrs. Hodgson, Brighton marine algæ. Mr. Clarke, Mayor of Saffron Walden, rare British plants; Mr. R. C. Roper, leaf fungi; and Miss Turner, New Zealand ferns.

Mr. T. H. Hennah lent a number of British ferns in pots.

During the meeting the Society's Weather Charts, issued by the Meteorological Office, were suspended in the Reception-room.

TREASURER'S ACCOUNT.

For the Year ending September 1st, 1872.

Cr.				£	s.	d.
By one year's Subscription to the Dispensary				2	2	0
" One year's Subscription to the Ray Society				1	1	0
" One year's Subscription to the Palæontographical Society				1	1	0
" Subscription to the Sub-Wealden Exploration Fund				5	5	0
" Contribution to the Medico-Chirurgical Society towards expenses of room				1	1	0
" Fire Insurance of Books to 29th September, 1872				0	10	0
" Printing,—						
New Catalogue	£7	0	0			
Report and Abstract of Proceedings	14	12	6			
Circulars, &c.	6	9	0			
				28	1	6
" Stationery and Postages				4	5	3
" Salary to Assistant Secretary				1	10	0
" Tea and Coffee				5	4	4
" Commission on Subscriptions received by Collector				2	5	6
" Messenger for delivering Notices				2	6	0
" Meteorological Charts				0	10	2
" New Books and Periodicals				23	16	1
" Expenses of Soirée				9	16	0
" Lamps				1	10	0
" Sundries				0	19	1
Balance				19	11	2
				£110	15	1

Dr.	£	s.	d.
To Balance from 1870-71	12	0	1
" Subscriptions in arrear on 1st Sept., 1871, since received	10	0	0
" Subscriptions due on 1st Sept., 1871, since received	66	10	0
" Entrance Fees	22	0	0
" Donation by Mr Bellingham towards the expenses of the Soirée	0	5	0
	£110	15	1

Examined and found correct,

GEO. D. SAWYER,
ROBERT GLAISYER, } Auditors.

September 11th, 1872.

THE TWENTIETH to 24th

ANNUAL REPORT

AND

ABSTRACT OF PROCEEDINGS

OF THE

BRIGHTON AND SUSSEX

NATURAL HISTORY SOCIETY,

ADOPTED AT A MEETING HELD

THURSDAY, SEPTEMBER 11TH, 1873.

PRICE ONE SHILLING.

BRIGHTON:
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MR. J. E. HASELWOOD.

Vice-Presidents.

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MR. BIGGE,
DR. HALLIFAX,
MR. SIMONDS,
MR. PENLEY,
MR. GWATKIN,
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DR. HALL,
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MR. T. H. HENNAH,
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MR. C. P. SMITH,
MR. BENJ. LOMAX,
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Honorary Secretaries.

MR. T. W. WONFOR,
38, Buckingham Place.

MR. J. C. ONIONS,
56, Middle Street.

Honorary Librarian.

MR. GWATKIN,
49, Grand Parade.

Honorary Curator.

MR. R. GLAISYER,
Dispensary, Queen's Road.

At the Twentieth Annual Meeting of the BRIGHTON AND SUSSEX NATURAL HISTORY SOCIETY, held at the Dispensary, September 11th, 1873,

IT WAS RESOLVED,—

That the Report, Abstract of Proceedings, and Treasurer's Account, now brought in, be received, adopted, and entered on the minutes, and printed for circulation as usual.

That the cordial thanks of this Meeting be given to the Honorary Secretaries and Honorary Librarian for their labours in preparing the same.

That the following gentlemen be elected as Officers of the Society for the ensuing year :—President, Mr. J. E. Haselwood ; Treasurer, Mr. T. B. Horne ; Committee, Mr. G. D. Sawyer, Dr. Badcock, Mr. C. P. Smith, Mr. B. Lomax, Mr. W. H. Smith, and Mr. J. H. Brown ; Honorary Secretaries, Mr. T. W. Wonfor, 38, Buckingham Place, and Mr. J. C. Onions, 56, Middle Street ; Honorary Librarian, Mr. Gwatkin, 49, Grand Parade ; and Honorary Curator, Mr R. Glaisyer, Dispensary, Queen's Road.

That the sincere thanks of this Meeting be given to the Vice-Presidents, Treasurer, Committee, Honorary Secretaries, and Honorary Librarian, for their services during the past year.

SPECIAL BUSINESS.

"That Rules 6 and 7 be altered, by adding the words 'Hon. Curator' to the List of Officers contained in each."

(Signed) GEO. SCOTT,

PRESIDENT.

IT WAS ALSO RESOLVED,—

That the warmest thanks of this Meeting be presented to Mr. Geo. Scott, for his able conduct as President during the past year.

REPORT.

In presenting the Twentieth Annual Report, your Committee have the pleasure of recording the continued prosperity of the Society, which has increased in numbers during the past year, but regret the loss sustained by the death of Dr. Ormerod, F.R.S.

The state of the finances continues to be satisfactory, there being a balance of £6 4s. 9d. in the hands of the Treasurer, after an expenditure of £15 19s. 11d. in the purchase of new Books and Periodicals.

The following Books have been presented to the Society during the year, viz. :—The Fauna of Devon (Part 8), by E. Parfitt, from the Author; Notes on the Insect Fauna of Lundy Island, by E. Parfitt (from the Author); Annual Report and Journal of the Geologist's Association (from the Society); Proceedings and Report of the Eastbourne Natural History Society (from the Society); How to Work with the Microscope, by L. S. Beale (from Dr. Hallifax); on newly discovered Roman and Saxon Remains at Finkley, near Andover, by Dr. Stevens (from the Author); Ninth Annual Report of the Belfast Naturalists' Field Club, 1871-2 (from the Society); Journal of the Quekett Microscopical Club (from the Society); Eighth Annual Report of the Lewes and East Sussex Natural History Society (from the Society); Geological Formations above the Chalk at Brighton, by J. Howell, two copies (from the Author); *Brighton Daily News* Report of the Meetings at Brighton of the British Association, 1872 (from Mr. G. D. Sawyer); Extracts from the Opening Address of the President of the Botanical Society of Edinburgh (from the Society) ; J. Logan Lobley : The Stratigraphical Distribution of the British Fossil Brachiopada (from the Author) ; J. Logan Lobley : Two Days in a Mining District (from the Author) ; Seventh Report of the Quekett Microscopical Club, and List of Members, 1872 (from the Society) ; Catalogue of Microscopical Preparations in the Cabinet of the Quekett Microscopical Club (from the Society) ; the Flint Works at Cissbury, by Dr. Stevens (from the Author) ; Annual Report of the Geologist's Association for 1871 (from the Association) ; the Study of Geology—a Lecture delivered by J. Logan Lobley (from the Author) ; British Association, Brighton Meeting, 1872, Journals, Lists of Members and Associates, and Catalogue of the Pictures (from Mr. R. Glaisyer) ; Five Vols. Entomologist's Annual (from the late Dr. Ormerod) ; on certain Wingless Insects, by T. W. Wonfor (from the Author) ; Report of the Proceedings of the Meteorological Conference at Leipzig, translated from the original Report (from Mr. R. Glaisyer) ; A Guide to the Popular Natural History Clubs of London, 1872 ; Rules, &c., of the Chester Society of Natural Science (from the Society). From Captain Marshall Hall : Roscoe's Spectrum Analysis, Harcourt and Madan's Practical Chemistry, Valentin's Text Book of Practical Chemistry, Miller's Elements of Chemistry—Part 1 (Chemical Physics), Bowman's Practical Chemistry, Ganot's Elementary Treatise on Physics.

The following Books have been purchased during the year :—Gymnoblastic, or Tubularian Hydroids, by Allman, from the Ray Society ; Grevillea, edited by Cooke, 1872 ; Manual of Zoology, by Nicholson—2nd Edition ; Palaeontographical Issue for 1872 ; Depths of the Sea (Wyville Thomson) ; Harvesting Ants and

Trap-door Spiders, by J. Traherne Moggeridge, 1873; Bell's British Quadrupeds; Bell's British Reptiles; De Blainville, Manuel d'Actinologie ou de Zoophytologie, 1834; De Blainville, Supplementary Illustrations, Radiata, Infusoria, and Polypheria, 1834; Transactions of the Linnean Society—Vol. 28, Part 3; Transactions of the Linnean Society—Vol. 29, Part 2; Monthly Microscopical Journal, Vol. 1 and 2.

The number of volumes in the Library, which at the date of the last Report was 760, has been increased to about 800. The circulation of Books continues to increase.

During the year the Society's Microscopical Cabinet, which now contains 247 Slides, has received donations from the following gentlemen:—

Mr. Gwatkin	1	Captain Walker	11
Mr. W. H. Smith	3	Dr. Hallifax	6
Mr. Mc Intyre	2	Mr. Wonfor	8

Donations of Plants have been received from Messrs. G. Davies, Birch Wolfe, and A. Black.

Your Committee have much pleasure in reporting the continued success of the Monthly Microscopical Meetings.

The Conversazione, held in the month of January, at the Pavilion, was very successful, but as, in consequence of the enlarged scale upon which it was given, the expenses attending it consumed an undue proportion of the Funds of the Society, your Committee recommend that on future occasions the Tickets for Members only be free, and that a small charge be made for all other Tickets, but such Tickets to be issued only through Members of the Society.

Mr. Wonfor having, on April 10th, 1873, read a paper on "Suggestions towards the Verification of the Flora and Fauna of Sussex," your Committee, in accordance with a resolution of the Society, have taken steps to carry out this important object.

The thanks of the Society are due to the Brighton and Hove Dispensary, and to the Medico-Chirurgical Society, for the use of the Room at the Dispensary, in which the Meetings of the Society are held, and to those gentlemen who have read Papers, exhibited Microscopes and Specimens, and contributed to the Library, Album, and Cabinet.

The Field Excursions, since the last Report, have been as follows:—October, 1872, to Lancing; 1873, May, to Hassock's Gate; June, to Henfield; July, to Ditchling (by invitation from Mr. P. Capon); August, to Black Rock, Kemp Town (by invitation of Rev. J. H. Cross); September, to Shoreham.

The Annual Excursion took place on the 27th of June to Newick Park, by water from Barcombe, when, by the kindness of J. H. Sclater, Esq., the Members visited Newick Park and Fernery.

In concluding their Report, your Committee beg to request the Members to endeavour to promote the prosperity of the Society by bringing its merits under the notice of their friends, by contributions of Works of Natural History to the Library, of Photographs or Drawings of objects of Natural History for the Album, and of Slides for the Microscopical Cabinet; and particularly by reading Papers during the ensuing year.

ABSTRACT OF PROCEEDINGS.

1872-3.

SEPTEMBER 12TH.

AN EVENING FOR THE EXHIBITION OF SPECIMENS.

Mr. G. SCOTT, the new President, on taking the Chair, made a short presidential address. He considered a great deal would be expected of the Society in the future, for the town having been visited by the British Association, and having, contrary to the predictions of those who said Brighton contained no scientific element, come well out of the ordeal, friendly and unfriendly eyes would watch the doings of the Society, and see whether it was helping to dissipate that erroneous idea. It had become favourably known to many at a distance, who visited the town, and some of whom, notably the Geologists' Association, intended visiting Brighton one day next summer in a body, and wished to be in intimate connection with them. They would soon have opened the new Library and Museum which had been so liberally erected by the Town, and he hoped it would stimulate all to increased energies in the pursuit of science. Perhaps he ought to say a word about one of the immediate results of the visit, viz., the opening of the tumulus in the Dyke-road. He had brought down some of the flakes and drawings, which he would hand round presently. He hoped the members would bear with him during his year of office. One thing he promised, to let the Society, through its Secretaries and Committee, manage itself.

Mr. WONFOR, alluding to the opening of the Black Burgh, suggested that some steps should be taken for opening more of the tumuli in the neighbourhood of Brighton, and to securing the contents for the Town Museum.

Mr. SCOTT, who handed round flakes from the mound, and drawings of the objects found in it, thought there was a possibility of the objects discovered finding their way into the Town Museum.

Mr. WONFOR exhibited a white variety of *centaurea scabiosa* and several moths of this year, some of which were considered at one time local and rare ; specimens of *L. Quadra*, four-spotted footman, which had been rather plentiful in Sussex this year, one specimen of which was taken in his (Mr. W.'s) own garden ; cocoons of the puss-moth on the bark of elm, to show how the creature simulated the appearance of the tree bark on which the cocoon was formed ; and flakes and oak charcoal from the Black Burgh.

Mr. DAVEY mentioned that he had taken V. Antiopa, Camberwell Beauty, near Lewes.

Mr. WONFOR remarked that this insect had been abundant this year. He had been told that upwards of 200 had been taken.

Mr. G. D. SAWYER exhibited the Tree Onion, a plant which sends up a stem 18 inches long, on which a bunch of onions is formed, and from these there grows a pendent, at the end of which another bunch is formed ; also fossils in flints.

Mr. W. SAUNDERS exhibited a flying lizard from Cochin China, and a locust from Egypt.

Mr. H. J. H. NICHOLLS mentioned that he had taken *Deiopeia Pulchella* (crimson speckled footman) on the Marine Parade.

Mr. CHARLESWORTH exhibited portions of the lower jaw of the sperm whale, and called attention to its peculiarity osteologically, as being a mammalian jaw on the type of the reptilian, and, odontologically, to the possession of teeth only in the lower jaw, in which it resembled the horned ruminants. At present, no satisfactory explanation of the use of the teeth had been given. He also showed a portion of the jaw of a hippopotamus, cut to show the position of the teeth ; a vertebra of an Iguanodon from the Wealden, showing the non-ossification of the neural canal ; and Choanites from the Sussex coast, in which the silex, as in other Sussex flints, assumed the form of chalcedony.

Previous to the above, the receipt was announced for the herbarium, from Mr. G. DAVIES, of a rare lichen new to Sussex, *Calicium septatum*, found by Mr. Davies, August, 1872, in Ashdown Forest (this lichen is parasitic on *Thelotrema lepadinum*, on shaded holly trees, and previously had been found in England in Yorkshire and the New Forest only) ; and from Mr. CHARLESWORTH, provisionally for the Town Museum, of about 40 autograph letters of Dr. Mantell ;

for the Society's album, of a fine photograph of the Treasurer, Mr. Horne, from Mr. T. H. HENNAH.

Votes of thanks were given to the donors.

SEPTEMBER 26TH.

MICROSCOPICAL MEETING.—MR. J. H. HENNAH ON A NEW SERIES OF LENSES BY WENHAM.

Some would recollect seeing the new patent objectives at the Association Soirées; but Mr. Wenham kindly promised to send some down for exhibition to the Society. They were stated by Mr. Wenham to be on a perfectly new method of construction, two or three of the lenses of the older construction being dispensed with and a single front and back lens used. It was hoped thus to obtain a cheaper series of object glasses; but that would be no advantage unless better performance was also secured. Those sent down were all very good,—but he would advise the members to wait for still greater improvements. The 1-15th was an exquisite glass when properly adjusted, which, except in the hands of an experienced microscopist, was not easy of accomplishment. The 1-10th he considered a good glass, with a good working distance. They could be used as dry or immersion lenses. At present there was an inequality, for, while very good as dry on some objects, they were not so good when wet, and *vice versâ*; but on some objects the performance was equally good, whether wet or dry.

He had written to Mr. Wenham on the subject of a lens with moderate angle of aperture for naturalist's work, because he did not believe in the high-angled glasses at present in use, and he would read what Mr. Wenham said :—" I agree with you that a one-twentieth of about 95°, with corrected aperture (I do not mean a large aperture *cut down* to 95°), but a system just worked up to that aperture, so as to have a long focal distance, say one-thirtieth of an inch, would be a most valuable glass in the hands of the naturalist, enabling him to *see into* things instead of a mere surface observation of a few Diatoms, for the sake of performing the feat of defining the difficult marking on some half-dozen of them, and this is only what such a glass is at present used for." He (Mr. Hennah) considered this a wonderful admission, and any new sytem which would give them lenses for physiological and natural history investigations would be a great advance in the utility of the microscope.

Another altogether perfect lens for exhibition was a ½-inch. While the magnifying power was very great, the definition was clear and as deep as in an inch or inch-and-a-half. It was of 85° aperture; had a good working distance, with a very large leiberkuhn for opaque objects, and was coned down to admit the pencil of light for bull's eye or any other illumination. There was also the patent reflex illuminator, for getting opaque illumination, with very high power, which did its work admirably. Mr. Wenham, as an amateur, had done more than anyone else for the microscope; he had devised the binocular, and given it to the world, and although, by the advice of friends, he had allowed Messrs. ROSS to patent these latest inventions, he had no pecuniary interest whatever in them.

Mr. WONFOR enquired whether the higher lenses worked readily through ordinary covers?

Mr. HENNAH replied that they did. He would exhibit a *P. Angulatum* with a comparatively thick cover.

Votes of thanks were given to Messrs. HENNAH and WENHAM.

Previous to this Mr. WONFOR remarked that Dr. CARPENTER, F.R.S., very kindly gave him a small quantity of the Atlantic chalk, dredged up in the Porcupine Expedition. Some of this he had brought down for distribution, and, if time allowed, he would show that it contained foraminifera identical with those obtained from our chalk Downs.

The meeting then became a conversazione, when Messrs. HENNAH, GLAISYER, and WONFOR exhibited various objects with the new lenses. Their performance was pronounced admirable.

The one-fifteenth and one-tenth showed *P. Angulatum* and other diatoms, podura scales, and ultimate fibre from the pig equally well, while the half-inch gave beautiful definition and as great a depth as most one-inch objectives. Later in the evening, Mr. HENNAH strained up the half-inch with the highest eye-piece, and showed *P. formosum* marvellously.

Some very interesting objects were also exhibited by Messrs. F. E. SAWYER and SHILLINGFORD, and Mr. WONFOR, during the evening, showed identical form of foraminifera from Atlantic *chalk*, and some from the interior of a flint picked up on the Downs.

OCTOBER 10TH.

ORDINARY MEETING.—MR. F. E. SAWYER ON EARTHQUAKE SHOCKS IN SUSSEX.

After alluding to the different theories respecting the cause of earthquakes, the nature of their movements, their effects and their destructiveness, and calling attention to some of the most notable earthquakes recorded in history, Mr. SAWYER gave a description of the earthquakes, which, as far as he could learn, had visited the County of Sussex. In historical periods there was no distinct record of any shock in Sussex until 1638. Earthquakes were recorded frequently in other parts of England from the 4th century onwards. As on May 25th, 1551, a shock was felt at Reigate, Croydon, and Dorking, in Surrey, it was very possible this was also felt in the north of Sussex. The same remark applied to the shock of April 6th, 1580, which was said to have been felt throughout England, and specially at London and Dover and in Kent.

Mallet states that, in 1638, "at Chichester there were several earthquake shocks at the end of the year which did great damage. There was a smell like pitch and sulphur." This was the earliest record of any shock in Sussex. The next happened Oct. 25th, 1734, and was described in the Philosophical Transactions by the Duke of RICHMOND, F.R.S., as being felt at Chichester and Goodwood, and along the coast from Shoreham to Havant. Along the coast it was was most severe, less so at Chichester, and not "so perceivable" at Goodwood. The same earthquake was also described by Dr. G. BAYLEY, of Havant, who found the time of occurrence from P. BOISDAUNE to be a quarter to four a.m., and who describes the direction as being from E. to W. March 18th, 1750, a shock was felt outside the county at Havant, Portsmouth, aud the Isle of Wight. The next was the great earthquake of November 1st, 1755, which destroyed Lisbon and extended all over Europe. In the Philosophical Transactions, Mr. P. CARTERET WEBB, F.R.S., described the effect at a mill-pond at Midhurst, where there was a sudden swelling and agitation of the water. In the same transactions John Hodgson thinks the fissure in the rock at Petworth was not caused by an earthquake, though the water was disturbed in many ponds and thrown several feet above the banks, in one case leaving some fish on dry land. The diary of a Sussex tradesman, May 3rd, 1756, states that he saw in a Lewes paper that, on May 1st, "explosions was heard in the bowels of the earth, like an earthquake, in the parishes of Waldron and Hellingly."

The next recorded earthquake occurred Nov. 30th, 1811, about 2.30 p.m. At Chichester the shock lasted many seconds and closed with a tremendous crash. It was felt at Midhurst, Petworth, and Arundel, but most severely along the coast at Bosham, Selsea, Pagham, Bognor, and extended as far as Shoreham. The next earthquake was December 6th, 1824. At Chichester bells were set ringing, the shock lasted from three to five seconds, was more severe than that of 1811, and was felt from Portsmouth to Arundel. After an interval of nine years the next shock was felt on September 18th, 1833, followed by five others in three years. At Chichester, about 10 a.m., the bells were set ringing, chimneys were thrown down, and on the Downs a quantity of chalk fell, under which a man was buried and killed, the only instance of loss of life from an earthquake in the County. Another shock was felt at Chichester Nov. 13th, 1833, at 3.40 a.m., and set bells ringing and caused the town clock to strike. A less severe one was felt the same day at 5.30 a.m. The first of these extended about six miles round Chichester. Jan. 23, 1834, there was a violent earthquake shock with loud rumbling noise at Chichester and about twelve miles round; at Littlehampton the time was about 3 a.m.

Another shock occurred on August 27th, 1834, at Chichester. All the evening there was a lowering sky with much lightning; at 10.30 p.m., a loud rumbling noise was heard with powerful vibration of the earth. Glasses were rattled, bells rung, and the large town clock struck. Several chimneys were thrown down and windows broken. The shock was more severe than any preceding one in its effects and extended to a great distance. At Littlehampton the earthquake shock was felt at 10.30 p.m. It was the fourth in twelve months. At the time of the shock, the sea, previously very still, became suddenly agitated, and the same was noticed at Worthing. On August 3rd, 1835, two earthquakes were felt at Chichester, Emsworth, and the surrounding neighbourhood at 11.30 p.m., and on October 21st of the same year another slight shock was felt at Chichester and to the westward about 2 p.m.

These repeated shocks at Chichester attracted a good deal of attention, and a Committee was appointed by the Chichester Philosophical and Literary Society to investigate the cause of the frequent shocks in that locality, but he (Mr. Sawyer) was unaware what conclusion they arrived at. A suggestion was made in the newspapers that the bed of the Lavant had been diverted at an early period in the history of the city, by an earthquake shock, as formerly that river overflowed entirely round the city.

The next shock was on April 1st, 1853, and was felt at Brighton, being the first shock recorded here. A letter to the *Times* states that some ladies sleeping in a house on the King's-road, on the evening of that day, felt an earthquake shock, and a report of the Council of the British Meteorological Society in May, 1853, further states that—"The Earthquake of April 1st, 1853, so far as perceptible to the senses, appeared to have been confined to a portion of the English coasts, situated between Brighton and Weymouth, to a part of the French coast, between Coutances and Havre; and to that part of the English Channel comprehended between the coasts of England and France." It was also calculated that the area over which the shock was felt was 20,000 square miles. In the Isle of Wight it was also felt.

August 13th, 1859, another shock was felt at Brighton at 10.15 a.m. Again, October 6th, 1863, at 3.15 a.m., another shock was felt at Brighton, and also at Hurstpierpoint. One of the most remarkable shocks was that of August 21st, 1864. This appeared to be local, and was felt at Lewes, Ringmer, Alfriston, Cuckfield, Glynde, Battle, Brighton, and other places. The time was 1.27 a.m., and it lasted from 10 to 12 secs. being longer than any previously recorded shocks. There was great meteorological disturbance that day. The last recorded earthquake was on Sept. 16th of the same year, at Rogate; so that, during 234 years, 18 shocks (including two doubtful ones) had been felt in the County. Possibly more careful search might add to the number.

It was difficult to trace any connection between the nature of the soil and the shocks, as in some cases the same shock was felt at places with entirely different geological features. There seemed, however, to be a slight tendency in the South Downs to restrict the shocks in the district to their south. Out of 18 shocks, 11 had been felt at Chichester and its neighbourhood, two at Brighton and other places, and the others at various places.

At the time of the shock in 1863, much discussion took place as to the relative security of various places in England, in the case of a severe shock, and the following opinion was expressed by some eminent geologists :—

" London stands favourably for stability. Windsor and all the towns towards Oxford much less so. Winchester, Chichester, Southampton, Portsmouth, and Salisbury, might not be affected ; but Brighton, and nearly all the southern coast towns, except those just named, are like the opposite shores of France, standing on the old ocean bottom, elevated out of their level by an earthquake, and might be shaken back to it."

The frequency of shocks and their greater violence at Chichester, did not seem in accordance with this opinion, especially as the shocks at Brighton had been very slight.

After a vote of thanks to Mr. SAWYER, a discussion followed, in which Dr. HALLIFAX, Messrs. SCOTT, PAYNE, SEWELL, W. H. SMITH, G. D. SAWYER, and WONFOR took part. The last-named gentleman drew attention to another earthquake mentioned in the Autobiography of Sir John Bramston, and published by the Camden Society, as occurring Sept. 8th, 1692, about 2 p.m., in London, and being felt in Essex, Kent, Sussex, Hampshire, &c.

The receipt was announced from Mr. G. DAVIES of *Ramalina evernioides*, a lichen not previously localized as a Sussex plant, but found in September of this year by Mr. G. DAVIES, of Earnley, Sussex.

At subsequent meetings of the Society, Mr. SAWYER reported three other shocks. In 1758, on January 24th, " a slight trembling, lasting but a moment," was felt " in the parishes of Worth and East Grinstead." In 1833, about the 2nd April, at 8.15 p.m., a shock was felt at Horsham. In 1865, another shock was felt between three and four a.m., at Portsmouth, Bognor, Chichester, and spots lying between these towns, like a violent explosion. These three shocks, with that mentioned by Mr. WONFOR, increase the total in this County to 22. Mr. SAWYER also stated that the record of the shocks in 1838 said that " the atmosphere was obscured as if by a cloud " during the shocks.

The following table (page 17) gives a complete list of all the earthquake shocks in Sussex, of which any record has yet been found :—

YEAR.	DATE.	PLACE.	TIME.	MOTION.	REMARKS.	AUTHORITY.
1638...	End of Year.	Chichester.	......	......	Smell of sulphur.	Dresdner gelehr Anz.
1692...	September 8.	Kent, Sussex, &c.	2 p.m.	......	......	"Autobiography of Sir John Bramston."
1734...	October 25.	Chichester and West of County.	3.45 a.m.	Undulatory.	Shock E. to W.	*Phil. Trans.*
1755...	November 1.	Midhurst, &c.	Between 10 & 11 a.m.	Oscillatory.	Water agitated.	Ditto.
1756...	May 1.	Waldron and Hellingly.	......	......	Like an explosion.	"Diary—Sussex Tradesman."
1758...	January 24.	Worth & East Grinstead	2 a.m.	Tremulous.	Rolling noise and windows rattled	*Phil. Trans.*, Vol. 50.
1811...	November 30.	Chichester, &c.	2.30 a.m.	Tremulous.	Loud noise.	*Brighton Herald.*
1824...	December 6.	"	2 p.m.	Undulatory.	Bells rung.	Ditto.
1833...	April 2.	Horsham.	8.15 p.m.	......	Only felt in some houses.	"Garnier," p. 171.
" ...	September 18.	Chichester, &c.	10 a.m.	Tremulous.	Man killed.	*Brighton Herald.*
" ...	November 13.	"	3.40 a.m.	......	Town Clock struck.	Ditto.
" ...	"	Chichester only.	5.30 a.m.	......	Not so severe.	Ditto.
1834...	January 23.	Chichester, &c.	Before 3 a.m.	......	Rumbling sound.	Ditto.
" ...	August 27.	"	10.30 p.m.	Vibratory.	Town Clock struck: shock severe.	Ditto.
1835...	August 3.	"	11.30 p.m.	......	Two shocks.	Ditto.
" ...	October 21.	"	2 p.m.	......	Slight.	Ditto.
1853...	April 1.	Brighton.	10.50 p.m.	Tremulous.	Shock repeated.	*The Times.*
1859...	August 13.	"	10.15 a.m.	......	Rumbling sound.	Ditto.
1863...	October 6.	Brighton and Hurstpierpoint.	3.15 a.m.	Oscillatory.	......	*Met. Proceedings* and *Brighton Herald.*
1864...	August 21.	Brighton, Lewes, and East of County.	1.27 a.m.	Undulatory.	Shock S.E. to N.W.	*Brighton Herald.*
" ...	September 16.	Rogate.	......	......	Shock doubtful.	Ditto.
1865...	April 17.	Portsmouth, Chichester, and Bognor.	Between 3 & 4 a.m.	......	Like an explosion.	Ditto.

OCTOBER 24th.

MICROSCOPICAL MEETING; DR. HALLIFAX ON THE INVERTEBRATE EYE.

When requested to introduce the subject of the Invertebrate Eye, between which and the vertebrate eye were great points of dissimilarity, he thought, from having made many sections for his microscope of the eyes of insects and crustaceans, he might be able to direct the minds of some of his hearers to a very interesting question,—viz., the tracing out a unity of plan where there appeared to be a diversity of structure so striking.

Thus, whatever the organ we investigated in any class of the animal creation, it should be compared with the same organ in other animals, in order to show their connection by some general plan of unity. As an example of what might be deduced by comparison, he might mention what Mr. Wonfor, by studying the scales of butterflies, had deduced. He found certain scales, called battledore and tasselled scales, *only on the males* of certain butterflies, and, pursuing the plan of comparison, had arrived at the general law that the butterflies on which these scales were found were invariably males.

It was a strong incentive to enquiry, when we saw any particular organ devoted to the same evident purpose, but differing in apparent structure, to try and bring it in harmony with the general law of unity of plan. In the invertebrates, taking the eye of the dragon-fly as a type, was an apparent divergence, as wide as possible, from the highest type of the vertebrate, the human eye.

Comparing them side by side, we found in the first a great mass of optic ganglia proceeding from the cephalic ganglia (the equivalent of brain in the vertebrates), subdivided and covered with pigment, giving off nerves, covered also with a dark pigment, changing into a transparent substance terminating in a curved surface, which abutted on a cornea composed of numerous facets, 4, 5, and 6-sided, but each consisting of a lens, convex externally and internally. Each of these facets, or convex lenses, was capable of bringing the rays of light into a focus upon the transparent pigment-covered substance, consisting of transformed nerve matter.

In the vertebrate eye we had a globe filled with vitreous matter, a crystalline lens, and aqueous matter, refracting the rays of light, and causing them to fall on the nervous matter, called the retina, lining the interior of the globe. The nervous expansion of the retina was the only part of the eye cognizant of external impressions, the rest being merely a physical apparatus.

Now, the sensitive retina, only one hundreth of an inch thick in its thickest part, consisted of at least seven layers, all consisting of nervous matter : the first composed of rods and cones ; then four layers of granular matter ; next nerve cells ; and then the optic nerve.

It was believed that the rods and cones were the percipient part of the retina, and for a long time it was held that no similar structure could be traced in the invertebrate eye. Müller, who investigated the eyes of both, came to the conclusion that they were constructed on a totally different plan, and that there were two types of eye in Nature. Within the last few years Leydig and others had come to the conclusion that there was an unity of type after all. It was a common thing in Nature, while preserving the unity of form, to modify the structure, sometimes transforming or suppressing unimportant parts, but retaining all the essential ones, in accordance with the wants and habits of the creatures. A dioptic apparatus was not necessary, but the nervous mass, with its essential part, the baccillary layer was retained in the invertebrate eye. It would be seen that each convex-facet, hemispherical in the crustacea, abutted on the layer of transparent, pigment-covered rods and cones, which were allowed to be the essential parts of the vertebrate eye. It would be seen the essential parts were retained, viz., the rods, which were a modification of nerve-structure, abutting on the corneal facets, just as the baccillary layer in the human eye abutted on the optic apparatus, thus tracing out a unity of plan though diversity of structure.

These remarks had been made to introduce certain slides, one of great beauty, lent him by Mr. T. Curties, of Holborn, which cut through the eye of the death's head moth, showed the several parts, *in situ*, especially the cones in connection with the corneal facets. Seeing the eyes and antennæ of insects were their instruments of sensation, there was no wonder these apparatus were highly elaborated.

In proposing a vote of thanks to Dr. HALLIFAX, the President, Mr. G. SCOTT remarked that Dr. HALLIFAX had promised them a few introductory words, but had, without notes of any kind, given them an elaborate lecture.

Mr. WONFOR said Dr. HALLIFAX modestly attributed the views of the connection of the vertebrate and invertebrate eye to others, whereas, whatever others had done, to his certain knowledge the Doctor had at least six years ago worked out the views enunciated to them, and, moreover, had pioneered the way to making sections of eyes prior to that time. Some years since he explained his method to the "Quekett Microscopical Club," and a section of insect eye on the stage of his own microscope, showing the parts *in situ*, was made by Dr. HALLIFAX some five years ago.

The meeting then became a Conversazione, when the slide above-mentioned and sections made by Dr. HALLIFAX, were shown by him, and by Messrs. HENNAH, R. GLAISYER, and WONFOR.

NOVEMBER 14TH.

ORDINARY MEETING.—MR. T. W. WONFOR ON "CERTAIN WINGLESS INSECTS."

After briefly sketching the changes through which insects passed, from the egg to the commonly called perfect state, and showing that, with the exception of two groups, the *pediculi* and *Thysanuridae*, all insects possessed either four wings or their modifications,—the *halteres*, or poisers, of the *diptera*, in his opinion, being only modified wings, while the fleas, in the place of wings, had four scales,—it was pointed out that there were certain exceptional cases in which the wings were so little developed, or so perfectly rudimentary, as to be altogether useless to their possessors as organs of flight. This was the more remarkable from the fact that some members of the family had well-developed wings, and especially that occasionally the males alone possessed the power of flight, while the females, who would seem to want it most, were utterly unable to fly, or, in some cases, to move more than a few inches from the places where they had escaped from the chrysalis.

Among the moths was a small group, the *Liparidæ*, so named after one of their number, *Liparis dispar*, the Gipsy, characterized by the great breadth of their wings and smallness of their bodies, and nearly allied to the swift flying moths, the *Bombycidæ*. These latter included the lappet, oak eggar, Kentish Glory, &c., some of which were not only noteworthy for their great powers of flight, but also for the very strange habit, "sembling," that is, the collecting together of large numbers of the males, drawn from long distances by the females, examples of which had been detailed to the Society on former occasions.

Among these *Liparidæ* were those pests to the orchards of Kent, the brown-tail and gold-tail moths. The caterpillars of all were hairy, some were characterized by peculiar tufts of hair, as seen in the well-known hop-dog, while the common vapourer *(Orgyia antiqua)*, and the scarce vapourer *(Orgyia gonostigma)* had tufts of long hair as well, pointing over the head like brushes, each hair being tipped with a small knob. The caterpillars of the first *(Orgyia antiqua)* fed on many plants and shrubs, while the latter fed on the nut and oak, and each, when it was about to change to the chrysalis, spun a loose web intermingled with its hairs, and turned into a hairy chrysalis. The moths, which escaped from the chrysalides, were, from their peculiar rising and falling flight, called "vapourers." The males of both species had slender bodies and very broad wings, and were met with, not simply in the country, but in the very heart of towns and cities. At the proper time of year they might be seen "vapouring" among the trees on the Level.

The females of both species were nearly wingless, had large bodies, and were as unlike moths in appearance as was possible to conceive. The colour, too, differed from that of the active males, being of a dull grey or ashy brown, while the males were richly tinted, and in one case marked with a white spot on the upper wing. So slight was the power of locomotion in the female, that she very seldom got beyond the empty cocoon on which she laid her eggs and died. But though so unattractive to human eyes, they were not to their male admirers, as might be proved by taking a newly-escaped female into the neighbourhood of male vapourers, for then they came flitting around, and soon settled on the box containing the captive female.

The next examples would be taken from a very large family of moths, the caterpillars of which differed from those of other moths and butterflies in the number of their "false legs," and also in their mode of progress. The caterpillars of moths and butterflies possessed, as was generally known, six true legs, and in addition ten false legs or "claspers," by means of which they held on. In one great family most possessed only four of these claspers, which were situated at the tail end, so that the caterpillar could not hold on by the middle of the body ; the consequence was that when it walked the middle of the body was looped, from which circumstance they had been called "loopers," and from their appearing to measure the space they traversed, they had been denominated *Geometræ* or "earth measures." Many of these caterpillars resembled in colour the leaves or stems of the plants on which they fed, and when at rest clung by the anal claspers, and stood out at an angle from the twig, in which position they so much resembled a stick or twig, that the name "stick" caterpillars had been given to them. It was among this family that the power was possessed of linking the two wings together, when the insects flew. Another peculiarity belonging to some was that they rested with their wings folded back to back like the butterflies.

Among the geometers were several moths, the females of which either had small and useless wings, as far as they were considered instruments of locomotion, or so aborted as to appear altogether wanting. Thus in *Hybernia rupicapraria* (the early moth), which appeared in January, the wings of the male were ample, the wings of the female were very short, and cut off obliquely at the hind margin, while the body was short and stout. In *Hybernia leucophearia* (spring usher), the wings of the male were long and rather narrow, while those of the female were scarcely perceptible. In the (Scarce Umber), *H. aurantiaria*, which appeared in October, the wings of the male were very large, while those of the female are mere stumps; the body was larger than in either of the others. In another species (the dotted border) *H. progemmaria*, which appeared in February, while the wings of the male were large, those of the female were too small for the purpose of flight, but more ample than any other of this degraded, *i.e.*, imperfectly developed group. Another *Hybernia*, *H. defoliaria*, (Mottled Umber), which appeared in October, had, as regarded the male, large wings, but the nearly wingless female looked, when on the trunks of trees, like a spider, and the deception was the greater, owing to the length of her legs and the markings on the body. In *Anisopteryx Æscularia* (Marsh Moth) wings were quite wanting to the female, while those of the male were ample. In that destructive pest to plantations and orchards, *Chimatobia brumata* (the Winter Moth), thousands of which might sometimes be met with at this time of the year, the wings of the female were too short for flight. In places where they abounded, the females might be seen crawling like spiders over the tree trunks, while the males flitted easily about.

Another group of the geometers noted for their robustness and the strong character of their wings, contained three species in which the females were apterous. These were (the Brindled Beauty) *Phigalia Pilosaria*, (the Belted Beauty) *Nyssia Zonaria*, and (the small Brindled

Beauty) *N. hispidaria.* This was the more remarkable because in this family there were only three other species, *Biston hirtaria*, *Amphydasis prodromaria*, and *A. betularia*, in all of which, strange to say, the females had a larger expanse of wing than the males.

There was one more group of moths, in which the females were more degraded than any of the examples already given ; in fact, it had been remarked of them that they were simply egg sacs, while the males were pretty lively moths. There had curiously been much difference of opinion as to what group of moths they should be classed with, some at one time leaving them with the *Bombycidæ*, and others with the *Tineæ.* They were known by the name of the *Psychidæ*, and were remarkable from the habits of the caterpillars, which formed for themselves a case, somewhat similar to that constructed by the caddis-worm, composed of pieces of bark, leaf, or some similar material, fastened together by a kind of glue or silken substance secreted by the caterpillars. When engaged in eating, they protruded a portion of the fore part of the body from the case, and, as they increased in size, enlarged the case by first slitting it, and then letting it out by the addition of more material. Before moulting or changing to a chrysalis, the mouth of the case was closed, and in the latter state it served the purpose of a cocoon. When the final change took place the male escaped, but the female of one, *Fumea gemella*, crawled out, in appearance like a little worm, and, after depositing her eggs in the case, died. Others, like *Psyche graminella*, if females, did not emerge from the case, but deposited their eggs within, died, and shrivelled up. The young larvæ commenced their experience of life by eating up their dead mother's body, as rank a case of cannibalism as one could wish for, being, to say the least, an unnatural proceeding. Some of the female Psychidæ were not only wingless, but almost footless, without *antennæ*, and had eyes without facets.

Two or three questions naturally arose as to why the females should be so different from the males ? Was there any perceptible difference in the caterpillars to account for the difference in the moth ? Were there analagous cases among other insects ?

To the first question no satisfactory answer could, at present, be given. Those who had experimented upon moths and butterflies knew that alternations of scanty and bountiful food, or keeping them on scanty food only, tended to produce dwarfs and montrosities, and that keeping chrysalides rather dry or exposing escaping moths and butterflies to the action of dry heat, prevented the unfolding of the wings. These things, however, took place with males and females alike, and no such conditions could possibly exist in Nature and always produce wingless females. Again, granting it was hereditary, why should it be confined to the female line?

To the second question it might be replied that although some had fancied a difference could be detected between the caterpillars, which would produce males and those which would produce females, he believed it was, after all, mere fancy, and that whether there was any essential difference existing either in the eggs or the larvæ, was at present one of the unexplained mysteries.

To the third question an answer in the affirmative could be given, not alone among the Lepidoptera were there wingless females. One of the most striking examples was the cochineal insect, in which, while the males possessed wings, the females were not only destitute of wings, but almost of limbs; the absence of wings was also seen in the summer or immature females of the aphides. Some species of "walking sticks" supplied wingless females; among the cockroaches the wings were sometimes wanting in the females, while in the parasitic *strepsiptera*, the females were not only destitute of wings, but were for a long time, from their worm-like appearance, mistaken for larvæ, till dissection showed that these worm-like creatures were full of eggs. But perhaps the best known example was the glow-worm, the females of which *alone* were luminous, and presented the appearance of flat greyish brown larvæ, quite destitute of wings, while the males were active and flew well.

It certainly seemed a very strange phenomenon, and was opposed to what might be imagined the fitness of things, that, as far as the continuance of the race was concerned, the more important of the two sexes, the females, in so many cases, were unable to go far from home. This fact, together with the circumstance that the so-called perfect form, fell far short of the larval state in the means of locomotion, external decoration, or the possession of some organs, rendered the enquiry, "Why are some insects wingless?" worthy the consideration of scientific naturalists.

Mr. H. GOSS kindly illustrated the paper with a series of males and females of all the moths mentioned, with the exception of the *psychidæ*.

At the conclusion a cordial vote of thanks was passed to Mr. Wonfor for his interesting paper.

Mr. MOORE said the form of the male insect was doubtless the more developed in order that it might be able to seek the female.

Mr. W. M. HOLLIS said the lesson Nature would thus teach was evidently that ladies should stay at home and gentlemen go out to work.

Mr. WONFOR said he had written a sentence in the paper to that effect, but on second thoughts he came to the conclusion that it was rather too bad, and left it out. It was as follows :—" Opponents of the Women's Rights party may argue from this that the duties of the females are at home."

Some remarks were then made on the *halteres* of the Diptera.

Mr. HENNAH said that from their structure and from their position on the thorax, he thought they were the remains of wings applied to another purpose.

Dr. HALLIFAX said that the articulation of the *halteres* near the thorax bore a close rememblance to that of the wing. The position, too, corresponded. The four wings of an ordinary insect were, he believed, invariably joined to the two last segments of the thorax, and in the Diptera the wings were on the second segment, leaving the last for the *halteres*. After experimenting on " daddy long-legs," he came to the conclusion that the *halteres* were decidedly hollow, and filled with fluid. It had been suggested that they might be organs of hearing.

Mr. WONFOR said that fluid circulated in the wings of certain insects, and he thought this would make the analogy still closer. It had been asserted that the nervures were only stiff and straight and solely for the purpose of keeping the wings extended, but anyone who had cut the wings of a butterfly must have noticed a fluid oozing out. In fact, he believed there was not only a communication in butterflies from the nervures internally, but also outwardly to the scales. The scales from a live insect were seen under the microscope to be moist with a greenish fluid, resembling that which oozed from the nervures, or, at any rate, from the wings when cut. The existence of a fluid would seem to imply a circulation.

NOVEMBER 28TH.

MICROSCOPICAL MEETING.—MR. W. H. SMITH ON THE "INGREDIENTS OF UNFERMENTED DRINKS —TEA, COFFEE, AND COCOA."

After describing the tea plant and the processes through which the leaves had to pass in the manufacture of black and green tea,—the latter really yellowish or brownish in colour,—he remarked that the colouring matter used to give a green appearance to the green tea of commerce consisted of facing powders, composed of Prussian blue, turmeric, sulphur, gamboge, and Chinese clay. Unfaced tea when analysed consisted of a *Volatile Oil*, *Theine*, and *Tannin*. The *Volatile Oil* was not present in the fresh leaves, but was developed during manufacture. The headaches and giddiness to which tea-tasters were subject, and the attack of paralysis to which the packers were liable, were all said to be caused by this oil; and, in fact, the Chinese would not use tea until it was at least a year old and had probably lost much of its oil. Tea contained about one per cent of this oil. *Theine* was the active principle to which tea owed its great value as a drink. The teas of commerce contained on an average about two per cent. Theine appeared to have the remarkable property of stopping the waste of tissue, and thus acted indirectly as a highly nutritious body. It produced wakefulness, and hence was employed by students who wished to continue their work late at night. It had also properties which rendered it very useful in many cases as a medicine. It was a very remarkable fact that the three substances—tea, coffee, and cocoa —which were used as beverages all over the world, to the exclusion of almost everything else, should all contain alkaloids, one of which was identical with theine, and the other nearly so.

Besides the substance used to colour tea, the leaves of other plants, viz., sloe, hawthorn, alder, willow, plane, oak, poplar, beech, elm, and others had been detected as adulterations, while a tea denominated by the Chinese *Lie Tea*, made from tea dust, sweepings, sand, and other substances, mixed with gum and coloured, was extensively imported. In this country old tea-leaves had been re-dried, mixed with other substances, and sold as new tea. The microscope would detect adulteration, because certain characteristic markings of the epidermis of true tea-leaves were invariably wanting in its substitutes.

Coffee, the roasted seeds of an evergreen shrub, like tea, contained three active principles—a volatile oil, *Caffeone*, an alkaloid, *Caffeine*, and *Caffeic Acid*. *Caffeone* might be obtained by distillation, and appeared to have properties somewhat like those of the alkaloid. *Caffeine*, if not the same alkaloid, was considered to have the same properties as Theine. Coffee contained less than one per cent. of Caffeine, and was, therefore, only half the strength of Tea, but as it was customary to use more coffee than tea it was probable that a cup of coffee and tea contained equal quantities of the alkaloid. *Caffeic Acid* was an astringent acid similar to the Tannic Acid of tea, but still differing in some particulars. The peculiar odour of roasted coffee was supposed to be derived from this substance.

Besides chicory, first employed to add flavour to coffee, the following articles have been detected in adulteration :—Roasted grain, scorched peas and beans, roasted carrots, mangold wurtzel, rye, acorns, mahogany sawdust, exhausted tan, and baked horses' livers. 80 tons of coffina, consisting of the roasted seeds of some leguminous plant, were offered for sale by a Scotch house at £12 per ton, or about 1½d. per lb., and the same house offered 500 tons of foreign acorns at £5 a ton. The addition of some of these articles necessitated the addition of another substance called black jack, or burnt sugar, sold in canisters at 1s. per lb., to bring up the colour. Venetian red and reddle had been used for the same purpose. If coffee was suspected of being adulterated by chicory, a pinch of the suspected coffee should be placed on a glass slip, moistened with water, and allowed to swell ; it should then be torn to pieces with needles, and the structure examined under a ¼-inch objective. Coffee was not easily torn to pieces, and the cells were firmly bound together, but chicory was very easily torn to pieces ; the cells were very easily separated ; and some of the large characteristic dotted ducts of which there were so many in chicory and none at all in coffee would soon be detected.

Cocoa, derived from the seeds of the Theobroma cacao, like coffee, required roasting before being used. When roasted it contained a Volatile Oil, an Alkaloid, an Astringent Bitter Principle, and a Fixed Oil. *Volatile Oil* was developed during the process of roasting, and formed the aroma of cocoa. It had probably the same action as that of tea, but it existed in cocoa in a much smaller quantity. *The Alkaloid Theobromine* was very similar to Theine, but contained more nitrogen. Theine could, however, be prepared from it. Cocoa-nibs contained two per cent. of it, and the husk also contained a small quantity. *The Bitter and Astringent Principles* were probably distinct : the bitterness was greater than that of coffee, but the astringency less than in either tea or coffee. *The Solid Oil*, called *Butter of Cocoa*, was a hard substance, melting easily at moderate temperature, of an agreeable flavour, and not apt to turn rancid. These properties rendered it very valuable in Pharmacy. Cocoa contained about 50 per cent. of oil, a great part of which might be pressed out in a hot press. This oil, although highly nutritious, was yet found very indigestible by some people. It had been employed in the form of lozenges to cure habitual constipation, and in phthisis, scrofula, &c., instead of cod liver oil. The fixed oil, though highly nutritious, was found by many to be indigestible; therefore a large proportion was removed in the manufacture of certain forms of cocoa, such as Homœopathic, and starch and sugar added. This was said to render it more digestible. It certainly diluted the cocoa, but more objectionable forms of adulteration had been detected. In cocoas purchased in Brighton he had found ferruginous earth, and fatty matter derived from animals.

The paper was illustrated by specimens of genuine and adulterated tea, coffee, and cocoa, the ingredients obtained from each, and microscopic preparations, prepared by Mr. Smith.

After a vote of thanks and a discussion, in which Messrs. MOORE, T. GLAISYER, SMITH, and WONFOR, took part, the meeting became a Conversazione, when the ingredients of tea, coffee, and cocoa, prepared by Mr. SMITH, were exhibited under the microscope by Mr. W. H. SMITH, Drs. HALLIFAX and BADCOCK, and Messrs. WONFOR and T. GLAISYER.

Mr. WONFOR also exhibited a couple of slides lent him by Mr. T. CURTIES, of Holborn, and designated a microscopical novelty, in which birds, flowers, and insects had been built up from butterfly scales. Though to the microscopist they were only toys, yet they were marvels of what patience and skill could accomplish, and were pronounced by all very beautiful objects.

DECEMBER 12TH.

ORDINARY MEETING.—MR. R. GLAISYER ON STRANGE COMPANIONSHIPS AMONG ANIMALS.

In the vegetable world two distinct companionships are found, viz., the parasites, or those which lived at the expense of the host to which they attached themselves; and the epiphytes, or those which simply grew on the bark or external covering of plants, and deriving no sustenance from them.

In the same manner among animals, there were at least three kinds of companionships found, viz., the *Epizoa*, which lived on and at the expense of their hosts; the *Entozoa*, which took toll of the tissues of those animals within which they dwelt; and two other companionships in which the animals did not seem to make their host pay any other toll beside that of affording them either a resting-place or shelter.

One form of these lived on the outside of other animals, travelling as they travelled, being dependent on them much in the same way as railway passengers were who simply used the carriages as a means of getting from place to place, and did not derive any nutriment from the juices or tissues of the animals to which they attached themselves, any more than the barnacles did from drift-wood or a ship's bottom.

Another form of companionship was that in which, side by side and within the same dwelling, animals of a totally different order lived together, just as lodgers or boarders who occupied a part only of a house, but apparently with this difference, that they did not pay rent, rates, and taxes,—in fact, lived at free quarters. It is with these two latter that he had to deal, and which might be designated as "fixed" and "free" companions; the fixed being those which attached themselves to another animal and there remained, and the free those which lived within its domicile, and could, if they willed it, leave their lodgings.

Although, at first sight, apparently among the fixed companions, the *Clione* or boring sponge must be excepted, because it appeared to absorb the living or animal part of the shell of the oyster equally with the earthy matter, and, therefore, came within the range of the parasites.

Some "fixed" companions were so only during their adult period of existence. Thus the barnacles, which attached themselves to the skin of whales, were, during their larval state, free swimmers, but, when about to take on the final stage, they threw off their organs of locomotion and their eyes, and became dependent for a means of travelling on the huge whale to which they attached themselves.

Oyster and scallop shells, especially the latter, were often covered with a growth of animal and vegetable life. It was no uncommon thing to find perfect colonies of *serpulæ*, acorn barnacles, and *terebellæ*, together with *Alcyonium*, "dead men's fingers," as fixed companions on the shells of the *Pecten maximus;* but, at times, a free companion, such as an anemone or two, would also be found.

Free companions were more common among crabs, the most notable being the pea crab, found living inside the shells of oysters and mussels, and by some supposed erroneously to cause the illness "Musselling." The guest seemed to live on good terms with the host, and was supposed to render benefits in return for the protection afforded. Among the soldier or hermit crabs which occupied the shells of mollusks, many were noted for having free companions. Thus a common companion was a Nereis, or worm, which lived side by side on very amicable terms. Another always had on the outside of his abode a sea anemone. Observations made by Lieut.-Colonel Stuart Wortley and Mr. Gosse seemed to show that if the pair were separated they came together again.

Several other soldier crabs had twin attendant anemones; but one crab seemed to encourage on his carapace a perfect colony of polyps, polyzoa, and sea weeds, and, so concealed by his covering, easily approached his prey. One crab, owing to the companionship of five large oysters, was unable for four or five years to shed his coat.

One free companion, the *Echeneis Remora*, had been rendered famous from the days of Oppian and Pliny, the latter of whom describes this small fish as stopping the galley of Antony, at the battle of Actium, and that of the Emperor Caligula: though, in the latter case, 400 seamen were labouring at the oar! The people of Mozambique were said to utilize the Remora by putting a ring in its tail with a line attached and hauling in the line when the Remora had attached itself to a fish! There were also many fixed companions among the infusoria and rotifers, which attached themselves to the coverings of other animals, and so travelled without paying a fare.

Mr. GLAISYER exhibited some oyster shells bored by the Clione, showing, by the internal thickening of the enamel, that the perforation extended to a sensitive part, as well as some with serpulæ and barnacles attached.

After a vote of thanks to Mr. GLAISYER, a discussion ensued, in which other examples of fixed and free companions were instanced by Messrs. WONFOR, NOURSE, PANKHURST, DAVEY, BUTCHER, WILLS, T. H. HENNAH, and Dr. BADCOCK.

JANUARY 9TH.

ORDINARY MEETING.—MR. J. HOWELL ON THE NIGHTINGALE.

The male generally arrives from eight to ten days before the female. This is the period when a fierce rivalship occurs among the males, each striving his utmost to out-sing his fellow. A dozen may be sometimes heard in a favourite district. The habits of this bird are solitary. Its local distribution is very curious, for in some countries it is numerous, and in others wholly unknown. It extends as far north as Sweden, and even Siberia, while in this island its range is no further north than an isolated spot or two in Yorkshire. It is abundant in Greece, Italy, Spain, Portugal, and France, rare in Holland, and altogether unknown in the Channel Islands, Wales, Ireland, and Scotland. It is rarely, if ever, heard upon the border line of South Wales. Its distribution in England is also very local. Ignoring almost everywhere the palæozoic rocks, it ranges over its south-eastern part, viz., the Wealden, Cretaceous, and Tertiary formations of Kent, Sussex, Hampshire, Surrey, Middlesex, Berkshire, Buckinghamshire, Hertfordshire, Cambridgeshire, and Essex, and even in these counties it attaches itself to particular places in preference to others—a problem for science to solve. It scarcely ever remains near the sea upon our chalk downs, a fact that may be accounted for by the absence of trees, as it honours their wooded valleys. It does not visit Cornwall or the western part of Devonshire, and had never been heard in Staffordshire, Derbyshire, Cheshire, nor Lancashire, while the extent of its northern range is Doncaster in Yorkshire. It is abundant in the Isles of Greece, Syria, and Palestine. In Africa, like Europe and Asia, its local distribution is very partial. It haunts sequestered shrubberies, copses situated in low humid valleys, rich parks, embowered coverts, outskirts of forests and woods, and green hedgerows bordering our waysides. It delights to dwell in the immediate vicinity of water, being a cleanly bird and extremely fond of bathing. Once having fixed upon its place of abode, there it remains, returning year after year to precisely the same spot. This love-of-home trait has been taken advantage of to localise it in countries to which it is a stranger.

An attempt made by a gentleman of Swansea to introduce the nightingale into Wales by distributing its eggs among the nests of birds in that neighbourhood in the hatching season, proved a failure; for, though the nightingales were contented to remain in their new locality during the first summer, they never returned to it in subsequent years. Sir John Sinclair tried a similar experiment in Scotland, and with similar results.

Most of the poets speak of the nightingale in the feminine gender. This probably arises from the legend of Philomela being changed into a bird. There is another mistake, that it sings only by night; whereas it sings on and off from 4 a.m., sometimes all day and through the evening and night up to 2 a.m. Its singing depends on the weather. Should it be hot, it is generally silent from 11 a.m. till the evening, but if the day is slightly overcast, accompanied by misty rain, it will sing all day.

Bechstein says there are day and night songsters—that is, birds which sing by day and are silent by night and *vice versâ*. During the months of May and June, 1848 and 1849, he proved by observations that the same bird sang by day and by night; this might be proved by watching particular places, for each bird had its own singing ground.

The power of song possessed by the nightingale is thus expressed by Syme in his "British Birds." "The notes of soft-billed birds are finely toned, mellow, and plaintive; those of the hard-billed species are sprightly, cheerful, and rapid. This difference proceeds from the construction of the larynx. As a large pipe of the organ produces a deeper and more mellow-toned note than a small pipe; so the trachea of the nightingale, which is wider than that of the canary, sends forth a deeper and more mellow-toned note. Soft-billed birds also sing more from the lower part of the throat than the hard-billed species. This, together with the greater width of the larynx of the nightingale and other soft-billed warblers, fully accounts for their soft, round, mellow notes, compared with the shrill, sharp, and clear notes of the canary and other hard-billed songsters."

The song of other birds, when compared with that of the nightingale, was weak. The canary was valued, when its song partook of the tones of the nightingale. The blackcap was considered to be the only bird that could, in point of song, vie with the nightingale, without being wholly eclipsed. The only bird, in his opinion, worthy of being compared with him, was the thrush. The voice of this bird possessed about the same compass as that of the nightingale. So much do some thrushes, especially when their voices are mellowed by distance, resemble the nightingale, that it required a nice ear to distinguish the one from the other.

After relating his own experience in catching and training the nightingale, he remarked that the bird, when properly fed and carefully attended to, would live many years in confinement; but his birds scarcely ever retained their song in perfection more than four or five years, owing, no doubt, to repletion, for in confinement, through the want of exercise, this was sure to be the case. And when he could not prevent this, he gave the birds their liberty; for, when released, they reverted to their normal condition, and recovered their song, owing, no doubt, to sufficient exercise, natural food, and invigorating air. Bechstein mentions an instance of a nightingale's living in confinement for twenty-five years! Buffon has also recorded another instance of one having lived seventeen years. At fifteen the quill feathers of the wing and tail became white, the legs increased in size, the feet became gouty, and it was often necessary to sharpen the upper mandible, there being no other appearance of age, as the bird was lively and always singing.

The attachment of the nightingale, when once gained, was not only lasting, but most extraordinary. One of the best nightingales he ever had was trapped by him near Westmeston, in April, 1849. He was, in fact, the finest bird he ever saw, as regards intelligence, affection, and song. At the close of the first week in May, he burst forth into song. He continued singing up to the end of June, when he became silent, and soon began to moult. By this time he had grown very tame. When his food-pan was empty, he would strive to draw attention to the fact. If the action were unheeded, he would give forth his call-note, followed by its frog-like croak. This not being noticed, he would seize the tin pan in his beak, and continue to shake it violently till his wants were supplied. About the middle of September he became restless and fluttered about wildly, more especially at late hours, and moonlight nights, the instinct to migrate being strong within him. During this time, he lost all his gentle ways and acted as wildly as a newly-caught bird. On the following Christmas day, he burst forth into full song, loud, precipitate, and melodiously sweet. This was the only instance that ever came under his observation, or that he had read of in which a nightingale burst into full song without having previously "recorded."

Nestlings are of no value, for they will learn anything except the warbling of their sires. Even if placed under rich songsters, they will introduce foreign and discordant strains into their song. Young birds caught in the autumn, previous to migrating, were sure to turn out well, especially if placed under a fine songster the following spring. They would modulate their voice to any given key; could be taught to introduce variations in their song, and to take part in a chorus, but talking, though vouched for by Pliny and Gessner, was altogether out of the question. If properly fed and carefully attended to, he would become a most agreeable and affectionate friend; would accompany the pianoforte, the guitar, or any other musical instrument.

In the discussion which followed, many interesting facts were mentioned by the members present.

JANUARY 23RD.

ANNUAL SOIREE.

The Second Annual Soiree was held at the Royal Pavilion. Three rooms were used for the occasion—the Banqueting Room, the South Drawing Room, and the South Lobby. The chief feature of the evening was the display of microscopes, the greater part of the instruments being arranged in the centre of the Banqueting Room. The microscopes were contributed by Dr. Badcock, Mr. Upton, Mr. T. Cooper, Mr. R. Glaisyer, Mr. T. Glaisyer, Captain Marshall Hall, Mr. Hennah, General Worster, Mr. W. W. Mitchell, Mr. Haselwood, Mr. J. J. Sewell, Mr. G. T. Shaft, Rev. W. Payne, Mr. Wonfor, Mr. Wonfor, jun., Dr. Ormerod, Dr. Hallifax, Mr. Gwatkin, Mr. W. D. Savage, Mr. Shillingford, Mr. Nash, Mr. E. Moore, Mr. Dennant, Mr. Ardley, Mr. F. E. Sawyer, Mr. S. Aylen, Mr. Curties (Holborn), Mr. W. H. Smith, Mr. C. P. Smith, Mr. Moginie (London), Mr. C. Baker, of 244, High Holborn, London (who exhibited four of his new medical microscopes), and Mr. Rowley (circular microscope).

Although the microscopes occupied a considerable space, many interesting objects were exhibited ; the principal exhibitors and objects were :—Mr. Sewell, collection of Tasmanian, African, Indian, and New Zealand products, and Tasmanian sea-spider ; Dr. Badcock, plants in pots ; Mr E. Parkinson, walrus and hippopotamus' teeth ; Dr. Hallifax, micro-photographs and hygroscopes formed of the awns of wild geraniums and oats and very delicately sensitive to changes of the air ; Mr. R. Glaisyer, shells, brainstone coral, locust-bean, &c. ; Mr. Hurst, curious book with plates of animal and human physiognomy compared ; Mr. Shillingford, Indian butterflies and moths ; Mr. Wills, Indian butterflies, moths, and beetles ; Rev. T. Moseley, cases of birds and moths taken at Rose Hill, Brighton; Mr. T. J. Cooper, electro-magnetic machine; Mr. Butcher, British butterflies, moths, and beetles; Capt. Marshall Hall, sponge, *pheronema grayii;* General Worster, diatom casts by Dr. Maddox, photograph of the original chart of the solar spectrum, drawn by Fraunhofer, and foot of Indian elephant made into a footstool; Mr. Quartermain, cork model of Old London Bridge; Mr. Stroudley, working models of railways, safety carriages, and safety switches.

Mr. Wonfor, case of copper ore from Burra Burra mine, Australia, leaf from Himalayan stream, covered with crystals of carbonate of lime and tufa deposited on moss; Mr. Wonfor, jun., nine cases of British butterflies, a collection of moths taken last year, and two rare moths, one taken near Brighton and the other in Buckingham-place; Mr. Saunders, very fine corals from Red Sea, curious fish from Suez Canal, and 150 specimens of woods used in manufactures; Mr. H. Pratt, sketches of lunar scenery and of planets, shewing colouring, and of several rare British insects; a new form of spectroscope devised, made, and exhibited by H. Pratt and illuminated with magnesium light by Dr. Dawson; Miss King, revolving stereoscope; Mr. Aylen, nutmeg plant; Mr. Hilton, dried head of Indian chief, showing compression whilst preserving symmetry; Mrs. Branwell, minerals, silurian, lias, and coal fossils, including trilobites, corals, encrinites, and head of ichthyosaurus; Society's mosses, albums, &c.; Mr. Wallis, jun., British birds' eggs; Mr. Pankhurst, collection of choice minerals to illustrate Ruskin's "Ethics of Dust"; Mr. Mitten, living specimen of helleborus fœtidus; Mr. G. Nash, photographs and new form of kaleidoscope; Dr. Addison, injections by Goadby, made 30 years ago and still perfect; Mr. Rowsell, graphoscopes and bronzes; Mr. Nourse, very fine collection of coins, fossil wood from Cairo, &c.; Mr. Simonds, case of minerals; Mr. H. J. Nicholls, several cases of British birds; Mr. W. H. Smith, samples of pure and adulterated food; Dr. Ormerod, electric lamp; Mr. E. C. Hennah, electric clocks; Mr. T. H. Hennah, palms, aloes, yuccas, and ferns in pots; Mr. Penley, flexible sandstone, blood stones, marbles from Agra, New Zealand ferns, &c.; Mr. T. Glaisyer, fine collection of choanites from Brighton beach, tusk of narwhal, and water-colour drawing by Miss Glaisyer, showing head of narwhal, with tusk *in situ.*

One feature of the evening was a series of ten minute addresses by the President, Mr. G. SCOTT, Messrs. SCHWEITZER and BENJAMIN LOMAX.

Mr. SCOTT, on the Sub-Wealden Exploration. On behalf of the

Committee and Members of the Society, he wished to express his gratification at seeing so many persons present. Since their last annual *Soirée* they had had much to congratulate themselves upon. Their Members had largely increased during the meeting of the British Association in Brighton last August. The Society took an active part in that meeting, having organized the Botanical Department and the Microscopical display in the Corn Exchange ; and it was universally allowed that the Society gave great satisfaction. It took an honourable position with respect to the Sub-Wealden Exploration ; it subscribed to the funds, and it was arranged that the substances brought up in the course of the boring should be examined by Members of the Society, chemically, geologically, and microscopically.

Many would be glad to know that Mr. Wonfor, their energetic Hon. Secretary, had recovered from his late illness. Mr. Wonfor had an admirable *alter ego* in Mr. Onions, who had carried out nearly all the arrangements for the present *soirée*. He had been requested to say a few words upon the Sub-Wealden Exploration. The Wealden was a series of beds directly under the lower green sand beneath the chalk, and extended over large parts of Surrey and Sussex ; and, crossing the Channel, re-appeared in France, extending 200 or 300 miles. It had been said the exploration was an experiment to find coal ; but it was nothing of the kind. The plan was Mr. Henry Willett's, but it had been taken up by the British Association ; and a Committee was formed and subscriptions were obtained for carrying it out. The boring was not to find coal ; but to solve the problem—almost the only unsolved geological problem in these islands—of what underlies the Wealden. A well had been dug at the Warren Farm to a great depth, but although water was not reached so soon as was expected, no geological discovery was made. The successive formations were there known. But we know nothing as to what underlies the Wealden. It was very difficult to say at all what underlies them. Probably we might come upon the carboniferous formation or coal measures ; and that probability had perhaps led persons to suppose this was a search for coal. Should these measures be reached, Sussex might again become a great iron country, and the glare of furnaces might again be seen. What the result would be he was not prepared to say ; but he supposed we should have to grin and bear our good fortune. In any case, the Sub-Wealden Exploration would add greatly to our scientific knowledge.

Mr. SCHWEITZER then delivered an address, illustrated by experiments, upon Disinfectants. At times epidemics appeared, and when once they started they spread to other localities. We hardly knew how these diseases go from one place to another. It was difficult to believe they were carried simply by personal communication or by means of the wind, and it is almost impossible to believe they crept along the earth's surface, for they usually travelled in one direction and did not extend in a circle. But if we did not know how they were produced and propagated, we knew that uncleanliness, bad ventilation, and bad drainage, were conditions favourable to such results, and, consequently, that cleanliness, good ventilation, and good drainage were the best preventitives. When such diseases make their appearance we resort to chemical means to destroy them. And there were many chemical compounds which had a most powerful effect in destroying them. These compounds acted either by arresting decomposition or by decomposing organic matters. When the locality was known where the disease was, resort was had to such chemicals as were of a less volatile nature or were not volatile at all. If, however, the seat of the disease was not known, but where the rooms were infected with poisonous matter, then they applied volatile chemical compounds. The best of these were chlorine. This was a volatile gas which was able to fill the whole room and enter into every crevice wherever gas or air could penetrate. He had just been allowing chlorine to act on some violets, which were bleached. This bleaching was a similar process to what was taking place when chlorine attacked organic matters, especially such as produced disease. Chlorine had a most powerful affinity for hydrogen, and nearly all organic matter was composed of carbon, hydrogen, and oxygen in different proportions. The abstraction of the hydrogen from the organic compound altered its character so much that it lost many of its original properties and got new ones. Thus, when a poisonous matter was attacked by chlorine and some of the hydrogen removed, the remaining compound was new, and, as was found, an inert one. Chlorine was a most powerful disinfectant, but its affinity was not simply for poisonous matter, but for any organic matter. Nobody could breathe chlorine, and so the purifying could only last for a short time. When the chlorine was removed and the air admitted as before, then the room might be entered. Powerful though chlorine was, it was not the most practical remedy, because fresh poisonous matter might enter when it had been removed. Now, chemical elements were usually classified, those of the same class having similar properties. Of the same class as chlorine were iodine and bromine. He had tried the effects of iodine on smells, and he had found it to destroy them ; and, as it could be left in a room, it was a safer and better disinfectant than chlorine. It would remain like a watch-dog, waiting for the enemy, and, as soon as it appeared, destroy it. This was an important point; and it was this which induced him to bring the present matter, not the most pleasant, before them.

Mr. B. LOMAX said the most useful lesson of the microscope was to teach people to use their eyes microscopically; not simply to look at things as they appeared, but as they would be if greatly magnified. Those who had learnt to do this had learnt a thousand of the secrets of Nature, for Nature was made up of duplications and repetitions. If we could make a cell, we could make a honeycomb; if we could understand a branch, we could understand the tree on which it grew. In the Pavilion gardens, they might find amongst the grass little channels of water, say three inches wide and four feet long, emptying into the drain or gutter. Magnify one of those channels, and it became a mighty river miles long and a mile broad. It would be seen that the channel did not run straight; wherever it met an obstruction it turned aside and took a serpentine direction. This little channel amid the grass might show them how the Mississippi rose among forests, how it sometimes ran between high cliffs, then over turbulent rocks, and again formed great waterfalls. There was a lesson in geography. But it taught much more. Visit it another day and they would find the bottom of the stream had been changed; where were roughness there was now a smooth layer of mud; and the water was no longer clear. There was a deposit on the bottom, some of which was carried to the mouth, where it collected, and so divided the stream into two. This would show how a river like the Ganges, year after year, deposited a bed which might in time change its course. Magnify the grass on the sides of the little channel and it became a forest. Now this grass was a foreigner,—a poor relation of a great foreign family. There was a great difference between some foreign plants and our own; and the grass was foreign. In the Tropics were thousands of forest trees, corresponding to our grass, but being unlike the other plants of our land. These were only a few of the lessons to be got from a little stream of water; but they might get from it useful lessons in almost every branch of science.

Refreshments were served during the evening in the Drawing Room, and the company numbered over 500.

FEBRUARY 13TH.

ORDINARY MEETING. — MR. J. CLIFTON WARD ON THE SCENERY OF THE ENGLISH LAKE DISTRICT, GEOLOGICALLY CONSIDERED.

No thoughtful person could look at the varied scenery of the Lake district without asking, Were all the types of scenery formed at once by the "I will" of the All-Powerful, or elaborated gradually in the great workshop of Nature,—by the action of those laws ordained by the great First Cause? If the latter, what were those laws, and were they still in operation? In the first place, *was the rocky material forming all the varied types of scenery the same?* Upon examination, it was found that the low hills which encircled the district were formed of alternations of limestone and sandstone; smooth Skiddaw, of dark clay slate, an old mud deposit; the still more lofty Scawfell, craggy and precipitous, consisted of hard rock—a stratified volcanic ash; the hills round Stony Tarn and north of the Esk were of granite; the mysterious conical hill Mell Fell (north of Ullswater) was a conglomerate, and the soft grassy plains nestling between the mountains were formed of soft river mud and loose sand and gravel, evenly spread out.

The next question to be asked is, *what are the agents which produce scenery as a whole?*

The only possible ones were the denuding action of the sea along coast lines; the denuding power of the various atmospheric agencies (including the chemical and mechanical action of the air, and running water, and, as regarded the mechanical, of frost), and the violent upheaval of the rocky matter by an action from below. With regard to the action of the sea, it was evident that it could not produce the minutiæ of scenic detail, though it might as it were rough-hew the block of earth and so prepare it for the action of the other agents. The chemical and mechanical action of the atmosphere was more important and extensive than might be supposed. Greenstone became soft and crumbling by the action of the air, chemical decomposition taking place; limestone became completely honeycombed by the solvent power of the carbonated rain water; and sandstone speedily became weathered by the atmosphere. If the particles of silica were held together by a calcareous material the rain-water readily dissolved it; but, if by a siliceous the stone resisted disintegration to a greater extent. Some of the stones of the so-called "Macduff's Castle," built of the red sandstone, forming the cliffs on the coast of Fife, were almost entirely eaten away by the air in this manner, and this within the lapse of a few hundred years.

The mechanical action of running water need not be demonstrated, and its extent would be appreciated by all who had visited mountainous districts since they became acquainted with the principles of geology. And no one who had carefully watched the action of a stream would fail to conclude that the valleys had been carved out, the hills sculptured, by the very agents now at work.

The chemical action of the air and rain-water was continually disintregrating and dissolving the rocks, the freezing of the water among their crevices was yearly shattering them, and the heavy rainfall and flowing water was for ever bearing away the loosened material to lower and lower levels. Nor was the action of ice in the form of glaciers to be forgotten ; it had been a powerful agent in this country and was now in Switzerland. A glacier was a river of ice (representing the snow drainage of the mountains), but flowing very much more slowly than an ordinary river. The frost constantly detached blocks of stone from the snowless peaks ; they fell upon the ice and were carried onwards with the glacier, forming long lines upon its surface, and when it ended they were shot off and formed mounds of stony rubbish called terminal moraines. But the ice had another effect. Moving slowing over its rocky bed, it smoothed, ground, polished, and scratched it, rounding the rocks in a very marked manner, and often leaving large blocks of stone perched upon them. The whole of the English Lake district had been thus ice-worn ; in every valley the rounded and scratched rocks could be traced as well as the old moraines left by the retiring glaciers. Insignificant as many of these agencies appeared, they only required sufficient time to produce effects equal to those produced by powerful agents acting for a short time.

How far was the effect of these agencies varied by the peculiarities of the rocks in structure and composition? Taking Derwentwater, nothing could be more distinct than the mountain forms on either side the lake—on the one all rough and craggy, on the other smooth and sloping. The cause was not far to seek.

On the east side the mountains were formed of hard volcanic rocks, continually being shattered by the weather. On the west side the mountains were formed of Skiddaw slate, which instead of breaking away in large fragments, shivered into small scales; the waste of these hills was not found at the bottom in large blocks, but as a fine clayey and shaley wash of comminuted slate. Atmospheric agencies were at work lowering the mountains on either side the lake, but working in different materials they produced a very different result.

Looking into the details of the scenery, first came Friar's Crag, and Castle Head close by. These were formed of greenstone, intruded among the Skiddaw slates ; the former was hard, the latter soft, and hence the craggy prominences. The line of junction between the soft Skiddaw slates and the hard volcanic series ran along the eastern edge of the lake. The hollow in which the lake lay had been scooped out of the softer rocks. The craggy line of mountains rising above and behind Barrow House, were alternations of stratified ash beds and lava flows, all dipping into the hill at a low angle. Hence a step-like form was given to much of the upper part of this hill-side—some of the beds, being harder than others, stood out in relief. North and South of Barrow House was a great quantity of material fallen from the steep rocky cliffs. At the head of Derwentwater was a tract of alluvial land representing a part of the lake filled up by the matter rolled down into it by the river. This filling up was still going on, for a stretch of shallow water from five to nineteen feet ran full three-quarters of a mile into the lake.

On entering Borrowdale, rough, wild, craggy mountains, formed of cleaved volcanic ash and breccia, with occasional beds of contemporaneous trap, were found. The bedding and cleavage of the ash was frequently very conspicuous. But perhaps the most striking feature was the ice-worn appearance of the rocks. At Grange Bridge there was a fine example, the scratches being well preserved. Skiddaw slates, as a rule, did not retain their effects of ice so well as the ash and trap rocks, though some of the best examples were to be found among the former. On the summit of Brund Fell every rock was a rounded surface, and almost every surface was very deeply grooved and scratched in one definite direction, while occasionally there were fine examples of perched blocks. In Borrowdale, also, were two old lake sites, now filled up by the stream-borne detritus. Along the western side of the lake, by the flanks of Maiden Moor and Cat Bells (all Skiddaw slate), were many long grassy slopes, a few slightly craggy spots, where occasional harder beds or quartz strings occurred, and several streams of stones made up of small slaty fragments.

Amongst other features of the landscape were two inverted arches—one in Borrowdale, formed by the sides of Brund Fell and

Castle Crag (volcanic), and another on the west side of the lake, by the flanks of Cat Bells and Causey Pike (Skiddaw slates). The difference in the appearance of the two, originating in the different structure of the rocks, was very discernible.

The smooth surface of the Skiddaw slate series was sometimes modified by special circumstances—as when the slate contained harder sandy beds, standing out in relief, or when masses of eruptive greenstone occurred; thus, on the east side of Hindscarth, there was a long patch of greenstone, forming a very craggy side to the mountain. The relative direction and amount of the true dip and the cleavage dip of the slate frequently affected the form of the mountain. To this, probably, was due in great measure the shape of Blencathra (Saddleback); the gentle slope to the north at the back of the mountain corresponded in direction and inclination with the bedding dip, and the fine ravines upon the south-east side were produced by the weather along the steeper cleavage dip. Other instances of this might be mentioned.

Glancing at the rocks of the volcanic series, it was found that among the mountains of Borrowdale all the variety of rugged and craggy aspect was due to hard rocks, and yet rocks of different degrees of hardness. Standing on Stye Head Pass, the connection between the grandly rude step-like form of the Scawfell range, and the inclination of the massive stratified beds of altered ash forming it, dipping at an angle of twenty-five deg. in a S.S.E. direction, and traversed by numerous joints and dykes more or less at right angles, could be seen. When there occurred a great thickness of ash of nearly uniform hardness and well cleaved, the form of ground often more nearly approached that of the Skiddaw slates, as along part of the summit of Helvellyn.

The Vale of St. John was a striking instance of the dependence of the mountain form upon geological structure. On one side was a long range of precipitous mountains with evident lines of bedding running along its face, the strata of hardened ash, dipping steadily into the hill side at from eight to thirty deg., while on the other side the hill was made up of hard beds of trap and softer ash, lying in a long, synclina trough faulted at several points: each hard bed formed a prominent terrace. The various faults that ran through this district tended often to produce marked effects upon the scenery. Not that the actual dislocation had given way to gaping fissures, &c., but that rocks of various degrees of hardness, having been thrown together along the line of fault, the denuding powers had acted unequally upon them.

One of the most noticeable features in the Lake district was the number of wholly or partially filled-up lakes. Upon fell-tops one constantly met with tarns, filled-up with stream-borne detritus. Derwentwater and Bassenthwaite were at a former time one long sheet of water, but the River Greta had deposited a delta in its midst, and now the lakes were separated by some three miles of alluvial land. The same had occurred in the case of Buttermere and Crummock Water. Most of the Cumberland lakes yet examined seemed to be true rock basins ; they lay in rock hollows which had been rounded and scratched on all sides by the old glaciers, thus leading to the belief that these hollows, if not actually formed by the scooping power of the ice—as Professor Ramsay's theory suggested—had at least been deepened by it. The terminal moraines often formed a marked feature in the scenery, as above Seathwaite, on the east side of Honister Pass, at the head of Langdale, and several other places. At the head of Ennerdale Valley they were particularly striking—so much so as by some to have been taken for innumerable tumuli.

The oldest rocks in the district were the Skiddaw slates ; these were very ancient finely stratified mud rocks, containing, in some places, remains of marine shells, worm tracks, fucoids, shrimp-like crustaceans, and graptolites. These ancient mud deposits, however, had been hardened, altered, contorted, and cleaved. Their thickness was very great and required an enormous period of time for their formation. The marine conditions which probably prevailed for this long time over the district were closed by a great series of volcanic eruptions, at first submarine, the ashes ejected being stratified beneath the sea, and the lavas flowing over its bed. Very probably some areas of dry land were then formed by the accumulation of volcanic material, aided, perhaps, by the elevation of the sea bottom.

The total absence of ordinary marine sedimentary deposits, and of any traces of fossils in the whole of the great thickness of ashes and lavas now forming the mountains of Borrowdale would seem to indicate that much of the material must have been ejected upon dry land, and parts of it, perhaps, deposited in large crater-lakes ; for while there were great masses of unstratified or but rudely stratified ashes and coarse breccias associated with the lava-flows, there were also many intercalations of exceedingly fine-bedded ash, apparently deposited beneath water of some kind. On the close of the volcanic activity the district was again sunk slowly beneath the sea, and the various limestone, sandstone, and shale beds of the Upper Silurian age were deposited unconformably upon the great thickness of volcanic material. The remains of these rocks might now be studied south of Coniston and Windermere.

At the close of the Silurian period another gradual upheaval of the ocean bed took place, and as the land slowly rose above the sea, its waves planed away vast thicknesses of the strata, just as the sea was now doing along the coast-line hard by, until when at length the upheaving powers had got the mastery, and a tract of land stood fairly above the sea-level, the lower rocks were in many places exposed at the surface by reason of the denudation which had carried away the upper. This tract of land being thus upheaved, the rocks then curved, contorted, and cleaved, formed the roughly hewn block, so to speak, out of which atmospheric agencies had ever since been carving and sculpturing its present beautiful aspect. Around it were deposited the Old Red Conglomerate beds, then the Carboniferous Limestone seas probably only washed its base, and afterwards Coal Measures and the Permian strata were formed around.

And so on through the whole of the great Secondary Epoch, during which the Trias, Lias, Oolite, and Chalk strata of the greater part of England were being formed, was this district probably above water and exposed to the denuding agencies of the atmosphere. Also through the whole of the Tertiary Epoch there was no evidence of submergence until, in the midst of the last Glacial Period, the country probably sunk beneath the sea to a depth of at least 1,500 feet.

This immensely long stretch of time, from the Old Red to the present period, was considered, and with justice, more than ample, for the formation of all our valleys and glens by the atmospheric denuding agencies now seen in operation, and the wonder was rather that much more had not been removed ; for during the past ages the climate must have changed more than once, snow and ice alternating with almost tropical heat, and therefore every agent having its full power in turn. The Cumberland mountains were certainly of far greater age than many of the snow-capped ranges of foreign countries, the Alps, the Apennines, and much, at any rate, of the Himalayas ; these were but infants in age compared with our humble English group. We learn then that what we were apt to consider destruction and decay might be but the harmonious ringing out of Nature's changes.

The paper was illustrated by drawings, diagrams, and water colours by Messrs. J. C. WARD, A. BIGGE, and O. B. LOMAX.

FEBRUARY 27TH.

MICROSCOPICAL MEETING.—A GENERAL EVENING.

A present of two test slides of Podura Scales, *Lepidocyrtus Curvicollis*, and *Degeeria Domestica*, having been announced from Mr. J. S. McIntyre, for the Society's Cabinet, Mr. HENNAH, in proposing a vote of thanks, remarked that they were not only a valuable addition to the cabinet, but also possessed the additional value of being authentic. As this was their first microscopical meeting that year, he hoped members who had microscopes would exert themselves even more than they had done in the past year, and would lay before the Society the results of their observations.

He would also urge the younger members to fix on some particular subject to work at, for by that means they would greatly improve their knowledge and also their skill in the use of their instruments. Mr. Wonfor had suggested that the subject for the next meeting should be "Seeds, microscopically considered," a field that would yield much very interesting matter; for, apart from the beauty of their markings, a great deal might be done with sections. The most attractive object he exhibited at the late Soirée was a slide of "ragged robin" seeds, which, at repeated requests, he had to show again and again during the evening.

Mr. WONFOR said he should be pleased to introduce the subject, which he could illustrate with a great variety of objects, which, though apparently not very attractive, were far more beautiful in their markings than many so-called gorgeous objects.

Mr. E. MOORE exhibited an ingenious dipping tube, possessing the advantage of retaining what was taken up by it until required.

Objects of a varied and beautiful character were then exhibited under the microscope by Messrs. HENNAH, R. GLAISYER, and WONFOR; some of the most striking being portions of the wings of very beautiful tropical butterflies, polycystins from Barbadoes earth, among them a nearly perfect form of the beautiful cross-like *Astromma Aristotilis*; and the crystallization of silver into the fern-like form by means of minute points of copper added on the slide to a drop of a solution of nitrate of silver.

MARCH 18TH.

ORDINARY MEETING.—AN EVENING FOR THE EXHIBITION OF SPECIMENS.

Mr. WONFOR threw out a suggestion that steps should be taken by the Society to obtain lists of the Fauna and Flora of the County, for the purpose of making a complete record of the Natural History of the County of Sussex.

This led to a discussion, in which Messrs. HENNAH, HOLLIS, HASELWOOD, Dr. BADCOCK, and the PRESIDENT, Mr. G. SCOTT, took part, when it was suggested that Mr. WONFOR should embody his views in the form of a paper, as many would be willing to assist in carrying out so desirable an object, if it pointed out how they could work most profitably.

Mr. W. H. SMITH exhibited specimens of mistletoe growing on apple. This led to an interesting discussion on the nature and growth of the mistletoe, in which it was pointed out that the woody matter of the two grew side by side, the cells of the parasite not intermingling with those of the plants on which it grew; that, curiously, the greatest activity, viz., the flowering and fruiting, was during the winter months, militating against the idea that there was no circulation in trees during the winter ; that the oak mistletoe *alone* was sacred among the Druids ; that it was even then as comparatively rare as now ; and that several oaks were well known on which it still grew ; and, although a parasite, it did not seem to interfere with the productiveness of the fruit-bearing trees on which it was found.

Dr. BADCOCK exhibited a couple of *cicada*, from Naples, the males of which alone possess the power of making a noise, and hence they have been described as "the tuneful husbands of the voiceless wives."

It was mentioned that many species of this wide-spread family were known, and that one, from its periodical appearance every 17 years in America, was called *cicada septemdecem*. It derived its name from the circumstance of the grub living during that time in the earth.

Mr. G. D. SAWYER mentioned that, when living in America, between 1840-45, it was well known they were expected, and, true to the time, they made their appearance ; the ground in many places being riddled with holes. The noise made by them sounded like the word *Pha-ro*,—the first syllable being lengthened.

Mr. Wonfor exhibited some very large acorn cups, of the *Quercus Ægiolops*, the valonia of commerce, employed in tanning leather on account of the quantity of *tannin* which they contain ; coprolites, and other organic remains, including reptile tooth and a carapace of a crab from the coprolitic bed near Cambridge. He exhibited a fine specimen of amber, containing a four-winged fly, which he considered an ant. A very interesting discussion followed the exhibition of these and other objects, in which the President, Rev. J. Cross, Dr. Badcock, Messrs. Hennah, Haselwood, Hollis, Onions, Wonfor, and others took part ; and a vote of thanks was given to those who had exhibited specimens.

March 27.

MICROSCOPICAL MEETING.—MR. T. W. WONFOR "ON SEEDS MICROSCOPICALLY CONSIDERED."

One of the objects sought in setting aside an evening every month for the microscope was the opportunity it would afford members of comparing notes of observations, as well as enabling those who had paid attention to any particular objects to impart to others the facts they had been able to work out. The aim in introducing so common an object as "the Seed,"—was partly to induce some of the younger members to pay attention to it, as something deserving their study, and partly to show that an apparently insignificant object was well worthy their notice, both from the physiological teachings deducible from its structure and component parts, and for the assistance the seeds rendered in classifying the plants to which they belonged.

As some were aware, during 1862-3-4 he devoted considerable time and attention to the collection and examination of the seeds of wild plants, when, he might safely say, he examined some hundreds ; in fact, he seldom took a walk without bringing home a half-dozen fresh examples, a considerable per centage of which were so beautiful as to warrant their being mounted for the cabinet. Since then, he had, from time to time, paid more or less attention to the seeds of cultivated plants.

One lesson he had learnt, among others, was the family likeness which ran through seeds belonging to some of the great natural orders, and the assistance the microscopic characters afforded in determining the difference between species which approximated closely to each other in some particulars.

In its ripe state a seed consisted of a nucleus or kernel, and an outer skin called the *testa*, variable in texture, colour, and markings. Sections, such as those so admirably made by their friend, Dr. Hallifax, showed that three distinct layers might be detected in the *testa*, corresponding to the three coats of the ovule.

The nucleus consisted of two parts—the albumen and the true growing parts. The albumen differed in quantity and consistency, being soft in some and as hard as bone in others, as might be seen in an ivory nut, while it consisted of starch, lignine, oil, nitrogenous, and saline substances, contained in cells.

The embryo was either straight or curved, and consisted of the *radicle*, which developed into the root, and the *plumule*, which produced one or more seed leaves, and the gemmule, or first leaf bud.

Turning to the external appearance of the seed, the microscope revealed "a thing of beauty," as shown by the great variety of markings. Without entering into minute descriptions, he would indicate some of the families of seeds which, he had found, contained some of the most interesting examples. As before-mentioned, the family likeness was so great that it was often possible to indicate the family to which a seed belonged before knowing its name.

The Chili nettles, or *Loasaceæ*, contained very interesting and beautiful seeds, contrasting with which were the *Portulaceæ* or Purslane family, some of which bore a striking resemblance to the shells of the fossil ammonites, many of them shining with quite a metallic lustre.

Among the *Lobeliaceæ* would be found interesting specimens, not the least interesting being *Isotoma axillaris*, presenting an amber-coloured crystalline appearance with exquisite markings.

The Poppies, the *Papaveraceæ*, well repaid examination, while the *Scrophulariaceæ*,—a very large family, containing the foxgloves, mulleins, figworts, the toadflax, snapdragon, eyebright, pawlonia, &c.,—were all characterised, more or less, by hexagonal reticulations, with more or less minute reticulations within them. One cultivated plant, the Cape night stock, *nycterinia capensis*, was of a delicate primrose colour, and covered with minute rounded granulations.

Perhaps the most interesting group was the *Caryophyllaceæ*, the Pink family, some of the finest examples of which might be found among our English wild plants, such as the catchflies, chickweeds, stitchworts, campions, and soapworts, one of the most beautiful being the ragged robin.

Other families would supply beautiful objects; one must not be forgotten, the Orchids, which had been compared to gold coins in silk purses. With the exception of those which might be viewed as transparent objects, the rest should be mounted dry.

He had brought down between one and two hundred different kinds for examination, which he proposed should be arranged, under the microscope in groups, for comparison of the different families.

Mr. T. CURTIES, of Holborn, had sent him down, for distribution among the members, two dozen packets of seeds, interesting as microscopic objects. He proposed to distribute them later in the evening, and felt sure they would join in a cordial vote of thanks to Mr. Curties. This was done by acclamation.

Dr. HALLIFAX mentioned the facility with which those who had paid attention to seeds could separate not only those closely allied, but even hybrids.

Mr. SEWELL enquired whether seeds required drying with heat to prevent their moulding.

Mr. WONFOR stated that all that was necessary was to gather them dry and make sure they were free from moisture when mounted. Many of those he had brought down for exhibition had been mounted ten years.

Mr. HENNAH said he would vouch for the truth of Mr. Wonfor's assertions, for, looking at the seeds he had brought down, a greater part were mounted by Mr. Wonfor, and were dated 1863.

The meeting then became a conversazione, when Messrs. HENNAH, W. H. SMITH, F. E. SAWYER, SEWELL, R. GLAISYER, WONFOR, and Dr. HALLIFAX exhibited seeds, the latter gentleman showing some of his admirable sections.

April 16th.

ORDINARY MEETING.—MR. T. W. WONFOR ON THE VERIFICATION OF THE FAUNA AND FLORA OF THE COUNTY OF SUSSEX.

When at the last ordinary meeting of the Society, he suggested that the time had, he thought, arrived for them to take steps for the classification and verification of the Natural History of the County of Sussex, it would be recollected it was urged by the members then present that he should bring the matter forward again, explaining what steps the Society should take, and how individual members could co-operate in carrying out so desirable an object. In accordance with that request he proposed to offer suggestions, not so much for the purpose of dogmatizing, as eliciting discussion, and discovering what were the views of other members of the Society.

Some, possibly, might think the Society ought to have done what was proposed long since, but he felt that, to have attempted too much in its earlier days would have imperilled its existence or impaired its usefulness. Established as it was "for the purpose of encouraging the study of Natural History among its members," it began in a very unpretending way with a monthly meeting, and the nucleus of its present library. As it became older and stronger it extended its meetings to twice a month, devoting one to the microscope; this had been of great advantage to many, more especially the younger members, for it had been the means of imparting useful hints in preparation, mounting, illumination, and many other points in connection with the microscope.

Then the field excursions held during the summer months had been a source of great pleasure and enjoyment. Added to these the Soireés had enabled the Society to entertain not only their friends among the male sex, but also to let the ladies see what kinds of objects interested the members. With these additions to its sphere of usefulness, the library had also been increased, the annual reports had become volumes, and the right-hand of fellowship, by an interchange of privileges, had been held out to the members of kindred Societies throughout the country. The Society had also given to science an instalment in the shape of the "Moss Flora" of the County, and acting on the Latin maxim "Vires acquirit eundo" gained strength by progress, and thus was enabled to extend its usefulness.

It might be deemed out of place in addressing a Natural History

Society to give reasons why its members should study some branch of Natural History, and carefully put down the localities, or rather approximate localities, of the different plants or animals collected or noted by them; but, at the risk of being deemed presumptuous, he felt it his duty to break a lance on the side of Natural History, properly so called, for there were naturalists *and* naturalists, one set of whom better deserved the name of *collectors:* many of these, so long as they added a new dried plant, stuffed bird, or set-out insect to their collections, fancied themselves naturalists, though they were deplorably ignorant of the habits and economy of not simply their latest additions, but of the greater part of their collections. He had no wish to depreciate collections; but simply to point out that these mere collectors were not, in the true sense of the word, naturalists. The proper study of Natural History induced observation of the living plant or animal, and might, or might not, be associated with collections.

If botany, or any branch of that delightful study were the hobby, it drew us from the smoke and bustle of town to wander amid the wild scenes of Nature, to search alike woods, crags, marshes, mountains, as each had its peculiar plants, in the search after which charms unknown or unnoticed by others unfolded themselves to the view, supplying, as had been said, "keys which give admission to the most delightful gardens which fancy ever pictures—a magic power, which unveils the face of the universe, and discloses endless charms of which ignorance never dreams." If insect life were the object of study, with what zest did we search for caterpillars, watched them through their changes and transformations, noted the differences of structure or design when passing to their dormant state; and then the enjoyment of seeing them emerge as perfect insects, gorgeous and glittering, endowed with instincts which prompted them to deposit their eggs in or upon the food of their progeny. Let either of these votaries add but the microscope, which ought to be a part of the equipment of every naturalist, and then what a world of wonders opened to the mind, enabling it to discriminate differences which the unaided eye never could detect, and to see that beauty and perfection ran through all Nature. But whatever the nature of the "hobby," let it not be selfishly pursued *alone;* let each have a companion, at least, to share the enthusiasm, for one of the greatest advantages of properly studying Nature arose from its sociability: there was a kind of freemasonry, which bound true naturalists together; above all, the profit derived from the study of Nature, would be in proportion to the accuracy of our knowledge of things and their properties.

Coming now to the direct object of the paper, the suggestions naturally resolved themselves under two heads—What the Society collectively, and the Members individually, could do "towards the verification of the Fauna and Flora of the County of Sussex." The expression verification was used advisedly, because since lists had been published in such works as "Horsfield's Sussex," some species had become extinct, while others, not given in any lists, had, by the energy of some naturalists, been added from time to time to what was before known. Again, Mrs. Merrifield's admirable "Natural History of Brighton" was, as its title implied, limited in its extent, while the whole County, with its varying conditions of geological features, together with a more extended knowledge of the marine productions, required carefully working out in a somewhat similar but extended manner.

First, as to the Society collectively, he would suggest that the Brighton Society became the conservator and depository of all lists which might be entrusted to it, from time to time, by its own members, by other kindred Societies, either in or out of the County, and by naturalists generally; the question of publication of such lists, and in what form, to be determined at some future period, *i.e.*, either by the Society alone, or by assistance from without.

Secondly, that it appoint Sub-Committees, from time to time, to collate and compare the different lists sent in.

Thirdly, that it invite the co-operation, in carrying out these objects, not only of naturalists within the County, but of all who had been known to work in any particular branch, and especially to request information respecting new species.

Next, as to the members individually, he would suggest that all who had worked or were working on any particular branch of Natural History should contribute lists, with the *approximate* localities of all species of plants or animals they had met or might meet with in the County of Sussex, noting in each case whether, in their opinion, the specimens were common, rare, or local, together with any facts respecting particular districts or localities in the County, in which each specimen was found, with time of appearance. This would especially refer to land and fresh water plants and animals. In regard to the Marine Flora and Fauna, the times and seasons when found should in every case be given, because so little was absolutely known at present of the times, seasons, and changes of most marine plants and animals.

To those members who had given but a general attention to Natural

History, or had not directed their minds to any special subject, he would suggest that they should record facts about anything which interested them, or, better still, take up some particular branch and work at it, for by so doing they might help forward the good work, while improving themselves and finding an occupation for times of relaxation.

Possibly some might say, "What shall we work at?" or "there is nothing new to be learnt." He answered the second objection by reminding them that Messrs. Davies and Mitten had added considerably to the Moss and Lichen Flora of the County, and that similar results might accrue from further observation of other branches.

Next as to the enquiry what to work at. First, there was the sea and its products. With such a coast as Sussex had, much had to be done and many a plant and many an animal, if not new to science, at least new to the known species of the County, would be the reward of the diligent worker. Among Microscopic Algæ much had been done by such indefatigable workers as Ralfs, Smith, and Jenner, and what they did in parts of the County should stimulate others to carry on their work more completely.

Both Cryptogamic and Phænogamic Botany opened a field for research; one branch had hardly been worked at all, and that was the "Fungi," an almost new field to any workers who might be tempted to turn their attention to them as objects of study. In Zoology there was plenty of scope for workers. The Land and Fresh-water Mollusks required looking up. As regarded Ornithology and Entomology no County presented such opportunities for work. Captain Knox and others had proved how rich Sussex was in birds, and now that the "Wild Birds' Act" was in force, not a diminution but an increase in the number of known species might be reasonably expected.

Several branches of Entomology required working, notably the Beetles, the Diptera, and Spiders. The Hymenoptera had some very diligent workers; among these their much-lamented friend, Dr. Ormerod, and Mr. Unwin. Though the Lepidoptera, from their attractiveness, had commanded more attention than any other branch of the insect world, yet the Tineæ were still open to study, and careful attention would, he felt sure, increase not only the number of known species among the moths and butterflies, but certainly add to the localities. As an illustration, he could scarcely believe *T. Empyræa* was confined to two localities, and *A. Australis* to one locality, in the county of Sussex, as stated in the manuals. He had, then, he thought, indicated many points, which would reward a diligent student, not that the list, however, was anything like exhausted, the salient points only had been taken.

As assistances to work, the library contained admirable monographs in every branch of Natural History, which would prove invaluable in determining the genus and species of the specimens obtained. And here a word of advice to all—never be ashamed to confess your ignorance when a specimen was submitted to you, and which you did not know; and do not think your dignity suffers in asking for information from anyone who had paid attention to particular branches of study. First, we could not be up in all the branches of knowledge, and, secondly, our best naturalists were wont to refer the unknown or doubtful to those who had made certain branches their special study.

To meet a difficulty respecting non-members in the County, it might be mentioned that the Society possessed the power of making anyone residing out of Brighton or Hove an honorary member, if he contributed specimens or interesting matter to the Society.

One other suggestion in conclusion. He would urge on all who might be willing to assist in carrying out the "Verification of the Flora and Fauna of the County of Sussex," that when they secured a specimen for their own herbarium, cabinet, or collection, they, where possible, should secure a duplicate, and forward it to the Society, to be deposited in the Brighton Museum, or such other local museums as might from time to time spring up in the County. Local museums should be rich in local things, and he hoped to see the Brighton Museum not only well stocked with the Natural History of the County, arranged as was intended, with a view to education, but that it might become the nucleus from which might arise similar educational collections in different parts of Sussex, a desirable end which might be accomplished by the accumulation of duplicates.

The President, Mr. G. SCOTT, in proposing a vote of thanks, said he considered the paper not only one of the most interesting ever read before them, but one likely to lead to very important results.

In reply to a remark from the Chairman, Mr. WONFOR said that though he had not expressly alluded to the subject of Geology, it would be seen that it was included in the title of the paper, if the words were taken in their fullest sense. He was quite opposed to the idea of treating Geology as something separate from Natural History.

After a lengthened discussion, in which many Members took part, it was resolved,—"That the Society approves of the suggestions embodied in Mr. Wonfor's paper, and requests the Committee to consider the best mode of carrying the same into effect, and to report to a future meeting."

APRIL 24TH.

MICROSCOPICAL MEETING.—MR. T. H. HENNAH ON THE SCALES OF FISH.

A system of arrangement of fishes by their scales, useful to geologists, but not definitive enough for existing fishes, had been devised by Agassiz, which divided scales into *ganoid:* enamelled angular thin plates, as found on the sturgeon and bony pike; *placoid:* irregular points or plates of enamel, as seen in the sharks and rays; *ctenoid:* horny or bony scales, with spinous or serrated margin, example, the perch; *cycloid:* smooth horny or bony scales, the posterior margin being entire, as seen in the salmon, herring, &c.

For a proper understanding of their place in comparative anatomy it would be well to consider more generally the "Exoskeleton of Fishes," of which they were the most common form, so as to include those families having bony coverings.

The hard shells of the Mollusca and Crustacea were external skeletons, requiring no internal support; between which and the highly organised fish the difference of structure was apparently great, yet, by a careful selection of examples, the transition was seen to be less sudden than a cursory examination would lead us to expect.

In some of the earlier fossil fishes, such as "Pterichthys" and "Coccosteus," the body was partially covered by bony plates, so dense and firmly anchylosed as to constitute a dense shell, which, according to Owen, was accompanied by an arrest of the development of the internal skeleton, at an early embryonic stage. There was a recent example in an Indian fish, the "Pimelodus," which had been compared to an old dragoon in helmet and cuirass for head and thorax, but with unprotected nether extremity, which, with wise instinct, it buried in the mud-banks of the Ganges, while its armoured portion was extended in search of food.

From such examples we proceeded to the *Ostracionidæ* and *Syngnathidæ*, the Box and Pipe Fishes, which were covered with less dense bony plates, but which, in the former, were anchylosed so firmly as to be immovable except at the tail and fins. Thence to the Sturgeons, covered with broad shield-like plates, and on to the Sharks, Rays, and Skates, having their outer surfaces studded with spines and tubercles. The plates of the Sturgeon were covered with enamel, and were of a true *bony* structure with lacunæ and canaliculi, while the spines from the Skate and Shark were *tooth-like* in structure and hardness, and sometimes were, both in external and internal character, so like teeth that they might be mistaken for them. Associated with these external characters we invariably found an imperfectly-developed or cartilaginous skeleton.

In the *Osseous fishes*, with which we were most familiar, the *bony* skeleton was accompanied by an outer covering of horny and elastic scales, beautifully and regularly imbricated, smooth, and impervious to water, and arranged so as to offer the least possible resistance to the movements of the fish in the dense medium it inhabited.

In the *Ctenoid* fishes, such as the Sole, Basse, Perch, &c., the comb-like scales projected through the epidermis; but in *Cycloid* fishes, such as the Carp, Herring, Salmon, &c., they were completely covered by it. In the Eel—a *Cycloid* fish—the scales were so deeply buried in the slimy skin as to escape general observation.

Scales were true cuticular appendages, each imbedded in a separate sac or fold of the cutis, to which its under surface was adherent, while externally it was covered with epidermis and pigment cells. Scales were, in fact, mostly made up of layers of horny matter, secreted by the cutis in the same manner as the shells of Molluscs; the smaller and more superficial layers being first formed, while the larger and more recent lay beneath them and were in contact with the living skin. The radiating lines seen on most scales seemed, at first sight, inconsistent with the explanation just given of their mode of growth. It was, however, supposed that, after a few layers had been formed, they began to split by contraction in becoming solid, and that the lower layers were formed after each upper one had hardened, exceeding it a little in size and filling up the slit, giving rise to both radiating and concentric lines.

In the scales of the Carp the outer layers were as just described, while the inner layer was composed of numerous laminæ of a fibrous character, the fibres of each lamina crossing at different angles those of the laminæ in contact with it; between the two layers was a structure of calcareous concretions, chiefly arranged near the centre of the scale. Similar arrangements were seen in many scales, though differing slightly in the form of the concretions, and in some old and thick scales good specimens of the so-called dumb-bell crystals could frequently be found.

Scales from different parts of the same fish presented very different forms, although the same general character was maintained, except in some rare instances, such as Pilchards, in which the ventral line was supplied with scales altogether different both in form and character from those covering the other parts of the body. On most Fishes what was called the "lateral" line was composed of scales perforated by tubes externally large in diameter at the head, and becoming gradually smaller until at the junction with the tail they were scarcely to be perceived. Most of the Cycloid Fishes have a brilliant lustre, derived, not from the Scales, but from a layer of pigment and spiculæ seen through their transparent substance. These spiculæ were of constant form—that of a flat oblong prism, with angular ends. They were transparent by transmitted, but had a lustre almost metallic by reflected, light. When removed and placed in water for observation under the microscope, they were seen to be in constant motion, which was not interrupted even for some days after removal.

The authorities on the subject of scales were "Williamson," in "the Philosphical Transactions," "Yarrell," "Owen's Palæontology," "Gosse's Evenings with the Microscope," and Rhymer Jones' "Animal Kingdom." For the purpose of illustrations, and by the kind assistance of Mr. T. Curties and Mr. Wonfor, he had brought down a number of scales, &c.

After a vote of thanks to Mr. Hennah, and an interesting discussion, in which Dr. HALLIFAX, Messrs. HOLLIS, PAYNE, G. SCOTT, HENNAH, and WONFOR took part, the meeting became a conversazione, when scales illustrative of the paper were exhibited by Messrs. R. Glaisyer, T. H. Hennah, Wonfor, and Dr. Tuthill Massy.

Mr. T. H. HENNAH called attention to the wooden slides exhibited at the previous meeting ; they possessed the advantage of not being air tight ; they allowed the moisture to pass through the wood, and prevented fungus-growth on objects mounted in them.

Mr. WONFOR also called attention to Canada Balsam and damar dissolved in benzole, as affording great facility in mounting. This led to a conversation on the comparative merits of these two preparations and pure thin balsam, in which it was shown there were advantages in the last-named over any other form.

May 8th.

ORDINARY MEETING.—MR. F. E. SAWYER ON THE CLIMATE OF SUSSEX.

Although many observations on this subject had been made and published, yet no reliable information had been published hitherto except Mr. Prince's work on the "Climate of Uckfield," and the "Quarterly Reports of the Registrar-General." The observations he had sifted out were from reliable sources. In considering the physical geography of the County, the Downs divided it into two districts—the Coast, or *insular*, having an equable climate, an average humidity, a small daily variation of temperature, and a smaller rainfall; and the Inland, or *continental*, with an extreme climate, greater daily ranges, and a larger rainfall.

The highest temperature registered was at Uckfield, an *inland* station, 98° on July 14th, 1847; and the lowest, 4° below zero, January 20th, 1838; giving an extreme range of 102 degrees. On the coast the highest was at Brighton, July, 1852, 90°, and the lowest at Eastbourne, January, 1867, 10°; giving a range of 80 degrees. Extreme ranges were considered trying to the constitution.

Taking the mean temperature of the last five years at Worthing, Brighton, Eastbourne, and Hayward's Heath, it was found that Eastbourne was slightly higher than Worthing, Worthing than Brighton, and the last-named than Hayward's Heath; but so closely did they run that a mean annual temperature was very fallacious; for, comparing the daily ranges, it was found that Worthing and Brighton were about the same, Eastbourne about two degrees higher, Hayward's Heath still greater, and Uckfield half as much again as Brighton.

Popular opinion made westerly winds to prevail in the county ; but this was not found to be so by observation ; the average being 96 days for Uckfield, and 68 days for Brighton. The land and sea breezes during the summer months greatly influenced the climate of places on the coast. He had observed them blow on 21 days in the year. The temperature at Brighton seldom rose more than two degrees between nine a.m. and two p.m., owing to the land and sea breezes. The rainfall he had discussed last year in a paper before the Society.

Observations on atmospheric pressure were of no use unless carried on with standard barometers. These, corrected for index error and reduced to the temperature of 32° for sea level, gave, as the mean pressure for 17 years, at Uckfield, 29.982 inches. The highest pressure observed was at Uckfield, Jan. 10th, 1859, 30.824 inches ; the lowest at Worthing, 28.432, three a.m., Jan. 24th, 1872.

In an inland district the humidity was far less than on the coast, in the winter the latter being within 10° of saturation. In March, April, and October, sea-fogs occurred, probably connected with land and sea breezes. These were distinguishable from land fogs, which only prevailed in a calm, while the others were accompanied by wind.

Among remarkable phenomena were storms and incursions of the sea. In 566 a violent storm visited Kent, Sussex, and Hants. In 995 there was a hurricane at Chichester. In 1280 a violent storm, among other damage, destroyed 300 houses and churches at Winchelsea. Another, in 1287, drowned Winchelsea, and diverted the Rother from Romney to Rye. Many encroachments of the sea happened between 1260 and 1340 : 40 acres of land were washed away at Brighton, 160 at Hove, 40 at Aldrington, and 40 at Middleton. Early in the 14th century, 2,700 acres were submerged, and Pagham Harbour formed. In 1432, Shoreham was so encroached upon that the population was reduced from 500 to 36. The great storm of 1570 deepened Rye Harbour, formed the old Harbour at Newhaven, and washed away the Pier at Hastings. According to De Foe, the Great Storm of 1703 did great damage at Shoreham and Brighton. Several whirlwinds were recorded : one at Selsea Bill on January 20, 1840, when four fishing-boats were lifted a considerable height into the air and shattered. On August 3rd, 1848, £300 damage was done to the booths on the Race-hill, Brighton, by a whirlwind.

Records of waterspouts were numerous. A schooner off Brighton was struck by one in 1823, and lost a man and a mast. December 17th, 1836, a snow avalanche fell from the Cliffe Hills at Lewes.

Mock suns had also been seen: two at Rotherfield, Feb. 17th, 1635; one at Brighton, March 24th, 1861; and four halos. Only one mock moon was recorded, viz., May 2nd, 1863, at Brighton, with a lunar halo. Twice only had the sea been frozen in Sussex. The first time was in 1788, on December 22nd, during one of the most severe frosts of last century. On the receding of the tide, the water within the sand-bar was frozen over, and the Lewes paper of that date says— "Last Monday, we are told, the sand at Brighthelmstone, at neap tide, was covered with a most beautiful sheet of ice, and such as would have afforded excellent diversion to skaters had there been any there to have enjoyed it." The other occasion was on February 17th, 1855, during a very severe frost, when the temperature on the King's-road, Brighton, fell to 12 degrees. A sheet of ice, a quarter of an acre in extent, was seen at Black Rock by the coast-guard; and, at Bognor, the sea at low-water was said to be like a frozen lake.

In the following table are given the mean monthly temperatures of the five years ending 1872, for four stations, three on the coast and one inland:—

Months.	Coast.			Inland.
	Worthing.	Brighton.	Eastbourne.	Hayward's Heath.
	deg.	*deg.*	*deg.*	*deg.*
January	39·7	38·7	39·7	38·4
February	42·9	42·2	43·1	42·5
March	43·4	42·3	43·6	42·9
April	49·1	48·9	49·7	49·4
May	53·0	53·3	53·9	53·3
June	58·6	58·9	58.8	58·4
July	63·9	64·2	64·7	64·7
August	62·9	62·9	62·4	62·9
September	59·8	59·0	59·6	59·0
October	52·2	50·4	51·3	50·3
November	44·1	43·0	44·1	42·5
December	41·0	39·7	41·2	39·7
Mean	50·9	50·3	51·0	50·3

And the mean monthly daily range of temperature for the five years ending 1872 for Worthing, Brighton, Eastbourne, and Hayward's Heath, the means for Uckfield being for the 28 years ending 1870 :—

Months.	Worthing.	Brighton.	Eastbourne.	Hayward's Heath.	Uckfield.
	deg.	*deg.*	*deg.*	*deg.*	*deg.*
January	8·2	7·2	8·7	9·8	10·2
February	7·9	8·3	8·6	10·5	12·4
March	10·9	10·7	12·9	13·6	16·1
April	13.7	13·5	16·1	18·1	20·2
May	14·8	15·7	17·4	19·5	21·8
June	13·5	16·3	17·5	20·5	22·8
July	13·8	14·5	17·5	20·7	22·6
August	14.6	13·5	16·3	19·1	21·8
September	13·1	12·0	15.1	17·2	20·2
October	12·9	11·5	14·3	15·5	15·8
November	9·9	8·5	10·1	11·4	12·6
December	8·0	7·2	8·5	9·4	10·1
Mean.	11·8	11·6	13·6	15·4	17·2

May 22nd.

MICROSCOPICAL MEETING.—DR. HALLIFAX ON "POLLEN."

Pollen—Pollen grains, or, more correctly, Pollen cells, though minute bodies, performed a very important part in the functions of the reproductive organs of the Phœnerogams. Before treating of the Pollen, it might be well to consider the whole of the parts of the organs of which they formed a portion. These organs were the *pistils*, occupying the central part of the flower, around which were arranged the *stamens*; and these two bodies, sub-divided into different parts, constituted the entire reproductive system of Phœnerogams. The *stamens*, as would be seen by some admirable preparations by Mr. C. P. Smith, consisted of a filament, sometimes sessile, and the anther—a cellular organ containing the Pollen. The pistil, composed of three parts, though apparently foreign to the subject, must be considered, if we wished rightly to understand the question.

Its three parts were the *ovary*, composed of carpels, containing the rudimentary structure of the seed ; the *style*, a stem rising from the ovary, and terminated by the *stigma*, a very important organ, because the Pollen cells falling on it performed a very marvellous function. The stigma had a fleshy substance, possessing the power of secreting a sticky, honey-like fluid, by means of which the Pollen became adherent.

The Pollen Grains, which were produced in great abundance, resembled a yellow or other coloured dust, very diverse in form, but generally either spherical or oval in shape, though other geometrical forms were known. Their surface, under a low power, was seen to be corrugated, reticulated, depressed, &c., and covered over with points, fissures, or slits. Looked at anatomically, it consisted of an outer covering composed of two coats and the cell contents. The inner coat was of extreme delicacy and fineness. Within was a fluid, containing minute granules.

Physiologically, the Pollen Grains were very important. As soon as the pistil and stamen were matured and prepared to co-operate with each other, the lobes of the anther became fissured, when the Pollen Grains were shed abroad, and fell or were conveyed to the summit of the Pistil. Here a remarkable phenomenon occurred, in which it was seen that the Pollen Grains were endowed with a very striking character, as manifested by the results ; for they at once underwent a change.

From the fissures or slits the membrane protruded, and, gradually advancing, formed itself into a delicate tube from the 1-4,000 to 1-7,000 of inch in diameter, which, penetrating through the cellular tissue, at whatever point it became adherent, and not necessarily, as some thought, along the axis of the pistil, it insinuated itself through the whole length of the pistil,—sometimes several inches long ; in some cases this was accomplished in from three to four hours ; in others it took weeks ; but eventually finding its way into the ovary containing the primordial seeds. Here, ceasing to elongate, the extremity of the tube reached that part of the ovule called the *micropyle*, when, having performed its office, it died.

Changes now took place in the ovule, which, but for the influence of the Pollen Grains, would have remained sterile, and have gone for nothing. It now assumed great activity, and, by gradual changes, became the seed itself. This was saying a great deal; for that insignificant seed contained the embryo of the future plant, the embryo containing the radicle, stem, and a leaf, sometimes so large as to be seen by the eye. It was truly marvellous that these results should be brought about by so insignificant an agent as the Pollen, which converted the primordial seed into a poppy or oak, as the case might be: changes worked out by what we call vital power, beginning as it did in so humble a way, and ending in such important results. Whatever is the plan or pattern laid down for the Pollen Grains, that is the plan or pattern of the future plant. Thus the Pollen of the Polyanthus always produces a Polyanthus, and nothing else. He had brought for illustration a number of specimens, in addition to objects kindly furnished by Messrs. Curties and Wonfor.

A very cordial vote of thanks was given to Dr. HALLIFAX, when an interesting discussion followed, in which the President (Mr. G. SCOTT), Dr. HALLIFAX, Messrs. C. P. SMITH, PAYNE, T. GLAISYER, and WONFOR took part, the last-named gentleman stating that Dr. HALLIFAX'S modesty prevented his saying that he had not only worked out this subject years ago, and had made sections to show the Pollen-tube passing through the pistil, but had exhibited photographs showing the same thing last year during the British Association Meeting.

The meeting then became a conversazione, when some very beautiful objects, including the photograph referred to representing the Pollen-cells entering the stigma of the evening primrose, were exhibited by Drs. Hallifax and Badcock, Messrs. R. Glaisyer, C. P. Smith, W. H. Smith, F. E. Sawyer, and T. W. Wonfor.

Later in the evening some slides, obtained by the distillation of coke, were shown by Mr. Wonfor.

JUNE 12TH.

ORDINARY MEETING. — MR. J. J. SEWELL ON "COPROLITES."

He had been induced to introduce the subject of the "so-called Cambridge Coprolites," or phosphatic nodules, in comparison with the true "Coprolites" of Lyme Regis, from a two-fold motive: 1st, from the pleasant recollections of former years, when, in Suffolk, he first became acquainted with Mr. Charlesworth, then a zealous student, observer, and worker in geology, which he had made, with kindred subjects, the pursuit of his life, while with himself it was but as an amateur that he paid attention to geology; 2ndly, because it had been brought before the notice of the Society and the public upon two or three occasions, when, in his opinion, there had been misinterpretation of the views of the original introducer of the subject, and because he considered the opinions expressed by eminent geologists, at times referred to as antagonistic to Mr. Charlesworth's views, did not warrant the interpretation put upon them.

Referring to the discovery by Henslow of the "phosphatic nodules" of Felixtow, Suffolk, and believed by him to be identical in composition with those of Lyme Regis, he remarked that among those who shared this belief was Packard, of Ipswich, who, learning, when he was residing at Cambridge, that "a so-called coprolitic deposit" had been discovered in the greensand, communicated with him, and eventually embarked in an extensive speculation, profitable to himself and to agriculturists; the yield of phosphatic matter being 270 tons per acre and worth 50s. a ton. He would remind them that, in March, their Honorary Secretary had exhibited "coprolitic and other organic remains from the coprolitic beds at Cambridge." He was not present, but at the next meeting he asked Mr. Wonfor "Whether he interpreted the word Coprolite, as applied to the substances in question, to mean literally what the term implied, viz., the fœces or dung of animals?" The reply was, "If taken literally, most certainly." He then took exception to the statement "that all the leading geologists of the day proclaimed them to be of the coprolitic origin." It was then suggested he should read a paper on the subject.

Reference was then made to Mr. Scott's (the President) paper on "Suffolk Tertiaries," upon which occasion Mr. Charlesworth asserted that the nodules of Cambridge and Suffolk were unlike the true coprolites of Lyme Regis, being mere stones, whose formation was similar to that of the chalk flints. Exception was next taken to the deductions drawn from the papers read before the Geological Society by the Rev. O. Fisher, on Phosphatic Nodules of the Cretaceous Rock of Cambridgeshire, and by Mr. Sollas on the Upper Greensand Formation of the same County, and the opinions expressed by Professor Phillips, Mr. Godwin Austin, the Rev. T. G. Bonney, Professor Morris, Mr. T. J. Walker, and Mr. Forbes, gentlemen of high geolog:ᵣal status, said to favour the Coprolite theory, but whose expressed opinions did not, he thought, bear out the interpretation put on them. In opposition, and as bearing out Mr. Charlesworth's views, Mr. Scott, Mr. J. E. Taylor, Author of "Geological Stories," Mr. Seeley, and Mr. Packhard, were quoted. The last-mentioned had not only sent the specimens on the table, but had written "The Phosphatic deposits of the greensand differ from those of Lyme Regis. I quite believe coprolites, or dung stones, is an improper name for all these phosphates except Lyme Regis, where you may see it in the bodies of what were once living animals and afterwards fossilized; but Suffolk crag or greensand deposits are mere bones. Within the last four years some remarkable discoveries had been made in the south of France. The phosphate occurs there in massive rocks and *débris*, in the interstices of the limestone rocks."

He was induced to refer to this statement, as it indicated a possible source other than Coprolite for the production of phosphatic substances. After alluding to the discoveries by Buckland and Henslow of the Lyme Regis and Suffolk deposits, he next compared the two kinds. The true were spirally twisted, corrugated, and contained scales of fishes and sometimes bones and teeth. The "so-called" were round, cylindrical, pyriform, &c., but more commonly amorphous. Sections of the true showed scales, teeth, &c., while the "so-called" were homogeneous and without scales.

There was no doubt of the origin of the "true," but another for the "so-called" must be sought. Not only the rocks mentioned by Mr. Packard, but many others, contained apatite, or native phosphorite of lime,—a substance so rich in phosphate as to contain from 85 to 87 per cent. As this substance so abounded in rocks of the present day, it was but reasonable analogy to infer its existence when these "nodules" were formed, and to assign their formation to this cause rather than to the coprolitic. He considered, as Mr. Charlesworth had asserted, their origin bore a great similarity to that of flints. A flint was said to be formed by a chemical process,—might not these be similarly formed, phosphoric acid supplying the place of the silica of the flint formation? The verdict as to whether Mr. Charlesworth's two propositions were right or wrong he left in their hands.

After a cordial vote of thanks to Mr. Sewell for his paper, and ten minutes devoted to an examination of the specimens and diagrams,

Mr. Wonfor, opening the discussion, remarked that he never claimed all phosphatic nodules as Coprolites in the exact sense of the term, but contended that they were all of an organic origin, in contradistinction to being *mere stones*. The chloritic marl of Cambridgeshire contained true Coprolites, though they were of infrequent occurrence, and Coprolites were not confined to the Lyme Regis deposit, but were found in other formations, both of older and more recent date. Of this there was no reasonable doubt among geologists. Mr. Sewell had advanced nothing to confute, but rather to confirm, his views.

It had been pointed out by Bischoff that, while apatite dissolved in over 300,000 parts of water, phosphate of lime, derived from animal matter, dissolved in from 2,823 to 4,610 parts of water. It was also shown by the same authority that the excreta of animals and bones yielded from 23 to 60 per cent. of phosphate of lime. He considered, therefore, the organic origin was more feasible than the mineral and purely chemical. As regarded the absence of corrugations, it should be recollected that those in dispute had been washed out of an older formation, and had been, like all the fossils associated with them, eroded; whereas the Lyme Regis ones were found *in situ*.

The President (Mr. SCOTT) urged that Mr. Sewell had yielded the whole question, for all that was advanced by himself and Mr. Wonfor was, that, while Coprolites strictly meant fossilized fœces, yet the term had, almost by general consent, been so extended that it included all fossilized animal matter, and that the phosphatic nodules, even when not Coprolites in the strict sense, were yet included under the general term coprolitic. In this sense it was used by the Geological Society.

True coprolites were found in various formations, but retained their form best in the soft lias, because of very favourable conditions. Coprolites of fish from the coal shale in the neighbourhood of Edinburgh had been found in great numbers. In the Brighton Museum were three iron-clay nodules, brought by Mr. T. Davidson from Scotland, and each enclosed an undoubted Coprolite of a voracious fish. These had been washed out by the tide from the shale beds of the coal formation. They had been shown to Professor King, of Queen's University, and he expressed an opinion, not only that they were true Coprolites, but that it was a narrow-minded view to question their existence in such a bed as that at Cambridge, because of the fact that the associated bones of reptiles had been derived from an older formation, for if the bones had been so derived, why might not the Coprolites? Without mentioning all the formations in which the Coprolites had been found, Kent's Cavern yearly gave them in Mr. Pengelly's reports, while Mr. Davidson's recent additions to the Museum of his fine collection from the Paris

Basin, and Mr. Willett's collection from Wookey Hole, contained specimens of undoubted Coprolites.

Mr. HOWELL expressed himself in favour of Mr. Sewell's views.

Mr. PANKHURST thought from the paper that Messrs. Scott and Wonfor held views of a very antagonistic nature to those of Mr. Sewell, but, it appeared, both admitted Coprolites. The point at issue was, were they of mineral or organic origin? The case seemed to him made out in favour of the latter.

Mr. B. LOMAX pointed out how far conjecture from imperfect data might be from the actual truth of the origin. It was true that the scales of fish were found in the one set of fossils and not in the other; but might not this be accounted for by supposing that the latter animals had not a chance of eating the same kind of fish?

Mr. SEWELL, in reply, said that his paper was based on the idea that the term Coprolite would be understood on the opposite side in its strictest meaning.

JUNE 26TH.

MICROSCOPICAL MEETING.—GENERAL EVENING.

Mr. WONFOR called attention to some slides, the cells of which were made of different coloured cements; in some, the cell was built up with a white cement and finished off with concentric rings of different colours, presenting an appearance of what might to some appear a pretty cell; but, apart from this, a material new to the generality of microscopists had been employed. Dr. Hallifax, to whom he shewed them some little time since, had been experimenting, and had not only produced slides similar in appearance, but had obtained what he considered a trustworthy cement.

He would, therefore, suggest that "Cements" form the subject of the next Microscopical Meeting, and that Dr. Hallifax be asked to give them the results of his experiments. They had received many useful hints at different times from the Doctor, and he did not doubt at the next meeting he would give them a few more.

He also had to bring to their notice some slides of sections of insects cut through the optic apparatus by Mr. J. S. McIntyre, similar to the section of insect eye exhibited on the occasion of Dr. Hallifax's paper on the "Invertebrate Eye," in which the several parts were seen *in situ*. The preparations were mounted in Canada balsam. Mr. Curties had also kindly sent him a preparation of the head of the blowfly, mounted in fluid, in which, while the several parts retained their natural form, the whole was transparent. Among other parts he might call attention to the central teeth on the disc of the proboscis, which stood out admirably.

The meeting then became a conversazione, when many very interesting objects were exhibited by Messrs. WONFOR, SEWELL, R. GLAISYER, and SMITH, the last-named showing some beautiful coal sections, made by himself.

JULY 10TH.

ORDINARY MEETING.—REV. E. N. BLOOMFIELD, ON "THE MACRO LEPIDOPTEROUS FAUNA OF GUESTLING AND ITS IMMEDIATE NEIGHBOURHOOD."

The greater part of the insects enumerated had occurred in the immediate vicinity of the Rectory, some few in a heathy wood at Pett, and a few also near the sea in the same parish. The district lies on the central axis of the Wealden on the Hastings sands, much of the soil however being stiff clay.

The Diurni were very poorly represented by 32 species, scarcely any of the rarer species occurring, the best, *Colias Hyale* and *Vanessa Antiopa*, having only occurred as single specimens, and the same might be said of *V. comma album*, and *Argynnis Aglaia*, or *Adippe*, for he could not determine which species was represented by the ragged specimen which he had seen in 1870.

Of the Sphingidæ, excluding Anthrocera, he had only met with ten species, the great deficiency being in the genus Sesia of which he had but one, *cynipiformis*. *Smerinthus tiliæ* had not occurred, but the other two, *S. populi* and *ocellatus* and *Sphinx ligustri* were met with, the two latter commonly, as also *Macroglossa stellatarum* in most years. *S. convolvuli* appeared not uncommonly in 1868 and 1869, and the larva of *Acherontia Atropos* was met with occasionally—in two instances he had had the olive-coloured variety of the larva brought to him. To these might be added *Chærocampa Elpenor* and *C. porcellus*, of which species he had taken single specimens. The Bombyces and their allies were somewhat better represented, mustering 39 species. The rarer species were *Limacodes testudo*, *Nola strigula*, *Lithosia aureola*, *complana*, and *quadra*, while the beautiful *Arctia villica* was abundant.

The Geometræ were found here in great force, as he had met with 142 species, and had probably omitted to recognize some of the *Eupitheciæ*. The rarer species were *Selenia lunaria*, *Eurymene dolobraria*, *Pericallia syringaria*, *Ennomos erosaria* and *fuscantaria*, *Boarmia consortaria*, *Tephrosia consonaria*, and *extersaria*, *Phorodesma bagularia*, *Ephyra orbicularia*, *Eupisteria heparata*, *Acidalia rubricata*, *Macaria notata* and *alternata*, *Emmelesia unifasciata*, *Eupithecia irriguata*, *expallidata*, *dodoneata*, and *fraxinata*, *Lobophora sexalata*, *Camptogramma fluviata* and *Cidaria picata* and *silaceata*. He had left to the last what was probably the rarest of all—a damaged specimen of *Acidalia strigaria*. The pretty genus *Ephyra* was represented by all its species, as was also *Hybernia*, and several smaller genera.

Of the Drepanulœ there were four species ; only *unguicula* being absent of those which might be expected to occur. The Pseudo Bombyces numbered eleven species—the more uncommon were *Dicranura furcula* and *bifida*, *Clostera curtula* and *Notodonta dodonæa*. Several of this division were taken at light ; in fact, *Notodonta Camelina* and *Ptilodontis palpina* came pretty freely.

The Noctuæ were also very fairly represented, amounting to 139 species. Of the rarer species he might notice *Cymatophora fluctuosa* and *ridens*, *Diphthera Orion*, *Acronycta auricoma* and *leborina*, *Neuria saponariæ*, *Apamea fibrosa*, *Agrotis saucia*, *Teniocampa miniosa* *Hoporina croceago*, *Tethea subtusa* and *retusa*, *Aplecta tincta*, *Hadena*

Suasa and *genistæ*, *Cucullia asteris*, *Heliothis marginata* and *Plusia V. aureum*. On the other hand, some species seemed to be entirely absent that were usually reputed common, as *Apamea gemina*, *Noctua augur* and *C. nigrum*, while the following were scarce—*Agrotis nigricans*, *Anchocelis lunosa* and *litura*, and curiously enough *Teniocampa instabilis* and *Apamea basilinea*.

Of the Deltoidæ, there were eight species, the best of which were *Hypenodes albistrigalis* and *Herminia derivalis*, which used to be considered a rarity when he first took it. The *Pyralides* were badly represented by 30 species, but among them was one rarity, *Agrotera nemoralis*, while *Odontia dentalis* and *Stenia punctalis* occurred on the coast. To these might be added *Ennychia octomaculalis*, *Botys lancealis*, *Pionea stramentalis*.

He had neglected the Emdorea, or might have a better account to give. Of the *Crambites*, he had met with 25 species: of these 12 belonged to the genus *Crambus* and 12 to *Phycidæ*, the remaining species, *Chilo Phragmitellus* to the *Chilidæ*. Those most worth notice were *Crambus selasellus*, *Anerastia lotella*, *Cryptoblabes bistrigella*, *Phycis betulella*, *Meliphora alveariella*—two specimens of the latter were taken flying in Guestling wood. The remaining species of the *Phycidæ* were all interesting, but it would make the list too long to insert them. Of insects which might be expected to occur, being generally common, but which seemed entirely absent, the following seemed worthy of notice. *Argynnis Paphia*, *Sesia tipuliformis*, *Lithosia rubricollis*, *Acidalia incanaria*, *Noctua augur* and *C. nigrum*, *Apamea gemina*, *Cosmia affinis*, *Hydrocampa stagnalis*, *Ebulea sambucata*, and *Scopula luteatis*. While the following insects were either very rare or extremely local: *Nola cucullatella*, *Liparis auriflua*, *Ennomos angularia*, *Himera pennaria*, *Strenia clathrata*, *Anticlea badiata*, *Hydraecia micacea*, *Agrotis nigricans*, *Miana fasciuncula*, *Noctua umbrosa*, *Teniocampa instabilis*, *Anchocelis lunosa* and *litura*, *Hadena oleracea*, *Mania typica*, *Hypena proboscidalis*, *Cataclysta lemnalis*, *Ennychia octomaculalis*, *Botys lancealis*. Both these lists might be considerably extended.

Those who remembered Mr. Barrett's "Lepidopterous Fauna of Haslemere" (in Ent. Month. Mag., vol. v., p. 211), would know how very much the Fauna of Haslemere and Guestling corresponded; and he could adopt from the latter, in its entirety, Mr. Barnett's concluding remarks: —"This scarcity or absence of usually common species is, however, less remarkable, when we take into account the fact, that though so many species are found, the great majority of them are individually scarce, so that insects are really far less abundant than in many other places. Hardly any species comparatively were pests, while great numbers on the list were represented by but one or two specimens."

He would conclude by bringing into one view the numbers in the different groups: *Diurni*, 32; *Sphingidæ*, 10; *Bombyces, &c.*, 39; *Geometræ*, 142; *Dreponulæ*, 4; *Pseudo-Bombyces*, 11; *Noctuæ*, 139; *Deltoides*, 8; *Pyralides*, 30; *Crambites*, 25; total, 440. On comparing this summary with the Haslemere list, it would be seen that it fell considerably short. This might be accounted for, partly by the far more restricted area over which he had collected, and also to his being a far less energetic collector than his friend, G. C. Barrett. He doubted not that he should still meet with many unrecorded species, as he had met with fifty-one new species since 1869, and none of these had been very good collecting years. The names given, it might be mentioned, were taken from Mr. Doubleday's catalogue, second edition.

A vote of thanks having been passed to the author of the paper, an interesting discussion followed. Mr. WONFOR and Mr. H. GOSS pointed out that several species mentioned by Mr. Bloomfield were far more common in the neighbourhood of Brighton. This part of Sussex, in fact, was particularly rich in the Macro Lepidoptera. In 1860, Mrs. Merrifield stated that 570 of the 842 known species were found within a few miles of Brighton, and the list had been considerably increased since then. *Leucania Vitellina*, *Extranea*, and *Synia Musculosa* were first found at Brighton. Up to 1871, *Deiopeia Pulchella* was very scarce, but several had since been taken.

VERIFICATION OF THE FAUNA AND FLORA OF THE COUNTY.

Previous to the reading of the above paper, the following Report of the Committee was approved and ordered to be acted upon:—

"The Committee, having carefully considered the suggestions contained in Mr. Wonfor's paper, beg to recommend that the following circular be sent to Members of this and kindred Societies and to naturalists generally:—

BRIGHTON AND SUSSEX NATURAL HISTORY SOCIETY.

SIR,—

This Society has determined to collect facts in connection with the Natural History of Sussex, for the purpose of verifying existing

Lists, and preparing (with a view to ultimate publication) an authentic systematic record of the Land and Marine Fauna and Flora of the County.

We, therefore, have been instructed to solicit your co-operation in so important an undertaking.

We shall be much obliged by your assistance in any or all of the following ways :—

1stly. By forwarding to the Society lists of such species as may have fallen under your own *personal* notice.

2ndly. By contributing facts relating to such points as

*Approximate** locality :
Whether rare, local, or common :
Accidental variations :
Apparent extinction and re-appearance :
Times of appearance :
Any noteworthy matters connected with the life history of species : and

3rdly. By sending specimens to be deposited in the Brighton Free Museum or other Museums in the County.

Communications will be thankfully received by Mr. R. GLAISYER, Honorary Curator, Dispensary, Queen's Road, Brighton ; or by us.

We are, Sir,
Your obedient Servants,

T. W. WONFOR,
JNO. COLBATCH ONIONS, } *Hon. Secs.*

And that Mr. R. Glaisyer be requested to act as Honorary Curator."

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* In order to prevent the extirpation of rare species, the approximate, and not the exact, locality is asked for.

JULY 24TH.

MICROSCOPICAL MEETING.—DR. HALLIFAX ON "CEMENTS."

All who had mounted objects for themselves had some objection to the different cements and varnishes recommended in the manuals on the Microscope. Against some the objection was that after a time they cracked and peeled off; others gave off exhalations which not only clouded the covering glass, but spoilt the object; this latter fault belonged to all varnishes or cements containing oily substances. Dr. Carpenter, no mean authority, and one who had had considerable experience in the matter, advised that all valuable slides should be varnished annually to preserve them, thus showing, as the result of his experience, the untrustworthiness of the cements generally used.

There was one cement, though recommended in books, against which, so far as his experience went, such objections could not be raised, viz., sealing wax varnish or cement. This arose, he considered, from the nature of its composition, which, according to Ure, was 20 per cent. Canada balsam, 50 per cent. shell lac, the rest colouring matter, and a drop of Balsam of Tolu. A cement, formed by dissolving the best sealing-wax in spirit he had used now for years, and found neither leakage, chipping, flaking, nor exhalations; in fact, as far as his experience went, it was the most trustworthy cement he knew.

Some little time since Mr. Wonfor showed him some slides which had been sent him by Mr. Curties, the cells of which consisted of concentric rings of different colours; some presenting, perhaps, a fancy appearance, but, at the same time, it struck him, they were composed of a new cement. After various experiments he came to the conclusion that Canada balsam was the basis of the material. It would be seen by the slides which he and Mr. Wonfor would exhibit, that if he had not produced what he considered an identical cement, he had obtained one of a perfectly trustworthy character. He had mingled with the Canada balsam different pigments, and should it be objected that litharge added to gold size made it more untrustworthy, he might remark that gold size was an oily preparation, while Canada balsam was not.

Canada balsam was the simplest, purest, most manageable, and best working of all media in which to mount objects, and if it could be made workable with a brush it would then become a cement. Now, it was known to be soluble in various substances—such as ether, chloroform, and turpentine, none of which, from various reasons, he should recommend, but another solvent, viz., benzole, which he had used for some time. Since employing it as a solvent his views of its value had been confirmed by what Dr. Bastian had written in the *Monthly Microscopical Journal*. Canada balsam, when thinned by the admixture of benzole, dried rapidly, and readily mingled with insoluble substances, in fact, formed paints.

Bearing in mind that lead was used in the manufacture of paints, and that white lead was the basis of some cements for repairing china and glass, he thought that if he blended white lead with balsam he should obtain a trustworthy cement. Taking, then, Canada balsam and white lead he had experimented and produced the results he had handed round. He had found the greatest difficulty in removing a covering glass fastened by this medium, and the specimen of two pieces of glass united by it showed how tenacious it was. There was an additional advantage in this cement, it would take any colour, viz., such pigments as were used by the colourmen in making paints.

His mode of operation in making the cement was to rub down with a spatula, on a piece of glass used as a slab, white lead with balsam thinned with benzole until it was thin enough to run freely with a brush. For a thicker cement more lead should be added. To obtain the coloured rings seen on some of the slides, the powdered pigment obtainable at the painter's had been rubbed down in the same way.

If colour, or the addition of an insoluble substance was objected to, then balsam, thinned with benzole, could be used alone. In the majority of the slides he had prepared, he had put the white over the old mountings, and then added the coloured rings. They dried very quickly, and acquired a high polish. Some other balsams or resins might be found which would do as well, but he preferred Canada balsam, because it was easy of working and of great durability, while the white lead gave it body, firmness, and drying properties. Some might think the subject trivial ; but when we heard on all hands of spoilt slides from using untrustworthy cements, any thing likely to give them a secure cement was worth consideration.

Mr. P. C. Smith mentioned, in illustration of the untrustworthiness of gold size, thickened with litharge, that Jenner had spent almost a life time in preparing diatoms and desmids, using litharge with gold size to make his cells. At his death the whole collection was worthless.

In reply to a question from the Chairman (Mr. Sewell), Dr.

HALLIFAX stated that he made sealing wax varnish with the best sealing wax, crushed fine, and dissolved with a gentle heat in alcohol.

Mr. W. H. SMITH thought methylated spirits, not the *finish* of commerce, would do as well, as it was cheaper and 4° stronger than alcohol. If a small quantity of the Balsam of Tolu was added it would render it softer.

Mr. B. LOMAX felt sure the use of white lead with balsam would be permanent; it was making a superior kind of paint.

Mr. WONFOR spoke of sealing wax varnish as unchanged after several years' use. Some made seven years ago was as good as when made. Dr. Hallifax and he found an advantage in using a small quantity of chloroform in dissolving the sealing wax. When talking with the Doctor about the new cement, he understood him to say he had used benzoline, so he obtained the ordinary form used for illumination, and employed it in the same way as Dr. Hallifax had used benzole. It worked easily, was far cheaper, and dried readily. As a proof of the last-named quality, some of the slides he had brought down had not been made six hours, and were now nearly dry.

In proposing a vote of thanks to Dr. HALLIFAX, both the Chairman and Mr. G. D. SAWYER considered the information both useful and practical. Its importance also might be gathered after the examples quoted by Mr. SMITH and others.

Dr. HALLIFAX thought their thanks were due to Mr. WONFOR for introducing the subject to him, and confirming his observations and experiments; but Mr. WONFOR repudiated being anything else but a pupil of an admirable instructor, from whom he had constantly received very useful hints in mounting and preparation.

Previous to the above, it was announced that Mr. G. DAVIES had presented some rare plants gathered by himself and Mr. BIRCH WOLFE, in Sussex, including *Lolium temulentum*, poisonous darnel, *Rhinodina exigua* var. *horiza*, and *specularia hybrida*.—A vote of thanks was given to Mr. DAVIES.

AUGUST 14TH.

ORDINARY MEETING.—MR. BENJAMIN LOMAX ON "THE RESPIRATION OF PLANTS."

The so-called "respiration" of plants presented one of the least satisfactory chapters of botanical science, and the superficial way in which it had been treated by even the most accomplished phytologists contrasted unfavourably with the thoughtful manner in which the corresponding branch of animal physiology had been explored by those who had studied it. If we asked the merest tyro in medical science, "What is Respiration?" we received at once a definite and intelligible answer.

"Respiration," we should be told, consisted of three distinct operations. First, there was a pneumatical process. The chest cavity was alternately expanded and contracted by muscular action causing successive inspirations and expirations. This function was entirely dependent on vitality for its maintenance. The second process was hydrostatical. The blood was pumped through an infinite ramification of vessels, and exposed at a high temperature to the action of the atmosphere. Here also was an operation entirely dependent on vital action. The third process was chemical. The carbon and iron in the blood, uniting with the oxygen of the atmosphere, formed respectively oxide of iron and carbonic acid, whereof the former remained in suspension in the blood, and the latter was expelled. This last function was entirely independent of vitality, and would take place anywhere under similar circumstances of heat and exposure. It was especially to be remarked that the above changes were of the simplest character. Given muscular action, the rest followed as a matter of course. Above all, there was no *decomposition*, not even that simpler kind which resulted from overcoming a weak affinity by a stronger. The carbon was merely *suspended* in the blood; the oxygen *mechanically* mingled with the atmosphere. Thus, two elements attached by one of the strongest affinities in nature were invited to conbine under the favourable circumstances of close contact, perfect subdivision and high temperature induced by the chemical action itself.

If a similar question were addressed to a student of botany, and if his education had been based on modern text books, he would probably confess utter ignorance of the matter; but if his studies had been among the treatises current thirty years ago, he would say that the green portion of plants absorbed carbonic acid, decomposing it, and liberating its oxygen; that this operation was only carried on during the day, but that at night the function was reversed, the oxygen absorbed and returned in the form of carbonic acid. That was the statement which students were expected to receive without explanation or comment, yet, if true, it involved one of the most remarkable phenomena in the whole circle of natural science.

The *direct* decomposition of a compound was an operation which chemists but seldom performed, and which presented great difficulties when the affinity between the constituent elements was great. He might safely say that a means of *directly* decomposing carbonic acid was yet unknown to chemical science. The animal organisms gave facilities for chemical union, as in the lungs; for solution and precipitation, as in the stomach and duodenum; and they determined the re-arrangement of organic compounds in the various glands; but we had yet to learn that *direct* decomposition was among the animal functions. Yet we were told that the mere cuticle of a leaf was able to do that which the whole animal organism seemed unable to accomplish, and which human science, with all its appliances, had not succeeded in imitating; while the same cuticle was credited with the contradictory property of performing, in the cold, and without special apparatus, the same function which the complicated structure of the lungs only discharged at a very high temperature.

But when the puzzled student sought for higher information in those treatises which were avowedly the treasuries of matured knowledge, he found not only that the explanations given were insufficient and variable, but that the very facts themselves were called in question, or confronted with others equally incomprehensible and self-contradictory.

Thus Ingenhousz, Priestley, and Percival narrated experiments performed on plants immersed in an atmosphere so largely charged with carbonic acid as to extinguish a lighted candle, the result of which was that the plant throve, and purified the air in three hours. Yet Daubeny asserted, on the strength of most careful experiments, that plants exposed to an atmosphere containing 20 per cent. of carbonic acid, died in a few days, even though exposed to direct sunlight. Ellis affirmed with the concurrence of Burnett, Garreau, and Carpenter, that plants exhaled carbonic acid at all times though sunlight re-decomposed a portion. Bloxham, on the chemistry of plants, asserted that leaves decomposed carbonic acid by day, and exhaled it by night to a less extent. Pepys, Cloez, and Gratiolet denied that any action whatever took place in darkness, but affirmed the disengagement of oxygen during the day. De Saussure stated that when a plant was confined in a definite volume of atmospheric air, that air was unaltered in composition after a definite time. Le Mavul and Descaisne, as translated by Hooker, asserted that plants, by day or night, poison the atmosphere, not only by the exhalation of carbonic acid, but also by liberating carburetted hydrogen, the product of the volatile oils to which the perfume of the corolla was due.

Add to these conflicting testimonies that the last named authors accredited plants with the power of decomposing water, retaining the hydrogen, and liberating the oxygen, that Morot, Lory, and others said that the white parts of plants, or whole plants like the Orobanchæ having no green parts, exhaled carbonic acid always and only, that Ville and Gratiolet affirmed that all plants decomposed ammonia and exhaled nitrogen, and that the single species called *Chenopodium vulvaria* claimed the property of exhaling ammonia, and we had a fair idea of the chaos into which the enquirer into the subject must necessarily plunge. He could not, of course, hope to throw light on a subject confessedly so obscure, or to decide where such doctors disagree, but he thought that he might usefully occupy himself in weeding the garden which he was not competent to cultivate, by arranging the various statements, rejecting opinions which had been disapproved, tabulating such as were established, and shewing on what arguments questions yet undecided rested, and he might state, in justice to himself, that he had consulted most of the authorities, and repeated most of the experiments referred to.

The statements requiring atttention were :—1. That leaves exposed to sunlight decompose carbonic acid and liberate the oxygen. 2. That leaves, during the darkness, or always, convert oxygen into carbonic acid, which they respire. 3. That plants respire nitrogen. 4. That *Chenopodium vulvaria* respires ammonia.

The first position, that plants decompose carbonic acid under the influence of sunlight, was, he submitted, fully proved. A potted plant placed in a jar of carbonic acid would rapidly convert it to oxygen, if exposed to the noon-day sun. A sprig of mint placed in a bell glass containing water charged with carbonic acid, would, when exposed to sunlight, discharge bubbles of pure oxygen. The confervæ of fresh water, and the algæ of salt water, manifested the same property, as every one who had an aquarium knew. It might be also taken as proved that this operation ceased in the dark, and was confined to the green parts of plants. The rhizome of a potato discharged no oxygen ; the yellow *monotropa* or brown *fucus* were equally powerless, while the bright green *Anacharis Canadensis* or the *Ulva latissima* would supply oxygen enough for the lungs of the inhabitants of the fresh and salt water respectively. Daubeny had ascertained by reliable experiments, that a leafy plant would add 18 per cent. of oxygen to the air of a jar. The question now occurred, by what agency was the decomposition of the carbonic acid effected? By the leaf, the light, or both. His own impression was, that the light was the sole agent, the leaf merely affording a suitable nidus.

He had already spoken of the difficulty of direct decomposition. The chemist effected it by three agencies of light, heat, and electricity. By heat, he separated oxygen from mercury or lead; by electricity from hydrogen; while light dissolved the union between silver and chlorine.

A series of experiments, conducted independently by Draper and Cloez and Gratiolet showed that the yellow ray of the spectrum produced the most rapid evolution of oxygen, exceeding that of the compound ray. The red, green, and blue took the succeeding ranks, while no effect whatever was produced by the violet and indigo, or by the extra spectral-space beyond them. It was remarkable that the rays which produced the effect were the illuminating, not the heating or chemical rays. It might be objected to his view that light produced no effect on carbonic acid contained in a jar; but even supposing that fact to be proved, allowance had still to be made for the subdivision caused by the cellular tissue. He did not, however, claim for his opinion any authority beyond that of a suggestion, as it was not susceptible of proof.

The second statement—that plants exhaled carbonic acid, came to us recommended by a great weight of evidence, and fortified by experiments made by Garreau, who actually collected the carbonic acid in lime water, and tabulated the results. From one plant, the *Rheum undulatum*, he obtained, after five hours' exposure at 111 degrees Fahrenheit, ·025 of carbonate of lime, or ·024 of carbonic acid, an amount almost too small for appreciation, and attributable in his opinion to other causes. His own belief was that no such respiration ever took place, and this opinion was favoured by the high authority of Mr. Haseldine Pepys, whose long and careful experiments have been confirmed by Messrs. Cloez and Gratiolet. A plant placed in lime water during the hours of darkness usually deposited some carbonate of lime before morning. His explanation of this circumstance was that the absorption of carbonic acid during the day was caused by the action of heat on the leaves, while its decomposition was due to the power of light. In houses the light usually declined before any sensible diminution of heat took place, and thus the leaves were caused to absorb a larger quantity of carbonic acid than the light had time to decompose. This excess being rejected at night had, in his opinion, led to the incorrect belief that plants respired carbonic acid, and the great heat at which Garreau's only successful results were obtained were strongly in support of his view.

The third statement, that plants respired nitrogen, was supported by no respectable evidence, and might be disregarded. It must be remembered that the gaseous products of plants were likely to be considerably modified by the putrefaction of dead leaves and roots, the secretions of insects and exhalations from the soil, so that experiments required to be guarded by very stringent precautions. The odour of ammonia proceeding from the *Chenopodium vulvaria* was now perfectly understood. The plant in question, an inhabitant of calcareous soils near the sea, had the peculiar property of assimilating carbonate of ammonia, the minute particles of which salt, on reaching the surface, readily decomposed liberating the gas. The phenomenon was a curious one, but had nothing to with the so-called vegetable respiration.

He might refer to the statements lately advanced, on most insufficient evidence, that the lower forms of animals absorbed carbon and respired oxygen. Even were the phenomenon in question better established it would be necessary to remember that the boundary between the animal and vegetable kingdoms was by no means fixed, and that we had fair reason to doubt whether a being presenting such abnormal characteristics had been rightly classified. In the hopes that the Society might yet prodce a genius competent to unravel the great mystery connected with the gaseous products of the vegetable world, he had ventured to lay before it the brief statement of the known facts.

After a cordial vote of thanks, proposed by the President (Mr. G. SCOTT), "for a very lucid and admirable paper," an interesting discussion followed, in which Messrs. HENNAH, PAYNE, W. H. SMITH, THE PRESIDENT, and Dr. HALLIFAX took part.

AUGUST 28TH.

MICROSCOPICAL MEETING.—MR. T. W. WONFOR ON "THE ANTENNÆ OF INSECTS."

Few, if any, organs belonging to the different members of the animal world presented such a diversity of form, or had led to so great a difference of opinion among naturalists respecting the special office they fulfilled in the animal economy as the *antennæ*, the jointed organs situated on the head in most of the different members of the great family of *articulata*.

While the *crustacea* possessed two pair, the *myriapoda* and *insecta* were furnished with a single pair only; in the last-named the form, number of joints, and sundry other particulars were used as a means of classifying the different genera and species.

Apart from their diversity of form, the antennæ deserved especial attention, because it was not yet absolutely determined what was their especial function, or in which part any one of the functions attributed to them was situated. Different writers had assigned to the antennæ the three several senses of touch, hearing, and smelling, and all adduced illustrations, or the existence of parts in these organs, to warrant their respective views. That they were organs of sensation none denied, but which, or how many of the three senses above-named they constituted, was still a moot question, though the microscope in the hand of Dr. Hicks and others had done much in recent days to help to unravel the mystery.

Those who had watched the actions of ants or bees must have been struck with the use made by these creatures of their antennæ, as a means of communicating information to each other. How this information was conveyed, or how they conversed, apparently, by the mere contact of their antennæ certainly was not known, but that they did convey information from one to another, ask for help, and give orders, was borne out by the observations of many diligent students of both the tribes. That in many cases they were admirably adapted as organs of touch or feeling would appear to be the case from the great number of joints, their extreme delicacy, and the easiness of movement in every direction.

Many insects, when at rest, folded back the antennæ, so as to conceal them, but as soon as they began to move, the antennæ were thrust forward, the parts separated widely, and while in some they were vibrated from side to side, in others, as in some species of wood lice (as observed by Kirby and Spence) they were used as organs of touch. It had been urged by some that they could not well be organs of touch, on account of the hard horny character of their outer surfaces, and that this function was performed by another set of organs, the *palpi.*

Many naturalists inclined to the idea that they were the organs of hearing. Now it was generally conceded that in the crustacea, especially the higher ones, the organs of hearing were situated at the base of the long external pair of antennæ, and, as in the case of the crayfish, consisted of a hollow cylindrical process, closed internally by a drum—a thin membrane, behind which was a vesicle filled with fluid, which received the termination of a nerve; but the organ of smell, as had been principally observed with crabs, consisted of cavities, lined with a mucous membrane, situated at the base of the inner pair of antennæ, and protected externally by fine bristles. Many observers had noticed that if a noise was made the antennæ of some insects were turned in the direction of the part from which the noise came. This had been observed in the case of the longicorn beetles, grasshoppers, and crickets, which, when suddenly surprised by a noise, had been seen to stretch out their long antennæ and stand, as it were attentively listening for the sound. Rennie mentioned a green grasshopper inclining its antennæ to the rustle of a piece of paper under the table on which it was placed, and bending one of them in the direction of the sound.

On the other hand, many circumstances seemed to prove that insects possessed a very acute sense of smell. It had been observed in "Episodes of Insect Life" that "no flocks of vultures can be directed more unerringly to their revolting prey by its odours from afar, than certain insects, such as dung-flies and carrion beetles, whose corresponding office is to assist in ridding the earth of offensive objects." That it was the sense of smell which directed the blow-fly to the deposition of the larvæ was shown by the fact that she had laid them on *stapelias,* a carrion-odoured hot-house plant, and on silk with which tainted meat had been covered.

Equally keen-scented were butterflies and bees; the latter had flown miles in the direction of particular flowers, whose odour had been wafted by the wind, while the former had alighted from a considerable height on their favourite flowers.

Then, as was well-known to lepidopterists, night-flying moths were attracted from long distances by anointing the trunks of trees with sugar or treacle, and this, he should think, by the sense of smell alone.

Again, as he had stated on several occasions, the males of some species of moths were attracted by the females under such conditions as to lead to the idea that either the sense of smell was wonderfully acute, or that they possessed some sense not yet determined by physiologists. Placed in boxes, either carried in the coat-pocket, put in a basket, or shut up in a leather bag, the perceptive faculty had been so strong in the males, that they had been seen flying over the top of a wood at least 300 yards off. Nay, more, he had had them settle upon himself, when the box, containing the female, was no longer in the pocket. His idea was that some of the scent imperceptible to man clung to the garment.

Among the authorities inclining to the idea that the antennæ were the organs of hearing were Sulzer, Scarpa, Schneider, Bockhauser, Burmeister, Carus, Oken, Kirby and Spence, Newport and Hicks. On the side of those who considered them organs of smell were Reaumer, Lyonet, Robineau Desvoidy, Küster, Erichson, and Vogt.

It might be asked—Had the microscope done anything, and, if so, what, in solving these difficulties? Newport in 1831 ("Transactions of the Entomological Society," vol. ii., p. 229) found all the joints, except the second, of *Ichneumon Atropos* perforated all round by very minute holes. He observed also tracheæ passing up the whole length of the antennæ, and giving off branches at every joint, and which, as he considered, communicated with the holes in the wall of the antennæ. Of this though he was not quite certain. He stated that the same structure existed in most setaceous antennæ.

E. F. Erichson published at Berlin in 1847 his "Dissertatio de fabricâ et usu antennarum in Insectis" in which he enunciated these laws: 1st. The wall of the antennæ in insects is by no means solid, but perforated by numerous openings. 2nd. These openings are closed on the inner side by a membrane. 3rd. The openings in the antennæ of different insects are arranged in different ways. He also showed that these openings were never found in the basal joint. He considered the numerous hairs found in the antennæ, between the pores or openings, protected them from extraneous bodies, and that the pores were organs of smell, because "as the olfactory organs of the higher animals are moist membranes, in order that the odorous particles may be dissolved by the humour secreted, in the same way these membranes performed the same office, were protected by the downy hairs, and kept moist by them." Another reason why he considered them organs of smell was that they were most numerous in those tribes of insects whose scent was acute.

Vogt pointed out in 1851 that "if the uniform antennæ are examined with a sufficiently high power, the outer surface of all the divisions, except the articulating joint, is found to be covered with minute punctures, which are closed in at the bottom by a thin membrane that appears to be clothed with numerous hairs. In the antennæ that are not of uniform shape throughout, there is a shaft or style, and these indentations are then found only upon the toothed branches, processes, and feathers of the antennæ, whilst the integument of the shaft is like that of the remaining portions of the body." He further says of them, "We are of opinion that these minute pores, filled with fine hairs, perform a function combining those of smell and touch."

Dr. Hicks, in two papers read before the LinnæanS ociety in 1857 and 1859, and published in vol. xxii. of "The Transactions of the Linnæan Society," pointed out that on the whole surface of the third joint of the antennæ of the blow-fly are a multitude of transparent dots, apparently vesicles, which on closer examination are found to be cavities in the wall of the antennæ, filled with fluid, closed in from the outer air by a very thin membrane, and that each little sac is connected with the nervous system by a distinct nerve. There were 17,000 of these perforations on the surface of each antenna in the blow-fly. Besides these, there were about eighty larger sacculated chambers irregularly dispersed, and connected with the nervous ganglia. He pointed out the existence of similar organs in the antennæ of the different tribes of insects, and came to the conclusion that they were organs of hearing because—" 1st, they consist of a cell, sac, or cavity filled with fluid, closed in from the air by a membrane analogous to that which closes the foramen ovale in the higher animals ; 2nd, that this membrane is for the most part thin and delicate, but often projects above the surface, in either a hemispherical, conical, or canoe-shaped, or even hair-like form, often variously marked ; 3rd, that the antennal nerve gives off branches which come in contact with the inner wall of the sacs, but whether the. nerve enters or ends in the small internally-projecting papilla is very difficult to say."

Dr. Hicks considered it impossible that the essential nature of an olfactory organ could be included in such structures, or that odorous particles could pass, first through a membrane, sometimes even spinous, then through a cavity filled with fluid, and thirdly through another membrane to reach the extremity of a nerve, but that they were well suited for the transmission of sound.

Notwithstanding the conclusions of Dr. Hicks, he could not help thinking that one of the functions of the antennæ was that of smell. In those moths, which exhibit "sembling," that is, the attracting the males by the female from long distances, not only the shape of the antennæ in the sexes differed in a marked degree, but the pectination in the males was very deep, and the number of hairs many times greater than in the female, while the organs pointed out by Dr. Hicks were more numerous.

It was a good time of year for such members as might feel an interest in the subject to investigate the matter for themselves; and he would advise that not only the method of bleaching recommended for rendering the antennæ more transparent be adopted, but that sections similar to those so admirably made by Dr. Hallifax be tried, and so some further light might be thrown, either way, on these organs, though the question whether they be confined to one sense, or whether they perform the office at times assigned to them of common sensation might not be made out to demonstration. The process recommended for bleaching by Dr. Hicks was one drachm chlorate of potash, one drachm and a half water; mix in a small wide-mouth bottle holding about an ounce: after five minutes add $1\frac{1}{2}$ drachm of strong hydrochloric acid. In this mixture place antennæ, and let them remain from a few hours to a week, according to their nature.

In the discussion which followed, Dr. Hallifax said that some years ago, without any preconceived idea, Dr. Addison followed out the experiments indicated by Dr. Hicks, but failed to come to the same conclusion as that gentleman. As to the actual functions of these remarkable organs he would not attempt to express an opinion, but it would certainly seem that insects possessed some sense with which we were not acquainted, or that their senses, if the same as ours, were far more exalted. The idea of Dr. Hicks—as to the antennæ being organs of hearing—was now, it appeared, by no means generally accepted.

Mr. WONFOR related some further wonderful instances of "sembling" that tended to corroborate the remarks of Dr. Hallifax. He had found by repeated instances that the males would come direct to the females from incredibly long distances, as long as the wind was right for the "scent" (if such it was), but placed in the other direction, even at a short distance, no notice was taken. He had even known males attracted by the female in this way when the latter was inside a room and the windows closed. Wonderful to say, too, when once impregnation had taken place, the attractive power, whatever its nature, ceased to exist. The facility with which ants evidently communicated with each other by their antennæ was then spoken of, and it was suggested whether it might not even be a kind of speech in so shrill a tone probably, as to be utterly imperceptible by the human ear.

The meeting then became a conversazione, when preparations of antennæ, illustrative of the paper were exhibited by Dr. HALLIFAX and Messrs. R. GLAISYER and WONFOR.

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THE TWENTY-FIRST

ANNUAL REPORT

AND

ABSTRACT OF PROCEEDINGS

OF THE

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NATURAL HISTORY SOCIETY,

ADOPTED AT A MEETING HELD

THURSDAY, SEPTEMBER 10th, 1874.

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MR. THOMAS GLAISYER.
12, North Street.

Committee.

MR. J. H. BROWN,	MR. DENNANT,
MR. BENJAMIN LOMAX,	MR. DENNET,
MR. C. P. SMITH.	MR. G. D. SAWYER.

Honorary Secretaries.

MR. T. W. WONFOR, 38, Buckingham-place.	MR. J. C. ONIONS, 56, Middle-street.

Honorary Librarian.

MR. GEORGE SCOTT.

Honorary Curator.

MR. R. GLAISYER,
The Dispensary, Queen's-road.

At the Twenty-first Annual Meeting of the BRIGHTON AND SUSSEX NATURAL HISTORY SOCIETY, held at the Dispensary, September 10th, 1874,

IT WAS RESOLVED,—

That the Report, Abstract of Proceedings, and Treasurer's Account, now brought in, be received, adopted, and entered on the minutes, and printed for circulation as usual.

That the cordial thanks of this Meeting be given to the Honorary Secretaries and Honorary Librarian for their labours in preparing the same.

That the following gentlemen be elected as Officers of the Society for the ensuing year:—President: Alderman Cox; Treasurer: Mr. Thomas Glaisyer; Committee: Mr. J. H. Brown, Mr. Benjamin Lomax, Mr. C. P. Smith, Mr. Dennant, Mr. Dennet, and Mr. G. D. Sawyer; Honorary Secretaries: Mr. T. W. Wonfor, 38, Buckingham Place, and Mr. J. C. Onions, 56, Middle Street; Honorary Librarian, Mr. George Scott; Honorary Curator, Mr. R. Glaisyer.

That the sincere thanks of this Meeting be given to the Vice-Presidents, Treasurer, Committee, Honorary Secretaries, Honorary Librarian, and Honorary Curator, for their services during the past year.

(Signed)

J. E. HASELWOOD,

PRESIDENT.

IT WAS ALSO RESOLVED,

That the warmest thanks of this Meeting be presented to Mr. J. E. Haselwood, for his able conduct as President during the past year.

REPORT.

IN presenting the TWENTY-FIRST ANNUAL REPORT your Committee have the pleasure of recording the continued prosperity of the Society, which has considerably increased in numbers during the past year. They regret the loss which the Society has sustained by the death of two of its members, viz., Mr. GEERE and Mr. J. J. SEWELL, the latter one of the Vice-Presidents and who had for many years taken an active part in promoting the prosperity of the Society.

The state of the finances is very satisfactory; for although the Committee have a balance of only 2s. in hand, they have been able to meet the exceptionally heavy expenses of the year caused by the necessity of purchasing book-cases to hold the books on their removal to the Free Library; and to expend the sum of £12 8s. 2d. in the purchase of new books and periodicals.

The following books have been presented to the Society during the year :—Tenth Annual Report of the Belfast Naturalists' Field Club, (from the Society) : Report and Proceedings of Eastbourne Natural History Society (from the Society); Journal of the Quekett Club (from the Society); Proceedings of Geologists' Association (from the Society); Annual Report and Proceedings of Maidstone and Mid-Kent Natural History Microscopical and Philosophical Society for 1874 (from the Society); Lists of the Local Fauna and Flora of Eastbourne, and Supplement to the same (from Mr. J. C. Roper); Summary of a Meteorological Journal, kept at Crowboro', by C. L. Prince (from the Author); Mild Medicines, by Dr. T. Massy (from the Author); Geology of Brighton, Part i., by J. Howell (from the Author); Quarterly Reports of Sub-Wealden Exploration (from the Secretary); Transactions of Smithsonian Institution (from the Institution); Recollections of Agassiz, &c. (from C. F. Dennet, Esq.); The Origin of some of the Lake Basins of Cumberland, by C. Clifton Ward, F.G.S. (from the Author); The Glaciation of the Northern Part of the Lake District, by J. Clifton Ward, F.G.S. (from the Author).

The following books have been purchased during the year:— The Norman People; Grafting and Budding; Tyndall on Heat; Linnean Society's Transactions, vol. 28, part iv., vol. 30., part i.; Geological Magazine; Zoologist; Entomologist's Monthly Magazine; Science Gossip; Monthly Microscopical Journal: Quarterly Journal of Microscopical Science; Popular Science Review; Quarterly Journal of Science; the Entomologist; Grevillea; Publications of the Paleontographical Society for 1873; ditto for 1874; British Annelids, by W. C. McIntosh (Ray Society's Publications, 1873 and 1874.)

The number of volumes in the Library is 800, exclusive of pamphlets and unbound current periodicals, and your Committee are pleased to learn the circulation of books continues to increase.

A numbered Catalogue of the Society's books has been prepared by Mr. G. Scott, and can be consulted at all times at the Library counter, while a shelf list has also been compiled, showing not only the position on the shelves of each work, but also the number of volumes.

During the year the Society's Microscopical Cabinet, which now contains 255 slides, has received donations from the following gentlemen: 13 slides from Mr. W. H. Smith and 4 from Mr. Wonfor. And your Committee report with pleasure the increased interest taken in the Microscopical meetings, and, as will be seen by the annexed proceedings, that very valuable papers have been read at them.

The Conversazione held in the month of February, at the Royal Pavilion, was very successful, both in the number of those who were present, and in the variety and character of the entertainment.

Your Committee report that scarcely any response has, up to the present time, been made to the circular inviting assistance in verifying the Fauna and Flora of Sussex, as suggested in Mr. Wonfor's paper of April 10, 1873, but they hope at the next Annual Meeting to present a more favourable report.

The thanks of the Society are due to the Brighton and Hove Dispensary and the Medico-Chirurgical Society, for the use of the room at the Dispensary, in which the Meetings of the Society were held up to March last.

Your Committee have great pleasure in commemorating the fact that since the last Annual Meeting the Free Library and

Museum has been opened to the public, and that upon the opening ceremony the Mayor (Mr. Alderman Ireland) gave a Soirée to over 3,000 of the inhabitants: when the chief part of the Microscopical and Scientific Instrument display was arranged, at the request of the Mayor, by this Society.

The thanks of the Society are specially due to the Town Council of Brighton for allowing the Society to take up its quarters at the Free Library and Museum, where its books have been deposited, on the condition that, while the Society shall hold its meetings in the Curator's room, the public may use its books under the same conditions as those in the Free Library, full rights being reserved to members of taking books home.

Your Committee are pleased to hear that the public have made great use of the Society's books since their removal to the Free Library.

The thanks of the Society are due to Mr. G. Scott, the Curator of the Free Library and Museum, for the valuable assistance he has rendered to the Society during the past year.

The thanks of the Society are due to those gentlemen who have read Papers, exhibited Objects, or presented Slides for the Cabinet, Photographs and Drawings for the Society's Album, or Specimens.

The Society is to be congratulated on the increased attendance at its meetings, the far greater accommodation afforded at the Free Library and Museum, and the growing interest taken by the Members in the welfare of the Society.

The Field Excursions since the last report have been as follows :—September, 1873, to Shoreham; October, to Glynde; May, 1874, to Balcombe; June, to Newick (by the kind invitation of J. H. Sclater, Esq.); July, to Henfield; August, to Shoreham.

The Annual Excursion took place on the 2nd of July to Groombridge, and being of a specially interesting nature, an account of it will be found in the subjoined proceedings.

In concluding their Report, your Committee beg to request the Members to endeavour to promote the prosperity of the Society by bringing its merits under the notice of their friends, by contributions of Works of Natural History to the Library, of Photographs or Drawings of objects of Natural History for the Album and of Slides for the Microscopical Cabinet, and particularly by reading Papers during the ensuing year.

ABSTRACT OF PROCEEDINGS.

1873-4.

SEPTEMBER 11TH.

ORDINARY MEETING—SPECIMEN EVENING.

On taking the Chair, the newly-elected President, Mr. J. E. HASELWOOD, said that as the Society had been the means of affording him much pleasure and gratification, he felt it his duty to respond to the request that had been made to him; but, as the members had elected him, knowing he had no special qualification, they must take the responsibility of the step in the event either of his Presidency being a failure or a success. He need hardly say, however, that he would do his utmost to fulfil the duties of the position, and he heartily hoped that the Society would have a prosperous career during the ensuing year.

Mr. G. SCOTT, in acknowledging a vote of thanks, said that when he was unexpectedly elected to the post he had just vacated, he determined to be as regular as possible in his attendance, and to try at least to preserve his equanimity of temper, whatever might arise. Fortunately there had not been a single opportunity of putting the latter resolution to the test, and, with regard to the former, he was glad to say that he had attended every ordinary meeting, he believed, except one, and then he was absent in Norfolk on an expedition by which he hoped the whole town would benefit. And that reminded him that a kindly reference had been made to his position as Curator of the Public Library and Museum. He wished to say that, when accepting this appointment, he felt a strong inclination to resign the presidency of the Society lest it should be thought to detract from its dignity. He was dissuaded, however, from doing this, it being pointed out that there was a very good precedent in the connection of Professor Edward Forbes with the Geological Society (applause), and he had certainly found since that advantages have arisen from the combination of the two offices. In conclusion, he could only say that he felt much pleasure in having such a successor as Mr. Haselwood.

Mr. F. E. SAWYER said he wished to remark that when he read his paper on Earthquakes in Sussex some time ago, he was not aware that Mallett had collected the particulars of every earthquake in the British Isles, of which there was a record. Having recently had an opportunity of inspecting Mallett's records, he was able to make the following additions to the list of Sussex shocks :—During the shocks in 1638, "the atmosphere was obscured as if by a cloud." In 1758, on January 24th, at two a.m., "a slight trembling, lasting but a moment," was felt "in the parishes of Worth and East Grinstead, accompanied by a rolling noise. The windows were made to rattle." This was recorded in vol. 50 of the Philosophical Transactions. In 1833, about the 2nd April, at 8.15 p.m., a shock of earthquake was felt at Horsham, and was "more perceptible in some houses than in others. Some persons were greatly frightened, whilst others felt nothing." The authority for this was Garnier, who quoted from a London letter of the 10th April, 1833. These two shocks, together with the one mentioned by Mr. Wonfor as occurring in 1692, increased the total number of shocks in the County to 21.

Another subject to which he wished to allude was the statistics as to the force and prevalence of wind in Brighton during the last year, the anemometer at the Pier Head having now been there twelve months. The distance travelled by the wind in September, 1872, was 11,633 miles; October, 10,436 ; November, 13,179 ; December, 12,174; January, 1873, 13,488 ; February, 7,667; March, 7,871 ; April, 8,760; May, 9,043 ; June, 7,962 ; July, 10,308 ; August, 12,846—total during the year, 125,367 miles, giving an average of 343 per day, or 14·3 per hour ; the maximum in one day was 904 miles, on December 8th, 1872. After this he could not help coming to the conclusion that Brighton is a windy place. At Rotherham the total is not above half so much but at Worthing it would seem to be about the same.

Mr. SCOTT asked whether these instruments could really be relied on ?

Mr. WONFOR pointed out that there was a very great difference between inland and coast towns, in consequence of the land and sea breezes. It was certainly very singular that less wind should be registered at Brighton in March than in any other month except February. He believed that Brighton suffered very much less from east-wind than places on the east coast, and that the prejudice respecting an east wind in Brighton was unfounded.

Mr. C. P. SMITH exhibited a new species of Solanum, obtained from Acton.

Mr. PANKHURST, flint spear head from Portslade, ironstone from Crowboro', curiously encrusted with a ferruginous coating, and silicified bone, said to be human, from Frome.

Mr. CLAYTON, fossils from the Brighton chalk pits, Sussex marble, and ancient iron crucifix from the Priory, Lewes.

Mr. W. NASH, iron nodules and chalk fossils from Amberley.

Mr. T. GLAISYER, a fine lump of Kauri gum, dug at the roots of the Kauri pine, New Zealand, almost in the condition of amber.

Mr. WONFOR, oak branch, partially stained green by the fungus *Helotium Æruginosum*. Oak thus stained is used in the manufacture of Tunbridge Wells ware.

Mr. R. GLAISYER, specimens of polished Sussex marble.

SEPTEMBER 25TH.

MICROSCOPICAL MEETING.—GENERAL EVENING.

A letter was read from the Mayor, Mr. ALDERMAN IRELAND thanking the Society for the assistance rendered at the Soirée given by him at the opening of the Free Museum and Library, Sept. 11th, especially with the Miscroscope, of which the Mayor remarked, "The gratification afforded by the Microscopic department has been a source of congratulation again and again." The Mayor's letter was ordered to be entered on the minutes.

It was also announced that the Lewes Natural History Society would hold a Microscopical Soirée on Monday, the 29th, at the

County Hall, Lewes, to which the Members of the Society were invited. It was thought, though the notice was short, that some of the Members would be able to avail themselves of the invitation, and take their microscopes with them.

The President, Mr. J. E. HASELWOOD, hoped, as this was the first Microscopical Meeting at which he had the honour to preside, the suggestion he was about to make would be favourably received, viz., that an evening should be occasionally set apart for practical instruction on some point in connection either with the mounting of objects or the manipulation of the microscope. He knew such evenings had been arranged in the past, when very valuable hints were given by some of the Members who had paid more attention than others to the microscope. One such evening he well recollected, when Mr. Hennah dissected out *palates* before them,—a practical lesson some of them were able afterwards to put in practice for themselves. He thought similar instruction would be not only appreciated but be very valuable to many whom he might call from their less practice, the younger microscopists.

Mr. WONFOR was sure, if it were indicated in what way some of them could help their fellow-workers, they would with pleasure render them assistance, as they had done on former occasions. One of the objects of setting apart one evening in each month for the microscope was to bring those Members who worked with it closer together, so that they might compare notes and give each other help.

Mr. F. E. SAWYER enquired whether any Member could give them instruction in cutting rock sections?

Mr. WONFOR feared none of their Members could help in cutting sections of the hard rocks, which required a lapidary's wheel; but as regarded the softer rocks, a plan he had illustrated some time since of rubbing down sections on sand paper of different degrees of fineness worked well. He thought some of the Members present had tried it with success and had obtained good sections, as well as of coal, a method of making sections of which he had also illustrated.

Mr. SEWELL thought Members would learn a great deal, if, after taking a practical lesson, they showed the results of their own work, their failures as well as successes, because they might then have pointed out wherein they had failed.

After various suggestions, it was resolved that the next Microscopical Meeting be devoted to practical instruction in "mounting in fluid," when it was hoped different Members would show how it was done.

The Meeting then became a Conversazione, when some very interesting and beautiful objects were exhibited by Messrs. R. Glaisyer, Hurst, F. E. Sawyer, W. H. Smith, and Wonfor.

During the evening Mr. Wonfor distributed among the Members present portions of the wings of butterflies and moths, and of the wing cases and bodies of beetles from the Museum, and which were in too broken and damaged a condition to be of any avail for Museum purposes, but which were thought might be useful to Microscopists.

October 9th.

ORDINARY MEETING.—DR. STEVENS ON SARSENS, GREYWETHERS, OR DRUID STONES.

Definition.

Throughout the western chalk districts of England, and following more or less the lines marked out by the middle and lower series of the Tertiary Eocenes, masses of stone had been observed, in some places profusely scattered and of huge dimensions, in others sparingly so, and of comparatively insignificant size. Aubrey wrote of them under the head of Sarsden or Sarsdon stones; and considered that "the name owed its origin to a village near Andover called Sarsden, *i.e. Csarsdene*, perhaps *don*, Cæsar's-dene, Cæsar's-plaine, now Salisbury-plaine." There was another derivation from *Saracen*, meriting more respect. The Latin *Saxum* had been suggested as fixed to them in Roman times, subsequently corrupted to *Sarsen* by the Romanized Britons. Another derivation had been found in the Anglo-Saxon *sel-stan*, great-stone. One other solution, the Saxon *ses*, a stone, the plural of which, *sessan*, came very near to *sāsen* or *sassen*, the name by which they were known among the Berkshire rustics.

The word Greywether evidently obtained its origin in the resemblance these stones bore to sheep, when distantly seen in scattered lines upon the Downs. As the stones on the Marlborough Hills all trended in the same direction, the idea at once took possession of the mind that it was a stream of rocks even yet moving onwards. In some places they lie hurled as it were at random over each other, as if they had formed the *débris* of an overwhelming avalanche, and in other places they were huddled one over another like the fallen ruins of some Cyclopean temple, or in scattered blocks as if thrown broadcast over the Downs.

The term Druid Stones referred especially to those Celtic monuments standing in detached places associated with Druidical rites.

Distribution.

The space over which they were found comprehended a triangular patch on the world's surface, its apex resting in North Wiltshire, and its base on the German Ocean—from Margate to Lowestoft. Lying along its north and south flanks were bold hills of chalk, which probably overlooked this Tertiary area during the glacial period, when their bases were washed by the waves of a surging sea.

On looking over the Berkshire area, it would be observed that the Kennet extended from the Marlborough Downs, eastward, and joined the older and more voluminous Thames at Reading, this same Thames eating its way from north and west through the lower stratifications of the great Tertiary plane of marine denudation. It was in the western extremity of the basin, and extending for miles over an area west of Marlborough, and away northwards towards Swindon that the Sarsens chiefly abounded. So thickly were they spread over miles of country that the traveller might almost leap from stone to stone without touching the earth.

Their distribution in places, nevertheless, appeared somewhat patchy, rendering it difficult to determine for what reason in the same district one slope of a valley was strewn with them, another left bare. Some of the Sarsens from their unworn condition evidently rested near or at the original spots where they were consolidated. Such concretions were to be looked for wherever the Lower Tertiaries had found a footing.

Origin and Structure.

Various theories had been advanced to account for their origin, some of a very unlikely character ; but some pointed to the idea that the Sarsens had been derived from the Woolwich and Reading series. Mr. Prestwich considered the evidence was in favour of their derivation from the mottled clays and sands overlying the chalk, known as the Plastic clay, from the Woolwich and Reading series ; and based his conclusions mainly on the fact that the sands of these beds were of precisely the same mineral character as the blocks themselves—the concretionary stone representing, in each case, the component part of some portion of the Woolwich and Reading series.

Mr. Whitaker advanced the opinion, evidently based on sound observation, that the sandstone masses, lying on the downs west of Marlborough, owed their origin to the Bagshot sands, these sands having rested on the chalk of that district, whither they extended beyond the London clay, which clay thins off to nothing near Marlborough. In further evidence he had found these sandstones resting on the London clay, which intervened between the Bagshot sands and the Woolwich and Reading beds. It was remarkable that on this outside edge the sarsens largely predominated ; and Mr. Whitaker's views were further strengthened by the fact that the blocks contained no fossils, whereas the underlying beds being in some cases fossiliferous, it was likely fossils would occasionally be found in them if formed wholly from these. At the same time, he coincided with Mr. Prestwich that some of the Conglomerates were referable to the Plastic clay.

The original idea that the greywethers of the Wiltshire downs were due to the Bagshots did not, however, rest with Mr. Whitaker, inasmuch as Smith, the parent of English geology, long ago advanced the opinion, that an extensive stratum of sand, containing these stones, once overspread the chalk of North Wiltshire.

Although no fossils had been observed in the greywethers, some peculiar root-like holes had the appearance of having come from marine plants. Their surfaces were in some instances pitted with basin-like hollows, somewhat resembling the depressions made in rocks along the sea shores, perhaps by the friction against pebbles lashed into motion by the waves. From the uniformity of structure in the Wiltshire sarsens it would almost seem as if they were the fragmentary remains of a continuous stratum that once had a wide range ; but there could be no doubt that, in some instances, they had been agglutinated in separate blocks, much as we now found them. Many were angular and unrolled, and had evidently not travelled far from the spots where they were imbedded. They were further agglutinated together in nodules of all sizes, and of greater or less hardness.

The variety of material out of which they were constructed—in some instances worn or unworn flints, in others pebbles, forming pudding-stone, in others again fine ferruginous grit—evidently served to show that, under favourable conditions, almost any material formed the rough substance of the stones when brought in contact with the cementing material. Those recently taken from their sandy beds were not unusually coated with imperfectly solidified sand, merging into the character of the parent blocks, the process of accretion seeming to be the gathering together of the siliceous particles around the surface of the stones. There were doubtless differences in the chemical constitution of these consolidations.

Mr. Maw, in writing of such concretions found in the drift of Suffolk, stated that the hardest nodules were resolvable into sand by the action of hydrochloric acid, which seemed to imply that the cementing material was calcareous; and one block was found to contain only a very little lime in the shape of silicate. The Sarsens of Wiltshire had been found to be composed of very pure silex; their structure consisting of pure siliceous sand, agglutinated by a siliceous cement. They contained no carbonate of lime; and the trace of peroxide of iron found in them was due, probably, to the infiltration of ferruginous particles from the neighbouring soil, as the iron did not penetrate beyond the exterior of the stones, the interior being generally quite white. There appeared to be a total absence of saline matter. The weight per cubic foot was 154lbs.

There were good grounds for believing that the drifting of these stones was coeval with the formation of those widely extended patches of deposits, called "Brickearths," which had resulted from the breaking up of the older Eocenes. These drifts had received able exposition at the hands of Mr. Whittaker; and although many oscillations of level had taken place since their deposition, and considerable modifications of climate, there was very little doubt that the Brickearths were laid down at the close of the glacial epoch, at the time when the valleys were eroding, and the face of the land about to be made to assume its present contour—a period that immediately preceded the advent of man.

A good deal of high land in the neighbourhood of the Kennet was covered with a deposit geologically called "clay-with-flints," overlying which were brick-earths, intermingled with which, and lying in the clay-with-flints, Sarsens were often found. Now, these beds always occurred in hilly ground, and in the upper chalk. In accounting for the presence of the Brickearths it would be necessary to consider that, at an early date, the stratified Eocenes, of enormous thickness in places, occupied an arctic sea, or rather two small inland seas, for such the so-named London and Hampshire Basins might be considered; and that, by exposure to rapid currents, tides, and ice-floes, a large portion of the strata became denuded, leaving, as the waters shallowed by a gradual retiring of the land, masses of unstratified amorphous material over the face of the country. This same denudation left bare in places the Bagshot sands, London clay or Woolwich beds, as standing memorials of the wreck to which the Tertiaries had been exposed. This was succeeded by the scooping out of holes and pipes in the underlying chalk, which Sir C. Lyell and Mr. Prestwitch considered must be due to the solution and carrying away of the chalky material by water, charged with carbonic acid gas, derived from the decomposition of the vegetable matter, which must have largely overlaid the surface. This process continuing would in time be the means of removing immense masses of chalk, the calcified water escaping down the pipes into the reservoirs and gullies permeating the chalk hills.

At the time the pipes were forming the clay became precipitated into them, and mixing with the chalk-flints the whole graduated to the bottom, and formed the clay-with-flints. The Sarsens also dropped into the holes; and that portion of the clay which could not be absorbed into the clay-with-flints, remained on the top of the beds, and had been denominated Brickearth. Green and black-coated flints were not unfrequently found mingled with these deposits. Straggling pipes were further found in connection with these pot-holes, filled with coloured clay, derived probably from the decay of the chalk; and sand had also frequently worked its way down into the pipes with the clay. During the time the sand-pipes were forming the clay, sand, and other materials had gradually become washed away, and channels formed in the superincumbent chalk. Then followed the snow, rain, and tempest of Mr. Tylor's so-called "pluvial period," which tracked the footsteps of the sub-arctic period, and these persistent agents ultimately scooped out the chalk-valleys, and the Sarsens, dropping down as the valleys deepened, finally found their present resting places.

It had often been conjectured that the blocks were transported from great distances by glacial agency; but there was no sufficient grounds for such an opinion, inasmuch as the stones were all of one local formation; whereas far travelled ice-borne boulders would most likely include rocks of very diverse kinds. It was quite probable, however, that ground-ice might have been an agent in transporting some of the larger masses for considerable distances along the valleys. Indeed, the abrupt escarpments on some of the hill sides, in the course of the chalk-valleys, so different in aspect from the ordinary rounded outlines which characterise chalk districts, pointed to some grinding action in their production, and such as might have arisen from masses of ice formed at the bottom of the streams, and which rising to the surface laden with stones and gravel, were swept onwards with immense force by the flood-waters, scarping the valley projections in their progress. A paper by Engelhardt, of which a translation appeared in the "Smithsonian Report" for 1866, pointed out the consequences of these ice-drifts in choking the rivers, and during a rapid thaw, flooding the Rhenish and Danubian provinces.

This grooving process had left unmistakable evidence of its handiwork in the drift lying along the sides of the Kennet-vale, at a height of, in some places, 60 feet above the present valley level, showing that the stream had once occupied that height. Thus the upper and lower beds were of very different ages. And although some of the Sarsens were unworn and untravelled, others showed signs of rough usage from swift currents of long duration, as they were found in places, as on Inkpen Common, drifted in amongst heterogeneous materials, derived from every formation in the London Basin. At an indefinitely less distant period the present diminished stream commenced flowing through the valley. All these several conditions were not accomplished without much and diversified handling on the part of the many handmaids employed by Nature. The land rose slowly or by starts, the terraces, probably, marking the changes of level; and when the more powerful of the denuding agents had ceased their operations, the lower valleys had begun to retain the gravel obtained from the older gravel beds on the higher ground, and of the chalk beneath, and gradually the silt, mud, and lastly the peat, brought the face of the valley to its present quiet contour; and now the contracted river, supplied by a less rainfall, and a diminished valley-slope, flowed on without any great periodical change in volume or velocity.

USES.

From the time that the ancient Celtic people pastured their herds upon the Downs to the present hour, the Sarsen stones had been appropriated to very various uses. Spread broadcast over the face of hill and dale, and easily accessible, and other building materials not being immediately at hand, what more natural than that the primitive Briton should have selected those fashioned by Nature to suit his purposes, and with them built his temples, cromlechs, and memorial stones. It was found therefore that he availed himself of some of the most gigantic specimens for the erection of two out of the four circles of Stonehenge, and the whole of Abury, together with its mystic serpentine avenues, which were stated by Stukely to have consisted, inclusive of the circles of the temple, of 600 of these Sarsen masses, their individual weight probably averaging from 60 to 100 tons. Similar stones, not half a century ago, surrounded many of the Wiltshire barrows; but most of them had been since used up for road repairing, or for building purposes. One remarkable relic of ancient times was a holed Sarsen, standing under a tree by the roadside at Kingston Lisle, near the famous hill of the White Horse. It had long given the name of the "Blowing stone" to a wayside hostelry. The noise emitted by blowing into the upper part of the stone was so terrific, that if uttered in the silence of the night it must have effectually awakened the Saxon slumberers in the vale below.

Some of the Romanized Britons used these stones to build, by simple impaction, their villages on the Downs; one of which stood near Russley, a lonely spot not far from the old Ridgeway, a British trackway from time immemorial used by the Welsh drovers, with their cattle travelling out of the West of England. And yet again, the materials used by the Roman Britons had been carted away to construct the modern village of Baydon. Walls, barns, piggeries, cottages, mansions, churches, all had received a taste of the Sarsens of the Tertiary Basin. These massive blocks, therefore, consolidated in a sea-bed thousands of years before man's advent, and left stranded by the gradual retreat of the waters, all their concomitant sands, clays, and other oceanic sedimentary matters washed away from them, and after subsequent exposure for ages to the rude elements, used as building stones in the Pagan temple of the Celt, as well as in constructing the mansion of the modern English Noble, their past might fitly furnish a theme for the Geologist, the Poet, or the Antiquary.*

A cordial vote of thanks, proposed by the President, Mr. Haselwood, was given to Dr. Stevens, in whose absence the paper was read by Mr. Wonfor, one of the Honorary Secretaries.

In reply to an enquiry by Mr. Sawyer,

Mr. WONFOR said that specimens of Sarsen stone might be seen on the Dyke Road, and in several parts of Brighton, some of them being very large.

Mr. SCOTT mentioned that they were to be found on the Hollingdean Road, in the village of Stanmer, and in Moulscombe Farm, near the Lewes Road, the largest piece that he knew of being at the last-named place. These stones were sometimes used for dividing estates. He had brought with him several pieces as specimens.

Mr. WONFOR remarked that Mr. Alderman Martin had told him that three large greywether stones, originally standing at the top of

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* REFERENCES.—Aubrey's Natural History of Wiltshire. Stukely's Abury and his Stonehenge. The Drift near Marlborough, S. B. Dixon, 1867. Sarsens, Rev. T. Adams, Trans. Newbury Field Club, 1872. Memoirs of the Geological Survey, No. 12, Whitaker; also Memoir to sheet 34. Remarks on Sarsens, found near Southampton, Geolog. Mag., July, 1866, Lieut.-Col. Nicolls. Journal Geological Society, Prestwich, Vol. X. Journal Geological Society, Vol. 18, Whitaker Memoir 7 Geological Survey. Abury, Wilts Magazine, No. XII. Long. Maw on Consolidated blocks, Drift, Suffolk, Geological Repertory, Jan. 1867. The Kennet Valley, Professor Rupert Jones, 1854. Buckland, Transactions Geological Society, Vol. II. Camden's Britannia. Art. by Rev. W. Fox, Geologist, Vol. V. Physical Geology, &c., by Professor Ramsey, 2nd Edition, 1864. The Kennet Valley, Professor Rupert Jones, Trans. Newbury Field Club, 1872.

Clifton Hill, had been used for forming the base of the Fountain on the Steine, and another which had marked the boundary on the Dyke Road, had been carried away to form part of a fernery. A very large one used to stand in the Temple field, near Denmark Terrace, but it had probably been disposed of in the same way as a flint stone of prodigious size, that was once to be seen in Kemp Town—a hole having been dug into which it had been placed.

Mr. SCOTT, for the sake of eliciting Mr. Ward's opinion, said he thought that possibly ice agency had something to do with the distribution of the Sarsen stones, seeing that erratic blocks had been carried some hundreds of miles by the same agency. He thought that Dr. Stevens had rather ignored this.

Mr. WONFOR pointed out that the formations were known from which other erratic blocks came; but there was no known formation from which the Sarsens could come.

Mr. H. VERRALL pointed out several facts which militated against this theory; among others, there was no evidence of glacial action south of the Thames line.

Mr. J. CLIFTON WARD, F.G.S., Geological Survey, remarked that where rocks were deposited by ice agency many different rocks were found; but the greywethers were not mixed with other rocks. From a very close intimacy with ice-borne boulders, he felt pretty certain the Sarsens originated as Dr. Stevens had suggested.

Dr. CORFE asked if the stones of Stonehenge were not different from the greywethers? He had always understood so.

Mr. G. SCOTT: Most of them are greywethers; but some are not; these had been thought to be presentation stones.

OCTOBER 23RD.

MICROSCOPICAL MEETING.—DR. HALLIFAX AND MR. WONFOR ON MOUNTING IN FLUID.

In accordance with a wish expressed by the President, Mr. J. E.

Haselwood, at the previous meeting, Dr. Hallifax and Mr. Wonfor gave a practical lesson to the Members present on Fluid Mounting.

It was first pointed out that failure in securing permanence and freedom from air-bubbles was not confined to slides mounted by amateurs, but was a common fault in the preparations of some professional mounters, notable examples of such failures being handed round for inspection.

Among the chief causes of the presence of air-bubbles was either a want of perfect union between the cell and the slide, or imperfection in the mode of fixing the covering glass. This was seen in glass cells in a less degree, but more so in the various substitutes for glass of a more or less porous character. The same remark applied to the shallow cells made with cement, and the turntable; the cause of failure in each case arising from a want of union between the slide and the cell.

Another cause of failure was a want of flatness in the cell; in the case of glass and some other substances it was difficult to grind down to a flat surface, but with cells made of the materials they had used for years a perfectly flat surface could be easily obtained. There was one caution very necessary to beginners, and a neglect of which was a very fertile source of failure. Never hurry the operation in mounting. It was also well to allow the object to steep for some time in the fluid in which it was intended to preserve it. By this means the fluid penetrated into the object, and the after-presence of air-bubbles in the mounting was often avoided. In some cases steeping in alcohol, the application of gentle heat or the use of the air-pump was very advantageous, though the last-named might be dispensed with by allowing more time.

When the object was placed in the cell it was found advisable to heap up the fluid, and then to place the covering glass on it as horizontally as possible.

The making of deep and shallow cells, with modes of fixing them on the glass slides, and the different kinds of fluid best suited for different classes of objects, with the method of manipulation were practically shown by both gentlemen mounting different objects in deep and shallow cells, many hints being given at the same time on the preparation of cells and objects.

Information being asked for respecting mounting in Canada balsam, it was recommended that it be used as fluid as possible and cold. The process of boiling, as recommended in some manuals, being strongly condemned for most preparations. If time or very gentle heat were allowed any trace of air-bubbles would vanish. Attention was then drawn to a mode of mounting fresh animal tissue in balsam by steeping in absolute alcohol, by which means the water was absorbed, then in an essential oil, such as oil of Cassia, and lastly mounting in fluid balsam. Preparations were shown mounted in this way in which the time consumed, from cutting the object until the covering glass was placed over it, was not more than twenty minutes. The object had been placed on the glass slide, absolute alcohol had been added and drained off, this was twice repeated, then oil of Cassia, and lastly fluid balsam.

Very cordial thanks were given to Dr. Hallifax and Mr. Wonfor for a practical lesson, which lasted an hour and a half, and was evidently appreciated by a strong muster of the Microscopical Members.

November 13th.

ORDINARY MEETING.—MR. E. A. PANKHURST ON "SOME OF THE RECENT DISCOVERIES RESPECTING THE VITAL POWER OF PLANTS."

There was great difficulty in determining "What is a plant," or to say where plant life ended and animal life began. If they affirmed that the power of independent motion distinguished the animal, then the coral, polyp, and many related species which had no more indepent motion than an oak, must be considered as plants, and the ciliated spores of plants which moved hither and thither in the field of the microscope must be considered as animals; and was the quick, rolling *Volvox Globator* less a plant, because it turned and moved.

Linnæus thought he had settled the question with his aphorism—

"minerals grow, plants grow and live, animals grow, live, and feel;" but as Dr. Carpenter remarked, "It is a very difficult problem to separate plants from animals by the simple distinction of feeling. The only idea we have of feeling in the lower animals arises from our attributing the same sensation to animals when they move as we experience ourselves." The tentacles of the sea anemones moved when they were touched, and so we said the sea anemone felt; the leaf of the sensitive plant moved when touched, the filaments of the barberry stamens fell down and struck the pistils when irritated—did they feel? The only criterion of feeling was movement in response to touch, and if this must be the test then many vegetable organisms, such as the sensitive plant, must be classed as animals.

The test of possessing a nervous system was an equally futile one. Some animals, like plants, had no semblance of a mouth or stomach, and received their food indiscriminately at any part of their surface. Fungi, too, demanded organic and not inorganic matter as pabulum, whilst the drosera or sun-dew of our English marshes, which had the faculty of entrapping insects, seemed to know what substances were worthy of being retained, as its glands did not close over pieces of wood which were put on the leaf, but a small piece of beef was at once caught and retained by the glands, and after some time the juices were extracted and it became colourless. These remarks applied with equal force to the sea anemone. Could they, on the face of the above experiments, refuse power of instinct to the strange animal plant of which he had been speaking?

It was well known, too, that those tissues of higher animals, which had the power of contracting when stimulated, viz., nerve and muscle developed voltaic currents, which had a certain direction in the tissues, and Dr. Burden Sanderson, of King's College, had lately discovered that these voltaic currents existed to a remarkable degree in the drosera and plants belonging to the same natural order.

It was further asserted that there were substances found in plants, which formed no part of the animal body. First, cellulose, the chief constituent of woody fibre, was declared to be distinctive of vegetable organisms; but this substance had been found in the human body. Next it was chlorophyl, that green colouring matter which gave plants their well-known hue, but Schultze enumerated eight species of animals—green animalcules—to which it gave their peculiar colour.

Dr. Carpenter alleged this as a distinction—"Where we find oxygen exhaled and carbonic acid given off we have an animal; and that where carbonic acid is absorbed and oxygen given out we have a plant." An elaborate series of experiments had, however, been lately made by Dr. J. C. Draper, of New York, and the conclusion he came to was, that "growth as applied to evolution of structure or organisation is inseparably connected with oxidation;" that was to say, that in the process of that cell-development whereby the structure of a vegetable organism was increased, carbonic acid was given off and oxygen inhaled, precisely the same as in animals. It was only the green parts that at any time exhaled oxygen, and then only under the influence of sunshine. The other parts of the plant above ground, which were not green, viz., the stem, twigs, flowers, &c., were at all times, day and night, exhaling carbonic acid. The whole history of the plant, from the time the seed was planted till its death, was a continual story of oxidation. Two distinct operations connected with the respiratory functions of plants must be distinguished. There was the preparation of this substance, out of which the cells were built and nourished. It was in this that the carbon was obtained from the carbonic acid, and oxygen exhaled. It was in this that the remarkable substance, chlorophyl, was intimately concerned.

The next inquiry was, by what power the functions of the vegetable organism were carried on? If they meant by these some special property which existed out of the animal or plant they raised up a kind of spectre, which was but the magnified image of their own ignorance. Forty years ago there was a hard and fast line between the inorganic and the organic—they could not build up in their laboratories the substances found in animal and vegetable organisms. The force which did this, to use Dr. Prant's words, "could not possibly be chemical; it was vital, and its nature was completely unknown." But now the chemist could prepare at least 1,000 substances precisely the same as those now formed within the living plant and animal.

Not only were organisms affected by light, heat, electricity, and magnetism, but plants, when placed under the different colours of the Solar Spectrum, were stimulated to the greatest activity under the yellow ray, which was the most luminous to the eye. In measuring the sum total of the vital energy of plants, scientific inquirers were at a great disadvantage; with man they could estimate the amount of nutriment imbibed, and could measure the work done, the weight lifted; they could ascertain the force with which the valves of the heart contracted, they could know the weight of blood raised by it; they could count the number of pulsations, and could ascertain the sum of the mechanical energy of existence—it equalled, one ton lifted 124ft. high every twenty-four hours. They had arrived at least at this position—in man and animals generally the power which the food supplied was expended from hour to hour; in plants the larger proportion of this power was laid by, was rendered latent as it were, was not actual but potential, so the sum total of the mechanical energy of a plant was difficult to calculate. There was no absolute distinction between plants and animals; every effort to make that distinction had failed and no doubt would fail.

After a vote of thanks, proposed by the President, Mr. J. E. Haselwood,

Mr. PIGGOT pointed out that it had been observed that cabbages grew more in windy than in quiet weather,—the supposed reason being that relays of carbonic acid were brought to them.

Mr. WONFOR considered they must not accept as proved some of the experiments made, as they were so startling that, until they had been confirmed, there was ground for reasonable doubt. The experiments with drosera were not new, but were made by Knight and others nearly thirty years ago.

Dr. HALLIFAX had heard nothing to upset the distinction between a plant and an animal, viz., a plant could assimilate inorganic matter. The food of an animal must have been elaborated by some vital principle before it could be assimilated. The case of fungi must be taken as an exception.

Dr. CORFE drew attention to the selective power of the roots of plants, and, in the course of his remarks, stated that he was trying a series of experiments in that direction, and would some day lay them before the Society. He felt almost inclined to describe what he had seen as approaching closely to instinct.

Previous to the reading of the paper, the receipt was announced for the Society's Herbarium, from Mr. G. DAVIES, of a very rare Lichen, *Verrucaria ochrostoma*, found that month by Mr. Davies in the Weald of Sussex. This lichen had been lost until then, not having been met with since Borrer first found it in Sussex in 1850. It was also mentioned that *Arthonia Spadicea*, new to Sussex, was found by Mr. Davies on December, 1872, in Ashdown Forest, near where *Calicium septatum* grows; and that he had found *Lecanora Hageni* with *L. sophodes*, var. *lecideoides*, near Cuckmere.

Mr. WONFOR reported that Mr. Willett had sent him, for examination, the second example of *lingula ovalis*, found at a depth of 294 feet, in the Sub-Wealden boring. It was believed that they had reached the Kinmeridge Clay, and some had thought they were nearing the Palæozoic rocks.

NOVEMBER 17TH.

MICROSCOPICAL MEETING.—MR. W. H. SMITH ON OPIUM ALKALOIDS.

Opium, whether derived from the white or black varieties of *Papaver Somniferum* was a very complex substance, consisting of one or two Acids and a number of Alkaloids. Morphine, Narcotine, Codeine Narceine, Meconine, Thebaine, Opianine, Papaverine, and Porphyroxine, had been long known, but Apomorphine, Chlorocodine, Codamine, Cotarnine, Cryptopine, Hydrocotarnine, Lanthopine, Laudanine, Laudanosine, Meconidine, and Protopine, were new Alkaloids but little-known.

If a drop of a solution of Opium evaporated to the consistency of treacle be placed on a glass slide, and a thin glass cover be gently pressed down over it, crystals of the different alkaloids would be formed. While a solution of opium in weak spirit contained all the alkaloids known to possess medicinal properties, the different alkaloids were found to possess different properties. Thus, while crude opium was narcotic, narcotine, a very abundant alkaloid, was not a narcotic, but a tonic, similar in its action to quinine. Thebanine had a convulsive action, somewhat like the action of strychnine ; apomorphine in doses of less than half a grain produced vomiting, without previous nausea, in ten or twelve minutes. The greater number though of the alkaloids possessed the narcotic principles of morphine in a less degree : thus, if the power of morphine was called 4, that of meconine and narcine would be $2\frac{1}{2}$, codeine 1, cryptopine (a rare alkaloid) 5.

These facts had led to the use of various solutions of opium and its alkaloids, from which certain other alkaloids had been excluded. Some of these solutions, whose preparation was a secret, possessed peculiar virtues. If these preparations were evaporated on a glass slide, the microscope would reveal the peculiar crystals, so that the alkaloids being recognised the Pharmaceutist studying the solubilities of various alkaloids in different menstrua, might construct a formula which would produce a similar solution.

The per centages of the different alkaloids in Turkey Opium had been given as Morphine, 10·0 ; Narcotine, 6·0 ; Thebanine, ·15 ; Papaverine, 1·0 ; Meconine, ·01 ; Codeine, ·02 ; Narceine, ·02 ; Meconic Acid, 4·0 ; Thebolactic Acid, 1·25.

As about 10-11ths of the narcotic power of all the alkaloids was due to morphine alone, theoretically, 1 grain of morphine equalled 10 grains of crude opium, though practically this was not the case. Some considered there was a narcotic power in the uncrystallizable matter, and others that the alkaloids acted better when in combination with their natural acids. Very careful examination had shown morphine free and in combination with sulphuric and meconic acid ; now as opium in its collection and preparation underwent rough treatment, and meconic acid was so unstable as to be decomposed by boiling water, the free morphine and sulphate of morphine might have been produced by the decomposition of meconate of morphine or a combination of morphine with some more unstable acid. A microscopic examination of fresh juice might solve the question.

Mr. GLAISYER having kindly procured him thebaine, papaverine, meconine, and sulphate of morphine, from which he had obtained very characteristic crystals, as well as from meconic acid, narcotine, morphine, codeine, and some of the preparations of opium, these would be exhibited under the microscope.

Narcotine, meconic acid, thebaine, and thick crystals of morphine were strongly affected by polarized light, while codeine, meconine, narceine, papaverine, and sulphate of morphine, were but slightly affected.

Narcotine and morphine both crystallised in prisms, the former polarized more strongly than the latter, and had pointed ends. Thebaine crystallised in very characteristic plates. Meconic acid in a very irregular manner, some of the crystals strongly resembling uric acid, but the typical shape appeared to be a square prism; codeine in octahedra, easily recognizable, or in prisms with pointed ends like those of narcotine, from which it was easily distinguished by its effect on the polarized ray; meconine in six sided prisms with dihedral summits; narceine in tufts of silky crystals, and sulphate of morphine in flat ended prisms, collected in tufts.

A discussion followed, in which Drs. Hallifax and Corfe, Messrs. W. H. Smith, Sewell, Payne, B. Lomax, and Wonfor took part; and after a vote of thanks to Mr. Smith, the Meeting became a Conversazione, when the preparations made by Mr. W. H. Smith were exhibited by the President (Mr. Haselwood), Messrs. Sewell, G. D. Sawyer, F. W. Sawyer, R. Glaisyer, W. H. Smith, and Wonfor.

December 11th.

ORDINARY MEETING.—MR. WONFOR ON THE BALANCE OF LIFE.

It was almost universally conceded that, with few exceptions, the plant obtained inorganic matter from the mineral world, and converted it into its own substance, and that the animal consumed the plant, appropriating to its own sustenance all the nutritious parts, and got rid of that which was useless, while the animal might itself, in turn serve as nutriment to another animal, by whom its parts would, more or less, be assimilated, and so on, until death and decay dissolved its frame, and returned its elements once more to what we termed the inorganic world.

It was true that to so general a principle there were some exceptions, in which the plant, instead of deriving its sustenance primarily from the inorganic world, utilized the elaborated juices of other plants, as in the case of the mistletoe, or derived its pabulum from either the decaying plant or animal, nay, in some cases, from the living plant or animal, as seen in the case of many fungi; but these were exceptions to the rule by which we could trace the changes from the inorganic to the vegetable, and from the vegetable through the animal back to the inorganic world.

While tracing any of these changes, certain marked facts stood out, showing that, where inorganic matter had passed through organized bodies, and returned to the soil, the constituent elements had, as it were, acquired higher properties and had become elevated by passing through organized bodies.

Thus if a portion of bare rock was exposed to the action of light, heat, and moisture, in a short time a greenish colour was seen to come over it, which, if carefully examined, revealed the fact that spores of some cryptogamous plant had found a suitable *nidus* in which to germinate. Soon a moss or lichen made its appearance, to serve as food to some minute animals. Some portion of it decayed, the animal deposited its refuse matter, the wind caused particles of dust to settle and, in time, a small accumulation of soil was formed, in which the seed of a phœnogamous plant nestled and germinated, giving rise to a plant which could not have obtained either a foot-hold or an appropriate pabulum, on the mere rocky surface.

Or take what was so admirably shown some years since by Mr. Hollis in a paper on "Isomeric Substances." How different was the action, whether as manures or medicines, of many chemical compounds when derived directly from the inorganic world or indirectly from organic substances; thus, while the chemist could detect no difference between some salts obtained from organic and inorganic matter, the plant on the one hand discriminated; and on the other, the effect, when exhibited as medicines, was diametrically different. This was notably the case in certain preparations into which phosphate of lime entered —that prepared from bones being positive in its action; while that derived from the Rock of Estramadura was negative. It would seem that when primitive elements, as they might be called, passed through organisms they became more elevated in their nature and properties.

Apart from these considerations, there was another law which seemed to run through plants and animals, viz., the provision made to keep down, or within limits, all tribes of plants and animals, so as to prevent, as it were, an extinction of some families or species through the overrunning of others.

There would be little difficulty in showing that, as far as the geological record revealed the facts, vast tribes of plants and animals had disappeared, to make way, it might almost be said, for higher and more developed forms, and, whether we accepted the conclusions of the evolutionists or not, the mass of life now was decidedly in advance of that of any other period of geologic time which preceded the existing Fauna or Flora. Of this it would be scarcely necessary to give examples, because to the most cursory observers the facts were patent.

If it were considered for one moment what would be the condition of things, if there were not agencies at work to keep down both plants and animals, we should possibly be startled by the calculations. Take for instance any one of our forest trees, which, like the sycamore, beech, or the oak, matured their tens of thousands of seeds annually—if there was nothing to keep them down, the land would in a few years be overgrown with these trees alone. Descending to smaller and less conspicuous plants, such as the groundsell, the shepherd's purse, or the chickweed, which seemed to produce several crops a-year,—in the course of but a few years, were there not some provision to check their progress, the whole land would be covered by them.

Take, among the animal creation, those pests to the gardener, the *Aphis* tribe. If the calculations be correct, one Aphis producing only 50 individuals for the first brood in the spring might be the fertile cause of so many individuals by autumn, that packed closely together her progeny would cover ten acres. Or assuming that the roe of a single codfish developed as many fish as there were ova, and so on for a few generations, but a short time would elapse before the sea would be full of codfish alone. Seeing these things did not occur, it might naturally be asked what agencies are at work to prevent such a catastrophe.

Both with animals and plants one agency by which they were kept down was this, they served as food to other animals, and when we sometimes unthinkingly asked what was the use of such and such creatures, the answer might not unfrequently be given—to preserve the balance of life.

In the balance of plant life, two very conspicuous agents played a part, viz., climate and soil. The former influence was possibly very slow; the latter acted more rapidly in checking the multiplication of individuals, while to these a third might be added, the smothering of seedlings by other and more vigorous plants. A curious illustration of this last was seen in the common maple, thousands of seedlings of which sprang up every year near the parent tree, and were killed by the smothering influence of the summer grasses.

Man for the purposes of cultivation disturbed the soil, either at home or in the colonies, and the result was, the spread of certain plants at the expense of the native plants. A curious fact had been observed by many—the greater abundance of annuals in cultivated, as compared with uncultivated countries, indirectly pointing to the fact that disturbed soil seemed necessary to their existence. Some had even gone so far as to assert that were the land in any populated country to be depopulated, the common wild "annuals" would become either very rare or extinct.

All must have noticed that when ground was disturbed, or a railway embankment made, plants such as the groundsell, shepherd's purse, poppies, speedwells, *poa annua*, and other annuals, make their appearance the first year, while sometimes the ground was covered with an *Equisetum*; the second year but few of these annuals were to be seen, their place being mainly occupied by biennials, such as coltsfoot, dandelions, and some umbellifers, which in time gave way to perennial grasses, docks, plantains, &c.

In America, wherever Europeans had put their foot, there Dutch clover had sprung up, while in South Africa, Australia, Tasmania, and New Zealand, the Scotch thistle, plantains, docks, &c., became noxious weeds, though the thistle had been found the best agent in breaking up the soil and rendering it fit for cultivation, owing to its roots penetrating so deeply.

One strange fact had been noticed—our European annuals in New Zealand proved themselves superior to the perennials of the country; thus, while few of the New Zealand indigenous plants were annuals, half the naturalized wild imports, to the number of 180, belonged to this class; while the dock, the sowthistle, and the white clover, were spreading everywhere, the latter displacing the native grasses, and the watercress was choking the streams, much in the same way as the American pond weed *Anacharis* was choking our English rivers. There did not seem the same vital force in plants imported from the Southern Hemisphere to the Northern, as from the Northern to the Southern ; some of our Northern plants, it was said, which seeded with us but once a year, or were only annuals, seeded frequently, or became biennials or perennials.

Buffon started the doctrine, that "taking beings generally, the total quantity of life is always the same," and "that man has made choice of some twenty species of birds and mammals, and these twenty species figure more largely in Nature, and are of more advantage to the world than all the others put together." Flourens, arguing from Buffon's *dicta*, has shewn that this tendency had always been observable—"relatively to the quantity of life, there is a kind of compensation upon the globe—in proportion as certain species die out the number of individuals in some others increases." And Darwin and his followers had shewn how, in the struggle for existence, the more powerful, and those best able to accommodate themselves to altered circumstances, survived, while the weaker and less yielding, had become extirpated.

Looking first at man and his selected mammals, and those animals which followed his footsteps, they had driven out, and were still driving out, the noxious and injurious animals, and replacing them with the useful. It was quite true that some of his companions did become pests. There was a Maori saying, "As the white man's rat has driven away the native rat, as the European fly drives away our own, and the clover kills our fern, so will the Maoris disappear before the white man himself"—a prophecy which it was feared, judging from the past history of the world, was too likely to be fulfilled. It was perfectly true that the Norwegian rat, which had nearly in our own island extirpated the black rat, had in parts of New Zealand extirpated the native rat, itself in many cases going out before the European mouse, while so patent was the disappearance of the native blue-bottle before the house-fly that colonists, knowing its usefulness, carried it with them in boxes or bottles to the inland stations. The pig, too, had become such a pest, that when 6d. a tail was offered, 22,000 tails were brought in from some runs without an apparent diminution in their numbers.

Descending to a still lower level, we saw how the balance of life was preserved by the agencies which tended to keep down what would in time become, and at times did become, pests. Few possibly realized, that while insects generally played an important part in the propagation of plants, by being the unconscious agents in perfecting the fertilization of flowers, they at the same time performed an important office in keeping down vegetation by eating the wood, the *alburnum*, or sapwood, the roots, the leaves, flowers, and seeds of plants, as well as removing what in the form of decaying and putrifying matter might become injurious. It was only when some especial ravage was performed that we realized their apparent destructiveness, as when the larvæ of beetles destroyed thousands of trees, locusts devastated a country, caterpillars laid waste the vegetable produce, or an *aphis* ruined our hops or grapes.

Birds were, as a rule, the agents in keeping down these pests, as those knew, only too well, by painful experience, where the birds, having been killed off, insects, destructive to their crops, abounded to an enormous extent. Other insects, themselves kept under by birds, preyed upon their fellow insects. Ichneumon flies deposited their eggs within the bodies of larvæ, which never became flies or beetles, able to propagate their race, while the larvæ of some species devoured the eggs and caterpillars alike, and so kept them in check. The aphides were devoured by the lady-birds, and their larvæ; by the larvæ of lace-wing flies, and those blue-black flies seen flitting about flowers, as well as being pierced by ichneumon flies.

He was partly induced to call attention to this matter by what was taking place in France. There some 87,000,000 acres of land covered with vineyards, producing on an average 1,100,000,000 gallons of wine a year, had, during the last eight years, been plagued by an insect pest, the *Phylloxera vastatrix* (closely allied to our well-known *aphis*, or green fly of the hothouse), which, during that time, had devastated 4,000,000 acres of French vineyards. Every possible device of the chemist had been tried in vain—carbolic acid, creosote, coal tar, petroleum, and naptha, with chloride of lime, sulphur, sulphide of lime, sulphurous acid, arsenious acid, and bisulphide of carbon, one of the most fetid of chemical substances, had each and all been used to no purpose.

It was true that some, notably the bisulphide of carbon, killed the pest, but it also killed the vines. Some suggested tobacco ; this did succeed, but it was found that to strew the ground a foot deep round the plants with green tobacco leaves, took an acre of tobacco to save an acre of vineyard. Some said introduce small birds, but the pest was of so recent a date that the absence of small birds could not account for its spread.

At last, a French naturalist, M. Planchon, went to America, whence it was believed the *phylloxera* was imported, studied the insects and their enemies, and there found a nesting *acarus*, a species of American "plant lion," which lived upon it; and now, having introduced both the bane and the antidote, they were in hopes of checking the ravages of the *phylloxera*.

Here he might pause, the lesson learnt being that Nature preserved a balance if man let her alone; but if he interfered, and either killed off what he fancied noxious things, or imported pests, he would suffer detriment until either the antidote recovered strength on the one hand, or was imported on the other together with the pest.

The PRESIDENT, Mr. Haselwood, in proposing a vote of thanks to Mr. Wonfor for his paper remarked, apart from the interest and instruction afforded, Mr. Wonfor's paper shewed the importance of the right study of Natural History, and he would urge on all naturalists to use their best endeavours to extend the Society's roll of membership.

Mr. G. SCOTT would like to know from some of the chemists present, in reference to a statement made at the last meeting, that the chemists had been able to manufacture from inorganic material 1,000 substances identical with those said to be of purely vital origin, whether such was the case in the main?

Mr. W. H. SMITH shewed that the chemist had been able to produce certain substances, such as essences and dyes, but that most of them had some organic source.

Mr. HENNAH pointed out that the oil of lemon had been manufactured by the chemist from inorganic substances; but Mr. T. W. Wonfor subsequently asked from what substances that oil had been manufactured, and Mr. Hennah replied from turpentine.

Mr. WONFOR then argued that in every case an organic substances was taken as the basis on which the artificial essences, &c., were built up.

Dr. CORFE pointed out that plants disseminated between organic and inorganic manures; and in the case of parasites, they were only found where degeneration of tissues had commenced.

Mr. G. SCOTT enquired how the appearance of plants on embankments and broken ground, without, so far as had been observed, previous sowing of seeds, could be explained.

Mr. WONFOR considered that the seeds were conveyed together with the earth, or brought to the surface, and so were able to germinate. It was a well known fact that different seeds possessed different degrees of vitality, some germinating only after a few months, while some retained their vitality for centuries.

A discussion was carried on for some time by Messrs. W. SAUNDERS, WONFOR, and HENNAH, on the greater vitality of weeds and seeds of the Northern or the Southern Hemisphere, the last named gentleman promising to make enquiries respecting the times of flowering and seeding of European plants introduced into New Zealand.

Previous to the reading of the paper, a pleasing reminiscence of the Society's Excursion in 1872, in the form of a painting representing a scene on the Adur, was presented for the Society's Album by Mr. O'Bryen Lomax.

JANUARY 28TH.

ORDINARY MEETING.—MR. J. C. WARD, F.G.S., ON THE OLD GLACIERS OF CUMBERLAND.

The general characters of modern glaciers were as follows:—

A glacier represented the snow drainage of a mountainous tract, and was a river of ice moving in all respects like an ordinary river, only much more slowly. It flowed faster at its centre than at its sides, and at its upper surface than at its lower; it became troubled on rounding a curve, and broken up in falling over a precipitous part of its bed. The line of swiftest motion changed from side to side with the curvature of the valley, as in the case of a river; and regelation constantly re-united the shattered portions on changing from a troubled to a smooth part of its course.

Rocky fragments were for ever falling from the mountain sides upon the glacier, where they formed long lines of débris—*lateral* *moraines.* When several glaciers united, some of their lateral moraines became confluent and formed *central* moraines upon the surface of the compound glacier. The ice, ever moving on, at last reached a point where the melting power of the sun's heat equalled the forward movement, and here the vast quantities of stony material carried along in the ice were thrown off and formed a great semi-circular mound called a *terminal* moraine.

As the ice was pressed down the valley, it rounded, smoothed, and scratched the rocks, by the aid of stones imprisoned between it and the rocky sides and bed. Oftentimes, sinking in height, it left blocks perched in strange-looking positions, into which they could not have fallen.

Where the ice was squeezed through a narrow gorge, its velocity was increased and its power of rocky abrasion likewise. Altogether, glaciers not only brought down vast quantities of rocky material from higher to lower levels, but they also deepened and abraded the valleys through which they flowed, producing greater effect at certain points, where the pressure of the ice was greatest, or the rocks were softest, than at others. The marks and effects of glacier action were perfectly distinctive, unlike those produced by any other natural agent.

When glaciers terminated in the sea, their ends broke off and formed icebergs, which floated away with the moraine material upon them, and scattered it over the sea-bed in melting.

Among the Cumbrian mountains the signs of glacier action at a recent period were everywhere plainly visible. Rocks were rounded, smoothed, and striated ; huge blocks lay perched in strange positions ; many an upland valley was filled with old terminal moraines.

The sequence of events during the so-called Glacial Period was probably much as follows :—

1. Glaciers, small at first, gradually increased in size as the climate became more severe, and kept pushing before them or partly overriding their first-formed moraines.

2. The separate glaciers became united into a more or less continuous sheet, clothing the mountainous country in one uniform icy mantle.

3. The climate ameliorating, the ice-sheet diminished, shrank into separate glaciers once more, and each glacier as it became smaller left moraine after moraine behind it, until when the ice had all disappeared, the country was covered with mounds of moraine material much broken into and re-sorted by the swollen streams and rivers flowing from the ends of the fast-melting glaciers.

4. Then a subsidence of the land ensued beneath the sea ; the moraine matter was remodelled and partly rounded beneath the waves and currents ; and banks of sand and gravel were formed at certain points, where currents met.

5. When the land had sunk some 800 and 1,000 feet beneath its present level, the cold conditions began to return, and floating ice swept through the various straits, which now are valleys parting one mountain range from another.

6. The subsidence continued, until probably merely the mountain tops were above water, and then as slowly was the land once more upheaved, and small glaciers occupied the mountain hollows.

7. Finally, the relative level of sea and land became pretty much what it is now, and the second set of glaciers, which, although large, had never attained to the size of the first, dwindled away, and left the very perfect moraines now to be found at the head of many of the upland valleys.

8. An early race of men, making *polished* stone-implements from the rocks of Scawfell, then inhabited the district, and saw perhaps the last of the Cumberland glaciers. This early race, by no means the earliest which England had seen, was succeeded by others to whom the use of metals was known, and the conquering Roman legions also left their mark on mountain top and valley bottom, which a short age before was covered with snow and ice.

———

The lakes of the district lay in *rock basins*, or hollows scooped out of the solid rock. The rocky sides of these basins were often smoothed and scratched, and it was certain that the hollows had been filled with glacier ice.

It was difficult to see how such hollows could have been formed either by mere weather-action, by running water, by the sea, by special depression, by rock-disturbance, or the formation of gaping fissures. Could the onward movement of the glacier ice have scooped out these shallow basins? (Ramsay).

The following points were in favour of such a solution to the question. The depth of the lakes was very slight as compared with the thickness of glacier-ice which pressed down the valleys. The deepest parts of the lakes were precisely at those points at which, from the confluence of several ice-streams or the narrowing of the valley, the onward pressure of the ice must have been greatest.

In the case of such lakes as Derwentwater and Bassenthwaite, the ice had produced a long and shallow groove along the bed of a flat-bottomed pan-shaped valley. In the case of such as Buttermere and Crummock-water, it was a round-bottomed valley that had been deepened. Hence the reason, probably, why the latter lakes were deeper than the former.

Since the formation of these rock-basins they had been greatly filled up by sediment and gravel brought down by the streams and rivers from the hills around. In several cases one originally long lake—such as Derwentwater and Bassenthwaite united, or Buttermere and Crummock—had been filled up in the middle in this way, and thus two separate lakes had arisen.

After a cordial vote of thanks, proposed in eulogistic terms by the PRESIDENT (Mr. Haselwood),

Mr. G. SCOTT inquired if there were any shells among the beds of sand and gravel referred to?

Mr. WARD replied that none had yet been found; but when they considered that there were many such deposits in Wales, which had been thoroughly examined, and only in one instance successfully, it was not to be wondered at that he, by a slight examination of those in Cumberland, had not found any shells.

Mr. E. PANKHURST asked what was the greatest height at which there were any signs of glacier action among the Cumberland Hills? He knew that the idea that the Lake of Geneva had been hollowed out by ice had considerably staggered a great number of geologists.

Mr. WARD said that the greatest height was rather more than 2,500 feet.

Mr. SCOTT thought they must indicate how well pleased they were to again see Mr. Ward. It was refreshing to have that gentleman away from his mountains, although at the same time tantalising to have to stop in Brighton while he was ranging among the hills. Mr. Ward had ingeniously tried to make them believe that a great deal of the information he had laid before them was old, that much of it had been brought forward elsewhere. That might be true, but they must recollect the great share Mr. Ward himself had in bringing it forward. What he had told them that night truly showed the immense importance of the Geological Survey. It gave a good idea of the work the members of it were carrying out, and the part Mr. Ward was taking in it. When they considered the extraordinary geological changes going on upon the earth's surface, the reconstruction, in fact, of the globe, by the transportation and deposition in ice of dirt and boulders, they were overwhelmed. A wide subject rose out of the lecture that night, namely, what brought about these glacial epochs? but that they might at a future time consider. They could not, however, separate without again manifesting their gratitude to Mr. Ward for his excellent lecture.

Mr. WARD, in returning thanks, remarked that he should scarcely be worthy of his salt, if he could go over those mountains in the prosecuion of his geological work and not see the things he had seen. Therefore, he did not think that any credit was due to him for making the observations he had; but that he would have deserved a deal of blame if he had not made them.

JANUARY 23RD.

SPECIAL MEETING.—CHANGE OF ROOM.

The President, Mr. J. E. HASELWOOD, explained the object of the meeting—to receive and consider a recommendation of the Committee to the effect, that the offer of the Town Council of Brighton to the Society, of the use of the Curator's Room, at the New Free Library, for accommodation for the books and meetings, be accepted. The question was a rather important one, not that he supposed there would be any difference of opinion in deciding it, but because the Committee had felt it was beyond their power to decide ; and hence the calling of them together that night. He would, however, call on Mr. T. W. Wonfor to name the reasons upon which the recommendation was made.

Mr. T. W. WONFOR, one of the Hon. Secretaries, stated that in October, 1872, a letter was directed from the Society to the Pavilion Committee of the Town Council, inquiring whether the Society could be accommodated with a room at the new Free Library and Museum, in which to hold it meetings and place its books, and upon what terms ? In reply, a letter, dated the 8th January, 1874, had been received, delay, they had heard, being occasioned by the deferring the consideration of their application till the Library had been rendered favourable to their admission, should that have been contemplated. The following was the answer to their communication :—

"Brighton, Town Hall, 8th Jan., 1874.

"DEAR SIR,—Referring to the application of the Brighton Natural History Society, for accommodation for their library of books and for the meetings of the Society at the New Free Library recently erected by the Corporation, I am instructed by the Town Council to offer to the Society the use of the Curator's Room for their fortnightly meetings, and for placing therein bookcases and contents, upon the condition that the books shall be under the charge of the Curator, and be available for reference by the public in the same way as the other works in the Free Library, but reserving to members of the Society their right as at present of borrowing any of the books so to be deposited.

I am, dear Sir, yours faithfully,

"DAVID BLACK.

"J. C. Onions, Esq., Secretary,
"Brighton and Sussex Natural History Society."

In reply to the above, the Committee had resolved to inform the Town Clerk that the Society accepted the offer on the terms specified, and, at the same time, requested him to be good enough to convey to the Town Council their thanks for the way in which they had responded to their request. The Committee, however, felt that they could not carry this resolution into effect without the sanction of a general meeting of the members ; and he should propose that this sanction be given. If the proposition were carried, he should feel that what little labour he had given to the Society in the past had not been thrown away, but been usefully bestowed; for by accepting the offer of the Town Council they would acquire a status in Brighton which they had not hitherto occupied, and which no other Society had ever occupied, namely a public recognition by the authorities.

There were sundry reasons why they should accept the offer. The room suggested for their use would afford them more than double the space they had at the present time. In the room in which they were met not many more than thirty persons could be comfortably seated; in the Curator's Room at the Library, above one hundred could be similarly accommodated. Then their library, which had been increasing so enormously, in the hands of their kind friend, Mr. Gwatkin, would also find a place at the Museum; and this was of great moment, for it was but a question of time when their library would outgrow the capacity of Mr. Gwatkin's territory, and require to be removed, and this could not be done under more advantageous circumstances than the present. It would be taken in charge by the representative of the town authorities in the person of the Curator, and, though their books might not be more secure, yet the members having them out would be more strictly looked after.

Another great convenience would be afforded by the use of the reading-room, particularly in the case of those who felt a delicacy in turning Mr. Gwatkin's territory into a reference-room. Some might urge that the books, when taken out by indiscriminate readers, would possibly get more or less damaged; but to that objection he would say, that the books were not allowed to go out of the Library except in the possession of members of the Society, and the town officials, he knew, looked very sharply after their own books, and they would look with equal sharpness after the Society's. One other consequence might be, that the books, being only available for reading by non-members in the rooms, many would be induced to join the Society that they might be enabled to take the books home with them.

Again, it might be urged that the Society had not yet been at any cost for book cases, and that a considerable expense would have to be encountered for such. Well, that would be a necessary expense, and the Society was quite able to sustain it, and the Committee would see that suitable and proper cases were procured. He was reminded by Mr. G. Scott that it was understood by him that, if their meetings should be so large as to overflow the accommodation of the Curator's Room, the lecture-room upstairs would be at their disposal. Another advantage would be, the facility provided for examining specimens in illustration of any lecture delivered. Letters had been received from several members, unable to attend the meeting, approving of the proposal. Mr. Henry Willett, whose consent to the removal was necessary, inasmuch as several of the books were his property, had also written expressing not only his entire approval of the suggestion, but also his wish that his books should go to the Town Library anyway, but, if the Society were to remove, that they should remain in their library, which would be added to by him. He moved that the recommendation of the Committee be approved and accepted, and that a letter be written to the Town Clerk.

Mr. G. D. SAWYER seconded. He endorsed all that Mr. Wonfor had said.

Mr. SAUNDERS inquired if they had any guarantee that the books, &c., should remain the property of this Society.

Mr. JOHN COLBATCH ONIONS, the other Honorary Secretary, replied that the Town Clerk had written that the books were simply to be deposited, and in one of their communications they had stated that it was, of course, understood that the books and bookcases would remain the property of the Society.

Mr. SAUNDERS said that he was quite satisfied.

Mr. J. DENNANT thought the change of locale would be of immense advantage to the Society: it would thereby become much more influential, and would most likely draw more young men into its ranks than hitherto.

Mr. GWATKIN, the present Librarian, expressed his concurrence in the proposal to remove their library, chiefly on account of the rapid increase in the number of books it contained. He had done his best with them, and trusted he had given satisfaction (hear, hear, and applause), but the baby had grown, and was growing, very large. (Applause.)

The motion was then carried unanimously.

Mr. T. W. WONFOR, feeling that they would not have occupied the position they were in had it not been for the kindness of the Medico-Chirurgical Society and the Dispensary Committee, moved that a letter be written by the Secretaries, as soon as they removed, conveying the best thanks of the meeting to that Society and that Committee for having granted them the use of the rooms for so many years.

Mr. G. SCOTT seconded, that he might have the opportunity of saying how extremely he was pleased and gratified by the unanimity in which this matter had been settled. The Library Sub-Committee, the Pavilion Committee, the Town Council, their own Committee, and the meeting that night had all acted unanimously in the matter. He knew they would all look back on the evenings spent in the old room with feelings of pride, gratification, and gratitude,—gratitude for the kind attention bestowed on them by Mr. Robert Glaisyer; and when they pitched their tent on a new camping ground, he could promise them a cordial welcome; and he hoped they would have many happy evenings there also.

This motion was also adopted.

Mr. W. SAUNDERS, seeing there was a large attendance of members, proposed a vote of thanks to Mr. Gwatkin, the Librarian, for the kindness and diligence with which he had filled that post for many years.

Mr. SIMONDS seconded; and the proposition having been carried amid applause,

Mr. GWATKIN returned thanks.

Mr. JOHN COLBATCH ONIONS, in highly complimentary terms, proposed a vote of thanks to Mr. Robert Glaisyer, for granting them the use of his rooms and assisting them in various ways.

Mr. T. W. WONFOR seconded, and remarked that the general aid Mr. Robert Glaisyer had given them entitled him to be called a third Secretary, an extra Treasurer, and occasionally the Committee itself.

The CHAIRMAN also alluded to Mr. Robert Glaisyer's invaluable services.

All hands having been held up for the motion,

Mr. ROBERT GLAISYER expressed his gratitude.

The following letter, in accordance with the resolution of the meeting, was sent to the Town Clerk :—

(COPY.)

"56, Middle Street, Brighton,
"27th January, 1874.

"DEAR SIR, -We are in receipt of your letter of the 8th instant, in which you state that, in answer to the application of the Brighton and Sussex Natural History Society, you are instructed by the Town Council to offer to the Society the use of the Curator's Room at the New Free Library for their fortnightly meetings, and for placing therein book cases and contents upon the condition that the books shall be under the charge of the Curator, and be available for reference by the public in the same way as the other works in the Free Library, but reserving to members of the Society their right as at present of borrowing any of the books so to be deposited. In reply thereto, we beg to inform you that we are instructed by the Committee of Management of the Society to accept the offer upon the above terms, and, at the same time, to request you to be good enough to convey to the Town Council the thanks of the Society for the manner in which their application has been responded to.

"It is, of course, understood that the books and book-cases will still remain the property of the Society.

"We are, dear Sir,
"Yours truly,
"T. W. WONFOR,
"JNO. COLBATCH ONIONS, } Hon. Secs.

"The Town Clerk of Brighton."

JANUARY 22ND.

MICROSCOPICAL MEETING.—MOUNTING IN GLYCERINE JELLY, PRACTICALLY ILLUSTRATED BY MR. T. W. WONFOR.

While Canada Balsam was one of the best *media*, as far as permanence and ease of working were concerned, it possessed the disadvantage that all objects, and especially fresh preparations, or those containing water, could not be mounted in it, though, in many cases, steeping some objects in absolute alcohol deprived them of the water and enabled the microscopist to mount them in Balsam.

Glycerine, from its well-known preservative qualities, had been recommended as a medium; one caution, though, must be borne in mind: substances containing lime would be spoilt, as had been pointed out by Dr. Carpenter, who, employing glycerine to preserve pentacrinoid larvæ of Comatula, found that the calcareous skeletons were dissolved and the specimens spoilt.

As a preservative medium, glycerine could be used alone, diluted with two parts of camphor water, with equal parts of gum arabic and water, and a small quantity of arsenious or carbolic acid; or, what he had found worked admirably with many objects, glycerine jelly.

The manuals on the microscope gave instructions how to prepare glycerine jelly; but, as it could be purchased ready prepared,—and a small bottle would last years,—he would advise those who wished to try it to obtain either Rimmington's or Aylward's, both of which he had tried and liked. The former contained creosote, itself a good preservative, while the latter liquefied more readily, sometimes an advantage.

For some delicate preparations he had found either could be diluted with water. He had also tried the glycerine jelly, sold by the chemists for chapped hands; but this required to be filtered before being used.

Whichever form was employed, the gentle heat of a fire, lamp, or, best of all, of warm water, was required to liquefy the jelly, which could be applied in different ways. One method was to place a drop on each of several slides and let them cool; then gently warming them the film at the top could be removed, thus carrying away air bubbles, or, while warm, the object could be immersed in the drop of jelly; or the object might be placed on the slide, and as much of the moisture as possible being removed by blotting paper, the jelly might be dropped on it or placed by it, to run in of its own accord.

The covering glass, previously warmed (best by dipping in warm water), might be dropped on and gently pressed down and allowed to cool, when the superfluous jelly being cleared away, a ring of varnish could be run round, and the slide would be ready for the cabinet. It should be mentioned that the objects to be mounted should previously have been placed in water or diluted glycerine.

One caution should be observed, viz., slide, jelly, covering glass, and objects, should all be raised to the same temperature ; if this was done air-bubbles would be avoided. As proof of this assertion, the processes described were gone through and objects mounted in each way without air-bubbles.

Dr. HALLIFAX, in reply to an enquiry, illustrated his method of mounting in diluted glycerine in cells, and exhibited a simple method for making oval cells, as well as a very ingenious contrivance by which thin sections of minute objects could be arranged while floating in fluid, in the centre of a glass slide, without disturbing or distorting the parts.

The President, Mr. HASELWOOD, exhibited a new form of section-cutting instrument, recently described in the *Monthly Microscopical Journal*, and having a glass plate and a receptacle for ice, or a freezing solution when cutting thin sections, &c.

FEBRUARY 26TH.

ANNUAL SOIREE.

The Third Annual Soirée was held at the Royal Pavilion.

The Rooms used on the occasion were the Banqueting Room, the Saloon, South Drawing Room, South Lobby, and Corridor. The chief feature of the evening was a display of Scientific Instruments. The Microscopes, which numbered about fifty, were contributed by the Rev. J. H. Cross, M.A., Rev. Mr. Payne, Drs. Badcock, Hallifax, Massy, and Taaffe, and Messrs. S. Aylen, Ardley, Baker (Holborn), Cooper, Capon, J. Curties, D'Alquen, J. Dennant, Gwatkin, T. Glaisyer, T. H. Hennah, J. E. Haselwood, Henry Lee, B. Lomax, Mitchell, G. Nash, W. Puttick, F. W. Payne, Ridge, J. J. Sewell, W. D. Savage, C. P, Smith, G. D. Sawyer, H. Saunders, G. T. Shaft, W. H. Smith, T. W. Wonfor, Wonfor, jun., and F. E. Sawyer.

Telegraphy and the application of electrical instruments was admirably shown by the Post Office authorities. Application having been made to Mr. Scudamore for the loan of instruments, the request was at once granted, and Mr. Sievewright, M.A., was appointed to superintend their exhibition. Mr. C. J. Whiting, the Brighton Post Master, also accorded the project his warm approval; and a staff of energetic, obliging, and painstaking clerks from the head office on the Old Steine were present to assist in the working, under the superintendence of Mr. G. Field. Numerous and varied were the messages sent from one end of the room to the other during the evening. One of the most compact and wonderful of all the telegraphic instruments appeared to be that by which messages are sent and received solely by sound, no other means of indication being afforded. This instrument required a skilful and attentive operator, but the practised ear seemed to overcome the apparent difficulty and transcribe the message with the greatest ease and facility. Telegraphy as applied to railway signalling was also shown.

An automatic spectroscope, constructed by himself, was shown by Mr. H. Pratt; amicro-spectroscope by Mr. Mitchell. In the Saloon Mr. F. E. Sawyer arranged an exhibition of meteorological instruments, charts, and diagrams, including a self-registering rain gauge, invented by Mr. E. Rowley.

Galvanic batteries were exhibited by Dr. Badcock, and Messrs. J. J. Sewell and B. Lomax; fine equatorial by Mr. D'Alquen; kaleidoscopes by Messrs. G. Nash and Haselwood; graphoscopes by Messrs. Rowsell and Treacher.

In the Corridor there was exhibited a magic lantern at intervals during the evening. The slides were chiefly natural history objects, lent by Mr. C. Baker, of Holborn. They were exhibited by Mr. G. Nash, and explained and remarked upon by Mr. T. W. Wonfor.

In the Saloon, South Drawing Room, Corridor, and Banqueting Room were also arranged various objects of Natural History and Archæology, the most noteworthy being:—Very fine carpological collection, consisting of some hundreds of fruits, about sixty specimens of Canadian woods, and a collection of Japanese plants, in pots, by Mr. Hemsley; two brass Persian lavers, about 400 years old, from a Persian temple, candlestick, lamp, and coffee pot, all exquisitely engraved, and five cases of Indian moths and butterflies, by Mr. Wills; nine cases of English moths and butterflies, chiefly taken in Sussex, by Mr. Wonfor, jun.; four photographs of the same group of beech trees taken at the four seasons, and several tropical plants in pots, by

Mr. T. H. Hennah ; vegetable hygroscope and micro-photographs of microscopic objects, by Dr. Hallifax; skeleton leaves and fruits, very beautifully preserved, by Mr. Gwatkin ; a fine collection of Sussex lichens, by Mr. C. P. Smith ; collection of minerals illustrative of iron and its combinations, by Mr. Pankhurst; coral, model of Parish Church, by Mr. J. J. Sewell; fine collection of shells, by Mr. R. Glaisyer ; models of anchors and ship, by Mr. H. Vaughan; specimen of Sussex marble, by Dr. Corfe ; conglomerate shells (from raised beach of St. Augustine, U.S.), by Mr. Warren, of New York; medallion of Ceres, made of compressed sawdust, by Mr. Tatham ; a drinking fountain of unburnt clay, modelled and made at Ditchling, of Sussex clay, by Mr. Johnson.

One feature of the evening was the delivery of several short addresses, at intervals of about half-an-hour.

The PRESIDENT of the Society (Mr. J. E. Haselwood) made a few introductory remarks. Having, on behalf of the Natural History Society, given the company a cordial welcome to the Soirée, he alluded to the fact of the Society having recently changed its place of meeting from the Dispensary to the Free Library and Museum. The arrangement had been effected in the most satisfactory manner, the Town Council, with great courtesy and kindness, allowing them the use of one of the rooms, in consideration of which the Society had agreed to place their valuable library at the service of the public. (Applause.) Of late years, the Society had largely increased and he was yet of opinion that 160 or 180 members were not enough for a town like Brighton. He hoped, however, that the change of *locale* would have the effect of increasing their numbers. They not only wanted men of scientific attainments, whom they would be most pleased to welcome ; but young men, who desired to improve themselves, and men of business who were able to spare the time. He could promise such that they would find the instruction which the meetings of the Society afforded blended with amusement.

MR. G. SCOTT ON "THE ELK."

Every visitor to the Brighton Museum must have been struck with the noble pair of antlers which were suspended at the southern end, for the possession of which the town was indebted to Sir Cordy Burrows. They were the antlers of the *Megaceros hibernicus*, or extinct Irish elk, the remains of which were now found in the morasses of that country. Their gigantic size would be seen when he stated that their antlers were something like 12ft. in width, and reached upwards of 10ft. from the ground. Perfect skeletons of the elk were now to be found in the British Museum and other places. The position in which their bones were discovered evidently showed that the noble creatures were driven into the lakes, and must have perished there. In an early poem relating to a hunt in the 12th century, the "scealch" was referred to, and this by some was thought to mean the elk; he, however, was disposed to think it meant the seal, which is still designated by many Scotch fishermen by that name. Passing from the extinct species to the living *(Alces malchis)*, as they are to be seen in North America, and North Europe, and Asia, the thanks of the town were due to Mr. H. Willett for having presented to the Museum a pair of moose antlers. The pair before him (which had never before been publicly exhibited) weighed 27lbs.; but a full grown pair would weigh double that. It was said that the black elk used its antlers for shovelling away the snow. He should like this to be true, but the probability was, he thought, that it was not. Of late, much had been said about the development of man, and that when he made his first appearance on the earth he was a poor degraded useless creature. But if he were so, Nature certainly made a great mistake in development; for he would want all his wits about him to deal with such creatures as the extinct elk, the gigantic hyena, the cave bear, the lions, tigers, and other animals which abounded at that time. (Applause.)

MR. T. W. WONFOR ON "SPONGES."

Over few natural objects had there been such differences of opinion among naturalists as over sponges. At one time believed to be produced from the froth of the sea; at another to be neither plant nor animals, though partaking of the nature of both; then claimed as inanimate objects possessing some kind of life; then deemed fungi or algæ; then zoophytes or plant animals; and last, in the estimation of most naturalists, they had settled down into undoubted animals, technically called *poriferi* or pore-bearers, from the circumstance of their surfaces being covered all over with pores or openings.

The sponge of commerce was not the animal, but only a part of the animal structure, the skeleton, according to the nature of which sponges were roughly classified into *keratose* or horny, *siliceous* or flinty, and *calcareous* or limy sponges. The forms with which we were most familiar were the horny, the skeletons of which were found so useful and were of great commercial value. Among some of the most striking of the flinty sponges were the exquisite Venus' flower basket, the sea-bird's nest, and the glass rope, the last-named for some time a bone of contention among naturalists, until the whole sponge was obtained. Most sponges might be said to consist of three distinct parts; the skeleton, the living part, and the spicules. The living part, called *sarcode*, was a glairy gelatinous substance about the same consistence as the white of an egg, of different colours, and composed of a granular substance similar to that simple organism, the Amæba, which in the living sponge enveloped and permeated the whole structure; portions of it were ciliated, and by means of these ciliæ, a circulation was kept up. This living sarcode secreted from its food material for re-formation, building up the skeleton and the formation of the bodies called spicules.

The spicules were composed either of silex or lime, and either formed, as it were, supports to the skeleton, or, as in the case of some of the siliceous sponges, served as a means of anchoring the animal. Microscopically considered, the spicules presented a very varied and beautiful series of objects of every conceivable combination of needle-like bodies, and would seem in many, if not all, to be not only invested but penetrated by the sarcode. In the siliceous sponges, and especially the anchoring ones, they were built up of successive layers of deposit, a fractured end presenting an appearance similar to a series of tubes as seen in a telescope.

The holes or pores in the skeleton were of two kinds—those which took in currents of water, and those larger ones called *oscula*, from which currents containing effete matter were ejected. So great was the reparative power among sponges that if, as had been proved by experiments by Bowerbank, a living sponge be cut in half and the parts brought together under water, in 24 hours all trace of cutting would be effaced; nay, if a piece were cut out of a living sponge and inverted so that opposite surfaces were brought together, in twenty-four hours all trace of cicatrix would be gone. This rapid and marvellous healing was accomplished by the jelly like mass. Several small bodies were at times found at the base of sponges and were ejected from the sponge itself; these were the gemmules, which afterwards become sponges.

In the Museum might be seen specimens of British and foreign sponges, chiefly of the keratose division, a beautiful specimen of the sea-bird's nest, presented by Captain Marshall Hall, by whom in the Norna expedition it was first dredged, as well as a capital example of the Venus' flower basket, deprived of all but its siliceous skeleton. There, too, might be found fossil sponges, notably those strange and till recently unclassed objects, called choantes, together with ventriculites from our chalk. During the chalk era sponges must have been very abundant, as proved by our flints; for scarcely a chip or flake could be made, without sponge or sponge spicules being traced. In the Aquarium might been seen living sponges, not so conspicuous as the Turkey and honeycombed sponges of the Mediterranean, but more interesting, because their growth and movements could be watched. One thing the Aquarium had done; if he were wrong his friend, Mr. Henry Lee, whom he saw present, would set him right, it had given a sponge new to science. (Hear, hear.) This was but one of the advantages science was deriving from the Aquarium. Under the microscope an opportunity would be given for any who wished to see portions of sponges, spicules, aud gemmules.

MR. BENJAMIN LOMAX ON A "GREY PEA."

As his lecture must necessarily be a small one, he had chosen a small subject—a grey pea, the missile of the schoolboy—the music of the boy's rattle—the apparatus of the thimble-rig man—and yet one of God's choicest works. Dry, hard, yellow, wrinkled, it looked different indeed from the full green seed, borne on a graceful twining plant, whose flowers gardeners had not disdained to cultivate, and whose scent perfumers had thought worth extracting. Yet, even in its corpsehood, it boasted a great commercial value. By thousands, by tons, by shiploads, peas passed through the markets, and travelled across all seas to every land. A vast acreage of green England belonged to the fairy "Peablossom." A good pea harvest meant prosperity, plenty, wealth to the few, and work for the many. A failure in the pea crop was poverty, desolation, ruin. And no wonder, for the pea was the chosen food of ancient and modern, of rich and poor, of man and beast.

On some plant of the pea kind Daniel and his companions lived, when their glorious Hebrew faces out-matched the flower of Persia. On peas poor Monmouth tried to feed, when the bloodhounds were on his trail. The nobleman gave a labourers' annual house rent for green peas at Christmas, and the beggar asked for pea soup at the Workhouse. Peas formed a large element of the Navy's food, and *they* nerved the arms that fought at Copenhagen and Trafalgar. Well might they do so, for in this little globe was contained a larger amount of *flesh* than in a similar bulk of "The roast beef of old England." Art could not compose, Nature had not produced, so much food in so little compass as in this pea, and its relation the bean. But what was it that we gobbled so recklessly? What, indeed! This seed contained a study too long for human life, a secret too deep for human science. There was a *life* within this pea. If he struck it with a hammer it separated in two halves, just as Moore's "heart indignant broke to show," in a truly Irish manner, "that still it lived." This pea split its sides from pride of birth, proving itself thereby one of the great family of double-seeded plants, not a connection of the downtrodden grass or awkward cactus, but a relation of the forest trees and the British oak itself. And no mean relation, for there were peas in America which bore pods a yard long, and twisted round large trees till they strangled them.

If this little seed were placed in the warm ground, and the dews of heaven were allowed to fall upon it, the skin that covered it would draw aside as gently as ever mother drew a counterpane off her sleeping infant; the two lobes would open, and two marvellous intelligences would pursue their way—one upwards, one downwards; one armed with a point shaped like a lady's thimble, hard and pointed as a lady's needle, flexible and thin as a lady's thread, and sensitive as a lady's finger, pushing its way through the hardest clods; and one green and beautiful, throwing out slender leaves, and taking hold with tendril fingers of some dry old stick, henceforth a thing of beauty, glorious with foliage, and flowers, and sweet perfume. The flower died, but in it grew up first a tiny pod, which swelled at last to a receptacle of peas like this—like this, a common vegetable, yet, he trusted, no unworthy subject of a ten minutes' lecture.

MR. E. A. PANKHURST ON THE CAÑONS OF THE COLORADO.

At their Soirée last year Mr. Lomax illustrated the meaning of his statement, that the most useful lesson the microscope could teach them was to use their own eyes microscopically, by directing attention to the little channels which tiny streams dug, the sediment they carried along with them, and with which they half-filled up the tiny pool that marked the end of its course. That subject he now wanted to carry further. Magnify that stream a few thousand, perhaps million, times, and they had still the same forces at work, acting in precisely the same manner ; but now the channel of the rivulet had become a huge ravine, and they had a vast torrent carrying on to the sea the dust and the *débris* of a range of mountains. From an imaginary sketch of such a reality he directed attention to an actual one suspended on the wall behind the platform. It represented the course of a river through a table land of Spain near Parrulena to the north-west of the Sierra Nevada, where for miles it flowed at the bottom of an abyss of hard rock, not rubbly chalk, which it had itself scooped out to the depth of two hundred feet or more. Lateral streams running into this chasm, or cañon, as it is termed, had cut down portions of its sides until hills had been thereby formed. But he wanted them, with the assistance of another diagram, to carry their imagination yet further. To the south of Salt Lake and the Mormon territory, in North America, lay a dreary series of plateaux traversed by the Colorado river and its tributaries, which bore their burthen of waters into the Gulf of California. Though that region possessed many considerable streams, it was over large areas a kind of desolate wilderness; for, instead of irrigating the ground, these streams flowed in profound gorges, in some cases more than a mile in perpendicular depth, the torrents having moulded and carved through 1,000 feet of hard granite and other substances. Of all lessons which geology, geography, and the exploration of the world taught them, that of the Cañons of the Colorado was, he thought, the greatest exhibited.

Mr. E. A. PANKHURST illustrated his remarks by diagrams hung upon the wall.

During the evening light refreshments were served in the Drawing Room by Mr. E. Booth.

MARCH 12.

FIRST MEETING AT THE FREE LIBRARY AND MUSEUM.—MR. G. SCOTT "ON THE GEOLOGY OF THE BRIGHTON MUSEUM."

In welcoming the Society in that room he expressed the feeling shared by every member of the Town Council. Many had long hoped that the time might come when there would be some centre in Brighton where science and literature could find an abiding home. He sincerely trusted that the Free Library and Museum, voluntarily supported by the public, and extending its privileges to all, might become that central home, by attracting to it similar Societies.

It was the very aim of the Free Library and Museum to assist in every way such a body as the Natural History Society, the members of which, recognising how little the wisest really knew and how much the most learned had yet to learn, were engaged in real work and earnest study. The Society could look back with satisfaction on much good work honestly done; all remembered many pleasant and instructive evenings in the old home, and he hoped and believed that under that roof, and surrounded by their growing library, many happy and useful years were before the Society in the future. He was also sure the public would duly appreciate the boon of having so large a number of valuable scientific books placed within their reach for reference and study in the Reading-rooms, and that no one in or out of the Society would have cause to regret a bargain which had so many advantages, including one dear to the legal heart—that of mutuality. They would, he knew, excuse these introductory remarks on such an occasion, and allow him to add that he felt much indebted to Mr. Gwatkin and Mr. R. Glaisyer, for the kind and cordial way in which they had handed over to his keeping the books and other property of the Society. And with a President and two Honorary Secretaries so earnestly desirous of co-operating with him and the public authorities, for the benefit of the public and of the Society, nothing but good could result from the arrangement so happily inaugurated that evening. Taking advantage of some promise more or less imaginary, their Secretaries had insisted that the first paper in that room should be read by him, and that the subject of it should be —"THE GEOLOGY OF THE BRIGHTON MUSEUM."

His aim would be simply as possible to place before them the state of an important department of the Museum, and so to treat the subject as to bring about, if possible, a rather more general discussion than they usually had on geological subjects. First of all, as an act of justice to an esteemed member of the Committee and Vice-President of this Society and to other old fellow-workers, he wished to correct a statement to which his attention had been called, namely, "That the Geological Collection at the old Museum was a complete jumble." For want of someone on the spot who knew or cared anything about the matter, dust had become a very largely developed deposit, and every specimen had to be cleaned and remounted. From the same cause, as specimens came in they were often placed anywhere, and in some of the lower cases they were simply stored.

Originally the collection was arranged stratigraphically; with the exception of the Chalk and Cave remains, which from want of space had to be kept in another room, the various deposits were in their proper sequence, and though far from complete—as, indeed, they still were—at the worst stage, which was reached after Mr. Peto left Brighton, the collection never deserved to be called a mere "jumble." It must also be remembered that the Chalk collection was mounted and named there, at Mr. Willett's expense, just as it existed in the New Museum, although it had now been found practicable to have that noble collection placed in its proper position with reference to other formations.

For the sake of brevity, he would consider, first—What they wished popularly to teach in a Geological Museum; and then—How they had been able to do it in the Brighton Museum. As to the first, a notion has been rather encouraged that some new light had suddenly dawned upon the Committee with reference to Geology, and to systematic arrangement. Now, with the exception of Mr. Crane and Mr. Shillingford, who had been admirable as workers, every member of the new Geological Committee had been for years a member of the old; and to show that the old Committee fully recognised the desirability of the state of things which, with more suitable rooms, they had now in some measure carried out, he might be permitted to quote the following sentence from a communication which he had made to the Brighton papers so long ago as 1867 :—" In the Geological Section, when the various sub-divisions of the different formations, with the characteristic fossils of each are exhibited and marked; especially when so arranged as to show at a glance an epitome of the entire series of fossiliferous rocks, in a descending order, from the present surface of the globe, and passing downwards through the Tertiary, Secondary, and Primary deposits to the Igneous rocks, the advantages to the student cannot be exaggerated of enabling him to pursue his studies in the Museum itself, so as to acquaint himself with the nature, order, and design of strata representing the whole range of Geological History." To say nothing of the acknowledged practical advantages of this study, it had long been unnecessary to apologise for the high place claimed for Geology among the Sciences, for as an eminent writer had said, " It is, indeed, not so much one science, as the application of all the physical sciences to the examination and description of the structure of the earth, the investigation of the agencies concerned in the production of that structure, and the history of their action."

Another Geological chieftain, Sir Charles Lyell, said, " Geology is the science which investigates the successive changes which have taken place in the organic and inorganic kingdoms of Nature. It inquires into the causes of these changes, and the influence which they have exerted in modifying the surface and external structure of our planet." That is, they had to give the means of studying not only the animal and vegetable contents of the rocks by means of Palæontology—the study of ancient life—but also the succession and causes of phenomena which, since the origin of our globe had brought about such mighty changes, and which, in greater or less degree of activity, were still in operation. They had, in short, so to open and expound the great book of the rocks, as to show the workings of the Almighty hand and the all-wise operations of the Divine will since the period, far back in the ages of the past, when, we are told, in language as exact as modern science could supply, that "God created the heaven and the earth. And the earth was without form and void."

As an example of the continuance of geological phenomena, he might mention that in studying Sir Samuel Baker's Nile Tributaries they were in the midst of the very same set of causes which brought about the Wealden formation—great rivers, the Athara, Settite, Salaam, Royan, and many others, which were mere sandy beds during the dry season, where the Arabs pitched their tents, became, when the rains began, noble rivers, 500 yards wide, carrying down to the Nile enormous quantities of mud, or rather of mould, washed into them by the torrents of rain from the rich table lands through which they flowed—and all this borne down by the Nile, not alone to fertilize Lower Egypt, but to be carried out to sea, there to form a new Delta, a new Egypt, beneath the waters of the Mediterranean. But besides these higher aims they must be prepared in such an institution to furnish instruction to many who were ignorant of the first principles of Geology, and even of what the science meant.

Had any illustration of this been needed, it would have been supplied by the popular ideas respecting the great experiment now going on in the pretty rural glen at Netherfield; for many as had been the difficulties encountered, they had been quite equalled by the number of surgical operations necessary to get into people's heads what the Sub-Wealden boring was for, and what it was not for. So that they must patiently bear with those who looked round the room and said, "Oh, stones and things," or "These are the things that they dig out of the ground"; or who, getting a step higher, say to each other, "Ah, Geology, all about strata, and so on;" or again, when we think we have been interesting some one in the wondrous story told by some fossil bone or shell, we are met with the question, "Isn't it a petrifaction?" They must be prepared to make plain many things which scarcely occurred to them as requiring explanation, such as the true meaning of such terms as rock, fossil, igneous, fossiliferous, strata, formation, and so on. There was one thing which the lecturer or teacher sometimes overlooked, but which he should strive to know, namely, what it was that the learner did not know, and therefore needed to be taught.

Coming to the second enquiry, "How had they been able to supply the popular teaching of Geology in the Brighton Museum?" it must be borne in mind, that, as in the Library, they had had to work with the materials which they found at their disposal, and with such voluntary contributions in the way of specimens as they could obtain, for they had not asked for a farthing of public money to expend upon the Geological section. They were arranged, as had been indicated, stratigraphically and zoologically, though they did not at present come up to his ideal, since it had not been found possible so to place them in one room, and partly in wall-cases, partly in table-cases, as to make them tell their own story. Still, when the general plan was understood, the order of arrangement was tolerably complete, and in carrying it out, and especially in distinguishing the upper, middle, and lower divisions of the different formations, they had the benefit of the practical skill of Mr. Etheridge, of the Geological Survey, and of Mr. Woodward, of the British Museum.

The series began with the Quarternary case on the east landing, containing remains of hyena, rhinoceros, elephant, &c., from several English and Italian caves, associated with human weapons, and also the teeth of the elephant from different parts of Sussex ; and it was resumed in the eastern room on the west side of the first table case, where, after a selection from the glacial beds of Bracklesham and the river gravel of Cambridgeshire, the Tertiary or Cainozoic rocks began, and passing round the case the Pliocene was arranged. The collection of characteristic fossils from the Norwich, Red, and Coralline Crag had been considerably enlarged by the liberality of Sir Cordy Burrows, Alderman Hallett, and Mr. Willett, who had made purchases of many fine and rare fossils, and Mr. Jesson, Mr. Shillingford, and others, had also made some important additions. The series was then resumed at the north-east corner of the wall-cases. Here the case set apart for Miocene was empty, for Miocene fossils were found in Britain only in the Isle of Mull and at Bovey Tracey, in Devonshire. At the latter place the cutting where they were found had been discontinued. But several Museums were anxious to obtain specimens, even those in the district being without them, and should a cutting for the purpose be opened, Captain Henry Hill, for the honour of his native county, would bear the expenses of their share. The Eocene was very fairly represented, and they hoped before long to have the local beds in a very complete state.

Coming to the Chalk collection, it was so widely known that it was unnecessary to say much. That it was one of the finest in existence was known to all, and Mr. Willett, in presenting it to the town, provided a monument of the scientific work of many years of an otherwise busy life. Mr. Etheridge, of the Geological Survey and Museum, assured him that there were not three such cases in Europe.

The Wealden collection, to which this Society made a handsome presentation, promised to become once more worthy of the county. Mr. Willett was constantly making additions, and Professor Rupert Jones was now making a selection of Wealden specimens, iguanodon, &c., which formerly belonged to Dr. Mantell, and he was sure they would all be glad to see them, by the Professor's kindness, restored to Brighton.

As an illustration of the advantage of having more Museums than one, he would show a little fossil plant. At the cleaning period, he found it broken in pieces. He mended and mounted it, and a fortnight ago pointed it out to Mr. Carruthers, of the Botanical Department of the British Museum. He at once pronounced it to be not only the rarest thing in the Museum, but that, as far as he knew, it was absolutely unique. A different specimen was figured by Mantell, as "a beautiful and rare plant *Cycadites Brongniariti*, in sandstone, Tilgate beds." That specimen had entirely disappeared, and he hoped to have the pleasure of lending theirs to Mr. Carruthers to be figured, as the only one known to be in existence.

The Oolitic collection was contributed almost entirely by Sir Cordy Burrows; and the Lias included fine reptilian and other remains, presented by Dr. Seymour. The cases for the Cambrian, Devonian, Permian, and Trias, were almost empty; but they hoped that by presentations and otherwise these vast formations, as well as the Gault, and others, would soon be more fully represented.

Friends of the Museum, both residents and visitors, had already done much in this way, especially in the Greensand, some of the promises made during the Brighton meeting of the British Association having but lately been carried out.

Leaving the British-room, the Northern Gallery was devoted to Mineralogy, arranged in four cases, and to the rocks and products of existing Italian volcanoes, the latter presented by Mr. T. Davidson, F.R.S. The case on the west landing was one on which, like those last-mentioned, he could not now dwell; but, as opportunity offered, he wished it to be made much more complete than it was. It was devoted to the Igneous rocks, which were arranged in the three simple groups—Volcanic, Granitic, and Trappean.

The room opposite was entitled Foreign Geology, and it contained the extensive Paris Basin collection, collected and presented by Mr. T. Davidson. This admirable collection showed by beautiful rock and fossil specimens, the various beds of this remarkable basin, from the Chalk up through the plastic clay, the marl, the gypsum, and other subdivisions, to the Post Pliocene, so that it really formed an epitome of the whole range of the Tertiaries.

In this room were also some fine Mammal bones, including a very perfect head of the Hippopotamus from the Miocene of India; but beyond a number of unarranged specimens from America, Tasmania, &c., there was little else to justify the title of Foreign Geology, and the question arose, was it desirable or otherwise in such a Museum as this to divide Geology into British and Foreign? Of course, to gentlemen engaged exclusively on the Survey and the study of the Geology of the British Isles, there was a great advantage in keeping the British collection distinct, and there was a real gain in being able to take British Geology as a part of the whole, so as to learn what formations existed or did not exist in these islands, and to ascertain the various epochs and mutations of form, and of animal and vegetable life, to which they had been subject. At the same time it was a fair subject for discussion, whether we did not not lose as much as we gained by the separation, and whether they did not thereby increase the difficulty to the unlearned, and even to the diligent learner, of grasping the meaning and scope of Geology as a whole, and of looking, not at this or that particular country, but at the globe itself, as the theatre of geological revolutions.

If they were to represent Foreign Geology, how many foreign collections must they have? Take for instance the Miocene, since at present it was unrepresented in the British-room. In the Foreign-room they had the Miocene of the Paris Basin, the Miocene of Touraine, the Miocene of Malta, the Miocene of Germany, and the Miocene of India. Were all these to be kept as distinct collections, or would it not be more instructive if they all fell into their places in one comprehensive series? Again, by simply dividing the Miocene from the

Eocene and Post Pliocene of the Paris Basin collection, and arranging each with the corresponding English beds, a really grand series would be the result; the separation would be but slight, and the Paris Basin could still be studied in its entirety, and yet fall into its more extended sequence instead of being as at present merely hung up by itself. Would it not, to take other instances, be an advantage to have the fossil fruit of the palm *(Nipadites ellipticus)* from the Brabant equivalent of the London Clay, shewn in a general Eocene series, instead of occupying a solitary corner? and the same remark applied to the crocodile bones from the French Oolite. Once more, when studying the Lias formation, would not the interest and the benefit be increased by having side by side with our English specimens the series of fossils now banished to the limbo of Foreign Geology, which were brought by Mr. Dunlop, C.B., from a bed in the Himalayas, 13,000 feet above the level of the sea? For, after all, what was English and what was Foreign? This was a wider consideration than that relating say to foreign and English entomology or botany.

The existing levels of the land, and intervention of seas, were but matters of to-day. The same Chalk formation bid defiance to the narrow strip of sea, and after forming its bed re-appeared on the Continent. The same Wealden of which they were proud in Sussex extended into France; and should the Palæozoic rocks be reached in the Sub-Wealden boring, they would be part of the same Palæozoic floor with which geologists and miners were familiar in Belgium. He would not detain them longer, and although he had thrown out his later remarks in an interrogative form, he had no desire to intimate the direction which the discussion was to take. Although, also, he had spoken of deficiencies quite as much as present possessions, the collection, even at this stage, was one of which the town had reason to be proud. That it and all the other departments of the Institution would increase and improve there would be no doubt, and he was quite convinced that the fullest discussion could only tend to promote the good of the Museum and Library, and along with it the best interests of the Brighton and Sussex Natural History Society, which this evening took up its abode beneath the same friendly roof.

The CHAIRMAN proposed a vote of thanks to Mr. Scott, for the paper he had read. He thought the members would agree with him that Mr. Wonfor had done right in putting a little pressure upon Mr. Scott to induce him to read the paper which they had just heard at this, their first meeting in the place. It was full of interest, and the subject could not have, perhaps, been so well dealt with by any one who was not situated as Mr. Scott was. He had been reminded by the Secretary that they had very nearly reached their majority—the Society had been in existence nearly 21 years—and he hoped that when they had become a man, and now they had got into new quarters, where they had the opportunity, they would do something more than they did in their childish days.

Mr. WONFOR remarked that Mr. Scott had in his paper brought before them plenty of new facts, notwithstanding that he had disclaimed doing so. In regard to the classification of the British and foreign departments of Geology in the Museum, the local and foreign collections of Zoology, &c., in the Museum were placed side by side. In the specimens representing a series or order of birds, foreign and British had no distinction whatever, there was the name only, as to whether they were British or foreign, still they were placed as they would be in a general collection. Therefore it seemed to him that this mode should be carried out in the arrangement of other departments in the Museum.

Let them do all they could to develop the local geology of the county, and he had heard that their local Geology was well developed, and that they had admirable collections from the Chalk and Wealden; still they had specially to consider the education of learners in this district, and this could not be done unless they placed before their minds the great grasp of the general subject. So far as British and foreign geology was concerned, they were mere names brought about by accidental circumstances, it was not like flora and fauna, specimens of geology could not live, they could not grow in this island, the same series existed in other places, and he thought the British and foreign specimens should be placed side by side.

The PRESIDENT, although not a geologist, supported the same view, as he thought if they had a broad science which extended over the world, they should not restrict themselves to local and insular matters.

Mr. PANKHURST remarked upon the fact that in their Society every science seemed to have more interested in it and who were able to talk about it than Geology.

Mr. Capron, to whom Mr. Scott had alluded as having a collection of geological specimens from the Sussex Chalk equal to the one in the Brighton Museum, next spoke. He said that his collection was not equal to Mr. Willett's, although he believed it was second to it. He had been induced to give his attention to the matter solely by Mr. Willett, whose collection he had previously inspected, and Mr. Willett had handed over to him the pits he had been in the habit of exploring on the condition that he should treat the men who worked them in the same manner as he had been in the habit of doing. He had been in the habit of going round the pits once a month, the men saving the fossils for him, and whether there were any good specimens or not, he had paid them the same. If he found more specimens than one of the same kind, he left them in the pit for the good of others, as the value of a collection did not depend upon multiplying specimens of one kind. By visiting the pits once a month he had got a collection which was far superior to almost any collection but that of Dr. Mantell. Mr. Willett had, however, always behaved fairly to the labourers, and when he had obtained good and rare specimens from them he paid them well for it, and they would find it best to always behave fairly to the men, who would then treat them in the same manner (hear, hear).

Mr. Capron then described at some length how two pieces of a very rare specimen of a reptile, *Longicolles*, had come into his possession at different times but which appeared to be different parts of the same reptile; however, he was not quite sure of it, so he had given the portion obtained last to the Brighton Museum.

Mr. Dennet remarked that he had recently, when visiting the South Wealden Boring, seen the same sort of clay brought up from a depth of 480 feet as he had seen on the beach at Boulogne. He advocated a system of exchanges between this museum and the museums of other countries.

Mr. Wonfor pointed out how much good might be done if the members would, when out for their summer holidays, bring home specimens from the places which they visited.

Mr. Capron said that many specimens might be found in the red chalk of Hunstanton and Yorkshire which were not found in Sussex. Yorkshire was especially rich in sponges.

Mr. Scott, in concluding the discussion, replied to some remarks that had been made, and said that they now had many workers in

Sussex, especially amongst the young people. A system of exchanges between this and other museums had already been adopted, and he should be glad if collectors would think of the Museum as well as of their private cabinets, as any specimens would be useful for exchange.

MARCH 26TH.

MICROSCOPICAL MEETING.—MR. T. H. HENNAH ON ILLUMINATION.

Far more depended on the proper illumination than on the objectives; inferior ones being made to show a good deal, while good ones without it failed to show anything like a proper performance. If objects were illuminated by transmitted light, parallel rays were very important, no matter what the illuminating apparatus, whether mirror, condenser, or prism. By carefully attending to this, almost any structure might be brought out by the mirror alone, without having the expensive substage appliances often recommended.

The angle of illumination should not exceed 90°, otherwise, instead of clearness, there would be indistinctness and confusion. No matter what the form of substage appliance, the light should be exactly focussed on the object, a point to which sufficient attention was not always paid. For thin and lined objects, or for diatoms, oblique rays were essential, but, for thick ones, direct rays were necessary.

There were several different methods of obtaining direct or oblique illumination by substage apparatus, such as the ordinary and flat mirror, the Nachet and Amici prism, the Reade's prisms, and the various forms of Achromatic Condenser; the action and mode of using each was described, preference being accorded, when the substage admitted of its application, to the Amici prism.

The different methods for illuminating opaque objects and for obtaining dark ground illumination, were the bull's-eye condenser, the Leiberkuhn, Parabolic illuminator, Wenham's parabaloid, &c.

After a vote of thanks to Mr. Hennah, the Meeting became a Conversazione, when interesting objects were exhibited by Messrs. Hennah, Haselwood, W. H. Smith, and Dr. Hallifax, the last-named also exhibited brass plates designed by Mr. D'Alquen, and having central black spots of different sizes, to be used with transparent objects, when it was wished to see them as opaque objects with the Leiberkuhn.

APRIL 9TH.

ORDINARY MEETING. — MR. F. E. SAWYER ON "WINDS," WITH REFERENCE TO THOSE PREVALENT IN SUSSEX.

Solar heat was the chief cause of the winds. The principal winds were formed near the equator. The air in the tropics became heated and expanded, and thus being lightened, ascended; cold air from the poles rushed in to supply its place, and so two currents of wind were formed, the upper current of warm air flowing from the equator to the poles, the lower one of cold air from the poles to the equator. The revolution of the earth caused these currents to diverge, and in the northern hemisphere turned the warm upper current into the south-west wind, and the cold lower current into the north-east wind; and in the southern hemisphere the upper current into the north-west wind and the lower into the south-east. The upper currents did not descend to the surface for some time after leaving the equator, and consequently in the northern tropical belt the north-east wind prevailed, and in the southern tropical belt the south-east wind, and these winds are known as the "Trades." At a distance of about 30 degrees from the equator the equatorial currents descended to the earth, and came into collision with the polar currents, causing violent storms in these regions.

If all parts of the earth maintained throughout the year the same relative position with regard to the sun, the four winds described would blow without intermission, but in the summer the northern hemisphere was inclined 23½ degrees towards the sun, and in the winter the same distance away from it. The earth's axis was only vertical on March 21st and September 21st in each year. This difference in position disturbed the four principal wind currents, and made them more variable, and probably was the cause of the "monsoons" which blow in the Indian Ocean. The north-east monsoon blew from November to March, and the south-west monsoon from the end of April to the middle of October. These periods coincided almost entirely with the periods during which the northern hemisphere was inclined to and from the sun.

Cyclones were amongst the greatest wind storms which occur. They were mostly of a circular form, and varied in size from fifty miles in diameter to several hundred. Buijs Ballot, the Dutch meteorologist, says :—"It is a fact above all doubt, that the wind that comes is nearly at right angles to the line between the places of highest and lowest barometer readings. The wind has the place of lowest barometer at its left hand and is stronger in proportion as the difference of barometer readings is greater." This applied to the northern hemisphere, the reverse occurring in the southern. This law was important, as it enabled us clearly to understand the modern cyclonic theory. If there was a region of low atmospheric pressure in the northern hemisphere, by drawing lines from the centre of the circle, where the pressure was lowest, to the circumference, where it was higher, then we found the wind came at right angles to each of these lines, having the centre of depression on its left hand ; the winds would thus blow round the depression against the sun or in the reverse direction to that of a watch's hands. Another way in which the same law was stated was "that with your face to the wind the centre of depression is on the right hand." Of course the law was reversed in the southern hemisphere.

According to Buijs Ballot's law, if there was a region of high pressure in the northern hemisphere, and the lines were drawn as before-mentioned, from the centre of high pressure to the places of lower pressure around, the winds would then come at right angles to these lines, with the low pressure outside and on the left hand : the winds would thus blow round with the sun or with the hands of a watch. To this phenomenon Mr. Galton gave the name of "Anti-cyclone," on account of its being the exact reverse of a cyclone. In the centre of a large cyclone there was generally a calm. It was considered by many, and probably very correctly, that all the winds which prevailed in Europe were cyclonic in character ; a careful investigation of the daily weather maps for two or three weeks would show that several cyclones and anti-cyclones had passed over this country. Recently, however, a serious question had been raised as to the form of cyclones. Mr. Meldrum, Director of the Government Observatory, Mauritius, stated that, as the result of several years' observation, the cyclones in the Indian Ocean were not circular, but elliptical, and that the wind blowing from points from N.E. to S.E., blew almost directly towards the centre. Now, according to the previous rule, with the wind blowing from S.E, in the southern hemisphere, a sailor would assume that the centre of the cyclone was in the N.E., and accordingly steer for N.W., so as to pass the centre; but by the new rule he would sail straight to the centre.

The necessity of a correct knowledge of the laws was shown by the fact that in one on February 25th, 1860, this mistake was made, and thirty-one vessels were lost near Mauritius, amounting in value to £134,000. In cyclones of the elliptical form the wind curved in towards the centre, and they were therefore called "incurving cyclones." It was not yet known whether any incurving cyclones were ever felt in the northern hemisphere, or, indeed, outside the Indian Ocean; but it was thought that the Atlantic hurricane of August 20 to 24, 1873, was of that character.

The velocity and force of the wind were recorded by instruments called anemometers. Those for the velocity had been invented by Robinson and Whewell, but Robinson's was most commonly in use. The chief pressure anemometer was invented by Osler.

The relative prevalence of the wind was shown in the following table, which gave the average number of days the wind blew from each point of the compass in each month, the average being for six years, 1868 to 1873 inclusive. The observations were made from the vane of St. Nicholas Church, Brighton.

The Uckfield annual totals were given for comparison.

	Number of days wind blew from								
	N.	NE.	E.	SE.	S.	SW.	W.	NW.	Calm.
January	3	5	3	2	4	6	7	..	1
February	3	4	2	1	3	6	6	2	1
March	5	6	2	2	3	5	5	2	1
April	4	6	2	3	2	5	6	2	..
May	2	6	2	3	3	6	6	2	1
June	3	3	1	2	2	8	7	1	3
July	2	4	1	2	3	10	6	1	2
August	3	3	2	3	2	7	6	2	3
September	2	4	3	3	2	6	7	2	1
October	3	2	2	2	4	5	8	4	1
November	6	6	2	1	3	5	4	3	..
December	6	5	1	1	5	5	6	2	..
Total	42	54	23	25	36	74	74	23	14
Uckfield average, 27 years.	25	60	35	24	19	95	68	37	...

From this it would be seen that both at Brighton and Uckfield the

S.W. and W. had the greatest prevalence, while at Brighton the E. and N.W. were least prevalent. During the last few years the study of meteorology had made great progress in the county of Sussex, and there are now four anemometers at work, all of Robinson's pattern. The observers were C. L. Prince, Esq., F.R.A.S., Crowborough Beacon Observatory; Rev. T. E. Crallan, M.A., County Asylum, Hayward's Heath; W. J. Harris, Esq., F.M.S., Worthing; and F. E. Sawyer, Chain Pier Head, Brighton.

The average distance travelled by the wind at Hayward's Heath daily in 1872 was 170 miles. The greatest distance travelled in 24 hours yet recorded was 990 miles on December 8th, 1872, at Crowborough, the amount at Brighton that day being 904. In the gale of September 28th, 1872, the wind travelled 916 miles on 28th at Crowborough, and 901 miles at Brighton.

The year 1873 was very free from heavy gales, and the greatest daily amount recorded was 823 miles at Worthing, on August 28th.

In the following table the result of the observations for each month in 1873 are given: –

TOTAL HORIZONTAL DISTANCE TRAVELLED BY THE WIND.

	Brighton	Worthing	Crowborough
	Miles.	*Miles.*	*Miles.*
January	13,488	...	11,979
February	7,667	...	6,488
March	7,871	...	8,694
April	8,760	...	7,587
May	9,043	9,764	6,284
June	7,962	9,009	5,819
July	10,308	11,522	6,270
August	12,846	12,638	...
September	10,010	9,759	8,810
October	9,566	...	8,040
November	10,767	10,716	...
December	8,119	8,005	...
Total	116,407		

It was probable that the great difference between Brighton and Crowborough was caused by the difference in level, the anemometer at the latter place being about 830 feet above the sea, and at the former about 35 feet.

The President, Mr. HASELWOOD, remarked upon the unsatisfactory state in which Meteorology stood, and upon the general ignorance respecting it ; at the same time pointing out the great advantages which must accrue from its patient, careful, and intelligent study He was inclined to think that the humidity of the atmosphere had a great deal to do with winds as well as heat.

Mr. G. SCOTT considered it unfair to make comparisons when the results were tabulated at different elevations : for the purposes of comparison the return should be from places of the same elevation.

Mr. SAWYER remarked that returns which had been forwarded to him from Rotherham, in the North of England, showed that Brighton experienced nearly double the amount of wind which that place did.

Mr. E. HAMBLIN questioned whether elevations made such a great difference in the wind as was supposed.

The PRESIDENT : You have only to take a walk up to the Downs to find the difference.

Mr. H. SAUNDERS thought the upper part of a cyclone was sure to travel swifter than the lower, as was the case with a stream of water.

Mr. SEWELL controverted the supposition that Brighton should be avoided in March in consequence of the prevalence of winds. There was far more wind in the Eastern Counties than in Brighton during this month. It was most desirable that this should be known, in order that the prejudice against Brighton which obtained in some quarters might be removed.

The PRESIDENT and Mr. A. DOWSETT both corroborated Mr. Sewell's statement with respect to there being much more wind in the Eastern Counties than in this part of the country.

Mr. SAWYER promised to obtain what returns were procurable as to the character and quantity of the winds in March. He also took this opportunity of mentioning two facts which he had not referred to in his paper. First, cyclones had a two-fold movement ; they moved onwards as well as round, though but comparatively slowly. Second, anti-cyclones sometimes appear in a place, develop, and then disappear.

Mr. G. Scott adverted to the comparative untrustworthiness of anemometers, and suggested the possibility of the indicators going further than they should. Should not the instrument be stopped at given intervals—say every half-an-hour? The returns, he thought, were much more likely to be accurate if this were done.

Mr. Sawyer admitted that different sized instruments gave different returns.

Mr. W. H. Nash was of opinion that Osler's was a much more accurate instrument than Robinson's.

April 23rd.

MICROSCOPICAL MEETING.—MR. WONFOR ON "PLANT CRYSTALS."

In most of the manuals on Botany or the Microscope, certain crystalline bodies found within the cells of plants were designated by the name *Raphides*, or needle-shaped bodies, a term inapplicable to some, because they were not needle-shaped, and on the whole misleading, because in the lists of plants generally given as containing them, it would seem as though their appearance was an accidental circumstance in the economy of the plant, instead of a constant quantity, not confined to one period of the plant's growth, but found in all stages of its existence.

The first to reduce to something like order and to indicate the value of Plant Crystals, in determining the differences between plants of otherwise closely allied families, was Professor G. Gulliver, by whom they had been arranged into the three groups—*Raphides*, *Sphaeraphides*, and *Crystal Prisms*.

Raphides were transparent colourless crystals, needle-shaped, and tapering to a fine point at each end, loosely connected in bundles of twenty or more in oval or oblong cells of slightly larger dimensions than themselves. The slightest pressure on the tissues of a portion of a plant, when under examination, causes them to escape from their cells. Examples could easily be obtained either by making thin sections or simply tearing with needles a portion of the tissues of any member of the balsams, woodruffs, evening primrose, arum, orchis, and some of the iris family

Sphaeraphides were more or less rounded, often spherical bodies, made up of white or opaque crystals or crystalline matter. In some the ends of the component crystals projected, and gave them a star-shaped appearance. They were much smaller than their cells, and, in some cases, were thickly studded throughout the cellular tissue. This was the case with many of the cactus family, some of which, when aged, had their tissues so filled with them as to render the plants very brittle. It was mentioned that plants of *C. Senilis*, reported over a thousand years old, when sent to Kew Gardens, had to be packed in cotton as carefully as if they were delicate glass or jewellery. The fruit of the prickly pear was full of *Sphaeraphides*, examples of which were easily seen in the crane's-bills, elm, beet, spinach, or violets.

Crystal prisms were found either singly or two, three, or at most four, together in combination within the same cell. While under a low power *raphides* did not present angles or faces, crystal prisms presented both ; instead, too, of tapering to a point at both ends, they were wedge-shaped or angular. Some were three or four-sided, while others were octohedrons. They were larger than *raphides*, and were not, as a rule, easily separated from the tissues in which they were seated. Examples might be found in the green-pea shell, the garlic, green fig stem, gladiolus, &c., and very abundantly in the soap tree of South America, used in Peru as a substitute for soap in the cleansing wool or hair, or in washing.

Chemically, plant crystals were chiefly composed of oxalates of lime and magnesia, or phosphate of lime.

Professor Gulliver's researches showed that so persistent were *raphides* in certain families of plants and so absent in others, that it was possible to differentiate, at all stages of their growth, between plants otherwise apparently allied. Thus *Onagraceae* and *Galliaceae* abounded in *raphides*, while none of their near neighbours contained them. So likewise the red berries of black-bryony and cuckoo-pint could be distinguished from those of red-bryony and guelder-rose, by the presence in the first two and the absence in the last two of *raphides*.

To the botanical student, characters such as those indicated were of very great value, and to the microscopist a wide field of research was opened, for not only would he find plants containing one or other of the plant crystals described, but great differences in their shape and size, many of them too, under polarized light, being very beautiful ; while a lesson was to be learnt by all—that they were not accidents of decay or disease, but part of the economy of life in the plants in which they were found.

A conversation ensued, in which Drs. HALLIFAX and CORFE, and Messrs. GLAISYER, the PRESIDENT (Mr. Haselwood) and Mr. WONFOR took part.

Mr. HENRY LEE, having been called upon to address the meeting, said that the few remarks he had to make belonged more properly to the conversazione part of the proceedings ; but they would perhaps not consider him out of order, as this was the first time he had appeared before them, if he expressed his gratitude to them for the kindness shown him in electing him an honorary member of their Society. It struck him that he might be useful occasionally, as he was to the Society at Croydon, over which he was President, in bringing down microscopical objects for mounting and distribution, such as the skins of dog-fish, eels, &c. It might be useful, while he set some of them aside for this purpose, and which he should be glad to present to any of the members of the Society, if he mentioned, as hints to the younger members, for he did not profess to teach the older and experienced microscopists before him, how he found it best to mount the skins. The usual mode was to mount them as opaque objects, and, as the tops of the spine were brittle, to do so either in a dry cell or in balsam, which gave them a good opportunity of examining them by polarized light. This conveyed to them a splendid colour, and showed that vessels seemed to extend down the spine, the same as down the teeth of the rays and sharks. There was another method, namely, dissolving out the animal matter by means of liquor potassæ, and well-washing in distilled water. By doing this the spines with their socket attachments were well shown ; but it should be remembered that they should be soaked in turpentine for some time before mounting in balsam, or the venation would be filled with air. He did not think that there was anything else he needed to state, except in reply to questions which, if put, he should gladly answer. The specimens which he had brought with him for exhibition and distribution that night were from the skin of the rough hound ; and from time to time he would bring down portions of skins of all the dog-fishes, so that the members of their Society might each have a perfect series in their cabinets.

The PRESIDENT (Mr. Haselwood) was sure that he would only be expressing the feelings of the Society when he said that they should be delighted to have Mr. Lee's presence from time to time, and receive valuable suggestions from his practical knowledge; that they hoped he would often find time to pay them a visit; and that they heartily thanked him for the specimens he offered them.

Mr. HENRY LEE remarked that there was one thing which he had forgotten to mention, namely, that in showing the objects he submitted, much depended on illumination—the manner in which the light fell upon them—and he would suggest, to younger members especially, that if they were in the habit of working with their lamp on any particular side, they should always put the label on that side where there was the best illumination, and towards the lamp. They would then always be able to place the object in the best position.

Mr. T. W. WONFOR observed that Mr. Lee had come to exactly the same conclusion in mounting the skins of dog-fish as that at which he had arrived in mounting the wings of butterflies and moths.

Mr. G. D. SAWYER was glad that Mr. Lee had thought fit to speak of several elementary facts, for they were of great service to those who were working up from the bottom of the ladder; and he hoped the more experienced microscopists would always, when they were lecturing, assume the presence of those who had to learn the first practical truths.

After votes of thanks to Messrs. Wonfor and Lee, the meeting became a conversazione, when both gentlemen exhibited very interesting objects, illustrative of their respective remarks.

It having been intimated that Dr. Hallifax had presented eleven micro-photographs to the Society, a vote of thanks was awarded to him for his gift.

MAY 14TH.

ORDINARY MEETING—SPECIMEN EVENING.

SAWDUST ORNAMENTS.

Mr. T. W. WONFOR opened the exhibition of specimens by showing a medallion of Ceres made from sawdust, and very much resembling *papier maché.* This was brought from Philadelphia ; it was given to him by Mr. G. H. Tatham to present to the Museum.

Mr. C. F. DENNET said that the manufacture of articles from this substance had been carried on in the States since 1860, and he should be happy to present a specimen of the manufacture to the Museum.

A PECULIAR FISH.

Mr. C. F. DENNET remarked that during the meeting of the British Association in Brighton there was much curiosity and speculation as to what a peculiar vertebrate-like object then exhibited belonged. He had since come across a paper in which the subject was dealt with, and an illustration of the animal given ; it proved to be what in the United States was called a stick-fish.

Mr. T. W. WONFOR said that the Alcyonium, or, as it was more commonly called, Dead-men's Fingers and Sea Paps, very much resembled the stick-fish, and was to be seen alive in the Brighton Aquarium.

Mr. DENNET promised to do his best to get one over alive from the States ; in any event, he would be able to present the Society with a dead one.

CREMATION.

The subject of Cremation was next discussed. It was opened by Mr. WONFOR, who exhibited a part of a small clay vessel, which was dug up within about 200 yards of the Lewes Road Cemetery, and which he thought, from the fact of coins and pieces of pottery being found with it, might possibly be part of a small cinerary urn. Whether this was so or not, however, there was abundant evidence to show that the early inhabitants of this country, and also the Romans and Anglo-Saxons, burnt the bodies of their dead ; and in this way rendered it impossible for the survivors to suffer in any way from the noxious gases which arose from churchyards and cemeteries.

Mr. DENNET pointed out that there was one advantage in being burnt. It would also prevent the decaying matter of bodies percolating springs and wells. But how about cases of poisoning and other forms of murder being found out ?

The PRESIDENT (Mr. Haselwood) said that cases of this kind very seldom occurred. Besides, there was something to be urged against every suggestion. He was glad to see that the public mind was so fully alive to the subject.

Mr. G. SCOTT was pleased that this subject had been brought forward. He had always held that the neighbourhood of the Round Hill Crescent, the Ditchling Road, and Hollingbury Castle would well repay being carefully investigated. In his opinion, however, the vessel in question was not a cinerary urn; they were generally very much larger—about half the size of one's body (and he subsequently brought in an urn from the Museum, which bore out this opinion). He was rather disposed to think that it was one of the vessels which were usually deposited with the dead, and which contained food or drink for the spirits of the departed. Mr. Scott then explained the various forms of ancient burial, and described the positions in which bodies were mostly buried when not burned.

Mr. HASELWOOD: The burning of bodies ceased about the time of the introduction of Christianity.

MR. E. H. MOORE showed that the ancients could not have had the means of reducing bodies so thoroughly as we had now; they would not be able to get so great a heat; consequently, there was a larger quantity of ashes left than there would by the process proposed by Sir Henry Thompson.

MR. BENJAMIN LOMAX adverted to the custom followed by the natives of Australia, in drying the bodies of their dead and carrying them about. After some further discussion the subject dropped, Mr. Wonfor half promising that the matter should be dealt with in a paper on some future occasion.

THE HABITS OF ROOKS.

The habits of rooks were next touched upon. DR. CORFE enquired the reason of odd birds always being set upon by their fellows. In many cases rooks had been known to set upon single birds and kill them, and it had been suggested that it was for some social sin. Was this so; were bigamy and polygamy punishable among rooks?

Mr. Wonfor did not think the question could be satisfactorily answered. He knew an instance in which a female rook was killed by the other birds because a hen's egg (which had been purposely put there) was found in her nest; but then it was a fact that birdcatchers made a practice of laying up for males in the same spots; for as soon as one male was taken another one was soon found to mate with the female.

Mr. Moore believed the weak and sickly birds were always killed, in all probability that they might be eaten by the others.

Mr. Dennet considered this was so in many cases.

The President pointed out that this was one of Nature's laws in respect to birds and animals, that the old and sickly should be killed off.

ELEPHANT OR WHALE BONE.

Mr. R. Glaisyer exhibited what some believed to be a unique specimen of part of the thigh bone of a fossil elephant *(Elephas primigenius)* which was dug up at Rottingdean, and which, by the kindness of the gentleman on whose estate it was found, had been forwarded to him for exhibition.

Mr. Scott questioned whether it was an elephant bone. Professor Andrew Ramsay had seen it and had expressed his opinion that it was a whale bone, in which opinion he concurred.

Mr. Wonfor hoped geologists would endeavour to settle this question; it would be most interesting and important to know if it was the bone of a whale which was found in the Elephant bed. If it was the bone of an elephant it must have been a most gigantic one; but he thought it was most likely to be a whale bone.

Mr. Benjamin Lomax thought it might possibly be determined by a careful microscopical inspection.

LOCAL GEOLOGICAL STRATA.

Mr. F. E. Sawyer drew attention to the excavations being made in Russell-street, Brighton, and recommended the members to make a point of seeing the strata there laid bare before the place was walled in. The natural soil extended about four or five feet; then came about nine feet of very sandy clay; and at the bottom a great quantity of flints lying on the Elephant bed. The excavations at Portslade for Coombe Rock (Mr. Hudson's) were also worth inspecting, some interesting points being opened up there.

Mr. SCOTT said he had examined the Russell-street excavations, and they were certainly singular; and it was his intention to take a run over to Portslade at a convenient opportunity.

OTHER SPECIMENS.

Mr. E. C. PANKHURST also exhibited several specimens of elatenite, a singularly bituminous mineral, fossil fern, calamite, &c.

The Rev. J. H. CROSS, a piece of the lace bark tree and other objects from Jamaica.

Mr. W. CLARKSON WALLIS and Mr. F. E. SAWYER, various small bones which had been found in the neighbourhood.

Mr. G. SCOTT submitted a piece of decayed wood, similar to that used in making Tunbridge ware, and which was found in the neighbourhood of Petersfield, and enquired what was the nature of the colouring substance, and if the wood was durable?

Mr. T. W. WONFOR remarked that it was not unless impregnated by something to make it so, and that the colouring was produced by fungus growth, and that it was the mycelium of the fungus, termed *Helotium æruginosum.*

MAY 28TH.

MICROSCOPICAL MEETING—DR. HALLIFAX ON "THE VEGETABLE CELL."

By the term "Cell" was denoted the primary and elementary component of vegetable, and, almost, if not all, animal tissues and organs. The entire vegetable kingdom was made up of cells, in which every vital action was performed, and while some were of extreme minuteness, others were of considerable size.

The Vegetable Cell had been defined as a sac or envelope, the wall of which was composed of a peculiar chemical substance named cellulose, and in its vital condition contained fluid. There had been some dispute with regard to this definition, because in certain lower forms of vegetable life provided with ciliæ, and floating freely in water, no trace of walls could be detected ; these, he considered, were erroneously, and, by a confusion of language, called cells.

The physiological aspect of the cell was far more important and interesting than the structural, as each cell lived and performed its offices as an independent organ. If the petal of a flower, such as the pansy, were examined, it would be seen that each cell secreted its own colour, the same cell never secreting two different colours ; the purple and yellow, though appearing to blend, always being found in separate cells.

Under the microscope it was not possible to show the physiological action, but the size, form, and relation of one cell to another could be exhibited. As regarded the form an infinite variety was found, caused by the laws of growth and external circumstances, such as pressure and from contiguity with other cells.

The primary form was spherical, but the greater number were polygonal, and some stellate. Besides forming beautiful objects for the microscope, there was an interesting study in endeavouring to solve the question, whether the cell in its juvenile state was spherical, and if so, how the diverse and wondrous shapes were brought about.

It was certain that some plants, consisting of a single cell, in obedience to the law of growth, took on an invariable form, which certainly was not spherical, though there might be exceptions. Many cells too, in their immature state, were devoid of those features which marked them in a state of maturity, when they had taken on what was called secondary deposits, obtained from the primordial uticle, or protoplasmic substance, spread over the interior of the cell.

In some plants, notably the *Nitella*, examples of which he would exhibit, the cells were not only of very great length, but so transparent that the physiological action of *cyclosis*, or rotation of cell contents, was easily seen. The hairs of many plants (modified cells) also showed a similar state of things ; and it had been conjectured that a similar circulation went on in all plants, so constituting the nutritive process.

Mr. C. SMITH inquired what the value of the cell, as an anatomical unity, was in building up structures? He imagined that it was a sort of protoplasm, for if not, they had one cell developing from another, and so on *ad infinitum*. There was one plant which had not a cell in its whole organism.

Mr. T. W. WONFOR presumed that there was a membrane, and contents of that membrane.

Mr. C. P. SMITH admitted that there would be a cell if the plant itself was designated one.

Dr. HALLIFAX indicated that had there been time, he would have gone into the origin of cells; but it was an intricate subject. Of course there must be a primary stage before the cell and cell wall were formed, but to ascertain what it was, was the great problem of the day. It was called a protoplasm, and was a gelatinous or semi-fluid substance, having in itself a central germinating element called nucleus. As to the plant to which Mr. Smith referred, if he understood that gentleman rightly, it was uni-cellular.

Mr. T. W. WONFOR raised the question, how did the cell contents pass from one cell to another? They evidently did so, for the nuclei went on rotating and increasing in number and size. It was supposed by some that the fluids passed from one cell to another by endosmose and exosmose.

Dr. HALLIFAX inferred that absorption took place.

The meeting then became a conversazione, when vegetable cells, illustrative of the paper, including *Nitella*, were exhibited by Messrs. Haselwood, Glaisyer, Wonfor, C. P. Smith, and Dr. Hallifax.

JUNE 11TH.

ORDINARY MEETING.—MR. G. SCOTT ON "THE WILD CAT AND OTHER MAMMALS, RECENTLY ADDED TO THE MUSEUM COLLECTION."

The Museum collection had hitherto been very deficient in Mammals, for they started in September last with very few; but during the last few months considerable additions had been made, including several species of monkeys, the badger, fox, ferret, weasel, stoat, hedgehog, wild cat, Australian native cat, squirrel, pied hare, pied rat, water rat, seal, and porpoise, also skeletons of porpoise, mole, and guinea pig. Of these, several had been presented by the Earl of Chichester, Mr. Brazenor, and other gentlemen ; but for the greater number they were indebted to their Vice-President, Sir Cordy Burrows, either personally, or through his exertions among his friends, and his influence with the Directors of the Aquarium, who had ever been anxious to help the Museum in every possible way. Fine specimens of the great ant-eater, antelope, and lynx, and the skeleton of a monkey were nearly ready for the cases, and he had the promise of a fallow deer from West Sussex, and of the first otter which could be speared by the Master of the Otter Hounds of one of the northern counties. By going on in this way, they not only secured the typical specimens which they required, but what the public wanted still more, namely, a tolerably extended collection. He should confine himself to a few words respecting the wild cat, the Australian native cat, and the monkeys last added.

When he promised Mr. Wonfor to say something about the Wild Cat he thought nothing would be easier, but on looking into Zoological works, he found that either very little was said or that the authors were very far from agreeing. Thus, Baron Cuvier, whilst he devoted five volumes to the class Mammalia, dismissed the wild cat in seven lines ; and Professor Nicholson was still more curt, and, as far as our island was concerned, his only remark reminded one of the celebrated chapter on snakes in Iceland—all that he told us was, "The wild cat formerly existed in Britain, but was now extinct." Of course, if this were so, there would be an end of the matter, and of our Sussex specimen along with it. But this, he thought, was a fair subject for discussion, for, whilst it was admitted to be rare, especially in the south of England, and that there were many cats which had escaped from a domestic life and run wild in the woods, there were differences which could be relied upon, and he should not very readily abandon the claim of their specimen to be a genuine Sussex wild cat.

First, as to the tail. It was admitted that the tail of the domestic or escaped cat could easily be distinguished from that of the wild cat. The former was long, slender, and tapering, whilst the latter was much shorter and more bushy, and it was proved that escaped cats leading a life in the woods transmitted their long tapering tails through many successive generations. Now, the tail of their specimen was exactly that of the true wild cat, whilst the head and body were of the exact average length, 1 foot 10 inches. Other distinctive features he had not had the opportunity of observing, but the general description of the wild cat applied with perfect exactness. "The ground tint of the fur is yellowish, or sandy grey, diversified with dark streaks drawn over the body and limbs in a very tigrine manner. These stripes run nearly at right angles with the line of the body and limbs, so that the creature has been termed, with some justice, the British Tiger. A very dark chain of streaks and spots runs along the spine, and the tail is thick, short, and bushy, with a black tip and rings of a very dark hue. The stripes along the ribs and on the legs are not so dark nor so clearly defined as those of the spine. The tail is barely half the length of the head and body."

Mr. St. John pointed out that the wild cat stood higher on its legs in proportion to its size than the domestic cat; and that its strength and ferocity when hemmed in or closely pressed were perfectly astonishing. That this animal, shot in Sussex, and presented as a true wild cat, was fierce and active enough for one, might be gathered from the fact, that as it lay wounded to death it seized the retriever by the throat, and so lacerated the windpipe that the dog died the next day. It was a desperate enemy to poultry and game, especially in the north of Scotland, where it still escaped the gamekeeper's gun. The *Zoologist* for April, 1873, spoke of "that reputed Scottish mammal, the wild cat," and, "of this mythical creature," and added "there is no British mammal, or reputed British mammal, of whose character, locality, and even existence, we are so totally ignorant as the wild cat." On the 29th of the same month Mr. A. H. Cocks replied in a short notice headed "The Wild Cat not a Myth," and gave an account of one which he had kept alive for the previous thirteen months. She was one of five he had seen alive, and was trapped in Inverness-shire. He tells us "she became to a certain extent tame; that is, although she never left off her habit of perpetually swearing when receiving a visit, she will come, when tolerably happy, from her 'bedroom' to the other half of the hutch cage she inhabits to receive food." He mentioned several others which had been kept in captivity, including six within two years at the Zoological Gardens, where Mr. Bartlett has now either one or two hybrids. He had a letter recently from Mr. Bartlett respecting theirs, but he did not like to give an opinion without seeing it.

The question would be asked, had not our household cat been domesticated from the wild cat? He would not detain them by going into particulars, but it was pretty well established that the domestic cat was a descendant of the tame cat of the Egyptians, introduced into the western provinces by the Romans. In support of this view he would only mention that, whereas the wild cat was so abundant in the time of Richard II., as to be one of the beasts of the chase—that King having granted a charter to the Abbot of Peterborough, giving him permission to hunt the hare, fox, and wild cat—the domestic cat was only heard of in Britain about the 10th century, when it was highly valued, and laws were passed to regulate its preservation. Thus Howel Dha, of Wales, who died A.D. 948, fixed the price of a Kitling (which is still the north country phrase) before it could see at a penny, and till it caught a mouse at twopence. At the value of money in those days this was a large price. But, besides this, it was enacted that if anyone stole or killed the cat that guarded the prince's granary, he was to forfeit a milch ewe, its fleece and lamb; or as much wheat as when poured on the cat suspended by its tail (its head touching the floor) would form a heap high enough to cover the tip of the tail. This legal process must have been more flattering to pussy's sense of dignity than altogether comfortable to her feelings.

The little animal which had been presented as the Australian native cat, although it was not a cat at all, he introduced for the purposes of getting their friends Mr. B. Lomax and Mr. E. Moore to tell them something about it; for like many Australian animals the accounts of it in works on Zoology were very limited. Indeed, as has been remarked, "There is hardly any practical writer on Zoology who does not lament the very incomplete state of our knowledge on the subject of Australian Zoology, and those who have thrown themselves most zealously into the work, and have achieved the greatest success, have been the most ready to acknowledge the enormous gap that has yet to be filled up, and to urge others to prosecute their researches in regions which have as yet been untraversed by the foot of civilized man, and which are the most likely to be the dwelling places of creatures on which, as yet, an educated white man has never set his eye."

He would endeavour to say a few words respecting their humble cousins, the monkeys, of which they had five unusually fine specimens on the table. Mr. Wonfor was very anxious that the paper should be a Sussex one if possible, and he was glad to be able to gratify him even in the case of the Quadrumana. That little creature, the pig-tailed Macaque or Bruh, one of the cleverest, most humorous, and most thievish of all the monkeys, was brought from Singapore by one of the sailor sons of Mr. Peters, at the Dome. Mr. Peters divining that he liked dead animals better than living ones, promised that he should have it if anything happened to it. It was sent a little way into the country, got playing as little boys would, entangled its chain in a gooseberry bush, and was hanged, so that to this extent it was a Sussex monkey. As they were preparing its skeleton the nails were wanting.

It was a native chiefly of Sumatra, and when young was trained to climb the cocoa nut palms and gather the fruit, and it was said that it selected the ripe nuts only. There were several other species of macaques, as the bonnet macaque, the black macaque, and the Barbary ape, and this seemed to be the general position of all of them in walking. He might mention that should any gentleman wish to lay out a few pounds on a Barbary ape for the Museum, there was a fine one in the town, and also a large orang-outan and several other monkeys, to be had. They had the head and skull of the diadem lemur of Madagascar, but there was not time to discuss that curious family, the members of which approached, in some respects, the quadrupeds. There were six molars at each side in both jaws, instead of five, as in ourselves, and in most of the old world Quadrumana. He was sorry they had only the head, but the commercial element was too strong for them, and the skin was made into a lady's muff. They had three examples of the Gibbon. They were all natives of Asia. They were told that the cry of the female was quite a musical performance, capable of being set to musical notes. The animal was said to achieve the chromatic scale admirably, with precision and rapidity. Beginning with E, she first ascended to the upper octave and then descended in the same way, but always sounding the lower E almost instantaneously with the upper note, whatever that note might be. In general they were all affectionate and engaging creatures, and it had been said, "If the gigantic and powerful gorilla be compared to Hercules, the light and active gibbons may find their type in Mercury, the swift aerial messenger of the Olympian deities."

There was only one other specimen with which he need detain them, the specimen of the Entellus monkey or sacred Hoonuman of India. They had all read of the crowds of monkeys to be seen in and around Indian villages, and swarming on the banyan trees, where they did just as they pleased, and took what they pleased at their own sweet will from every garden and sugar-cane field in the country. One writer told them, "They parade the streets, they mix on equal terms with the inhabitants, they clamber over the houses, they frequent the shops, especially those of the pastrycooks and fruit sellers, keeping their proprietors constantly on the watch, but no one punishing them for any delinquency." Another said, "Bangalore, a city of Mysore, is completely hidden by a dense grove which is a perfect metropolis of monkeys. Swarming in thousands, they chase each other on the roads, caper on the hedges, chatter on the boughs, and grin hungrily at everyone who passes with any eatable." Before concluding a paper which had, as usual, become too long, he might add they had occasionally heard of their distant relationship to the monkey. It was rather refreshing to have an opinion from the other side, and to learn that the monkey did not see it. Sir Samuel Baker tells us that Lady Baker's pet monkey, "being a far more civilized being than the African savages, did not at all enjoy their society, but was in the habit of attacking the unprotected calves of their legs, and amusing himself by making insulting grimaces, which kept the crowd in a roar of laughter. He was quite unhappy if out of the sight of his mistress, but he frequently took rough liberties with the blacks, for whom he had a great aversion and contempt. Wallady had no idea of a naked savage being "a man and a brother."

Mr. Wonfor thought Mr. Scott had proved, beyond a doubt, that the wild cat existed as distinct from the domestic cat ; they heard of domestic cats becoming wild, and breeding with wild cats, but he thought that this statement had not been sufficiently confirmed. As to where their domestic cat came from, they were unable to trace its originality, though Dr. Schweinfurth and others placed it in the centre of Africa. As to cats transmitting certain peculiarities to their offspring, as the absence of the tail in the Manx species, it was said they lost them after the lapse of a few centuries.

Mr. Dennet pointed out that, according to his experience, acquired chiefly in America, a veritable wild cat should possess five toes on each of the anterior, and four on each of the posterior, feet, a rounded head, elastic muscular body, strong limbs, sharp claws, and several other external characteristics. They were also gifted with acute sight and hearing.

Mr. A. HILTON thought that he had discovered what was not a peculiarity,—the large bushy tail,—stating that some domestic, and, on the continent, many hybrid cats, with bushy tails, twice the size of the one alluded to by Mr. Scott, were to be found.

Mr. G. SCOTT explained, however, that it was not in the length of the tail that the peculiarity lay, but in the short, combined with the bushy state.

Dr. HALLIFAX said that one of the most distinctive features of the wild, as compared with the domestic cat, was the great length of the intestinal canal. He also observed that, according to high authorities, the domestic might breed with the wild cat ; and, if so, that would rationally explain the large variety of cats.

Mr. T. W. WONFOR admitted that there might be cross-breeds, and that domestic cats had been known to disappear and return with progeny unlike themselves, and more or less wild ; but the question then arose—did that cat breed with a male cat, which had become wild, or with a truly wild cat?

Mr. G. SCOTT maintained that the varieties of the domestic cat were produced by cross-breeding, the same as with domestic cattle, pigeons, &c. ; for the wild cat never did vary, a fact which was confirmatory of his assertion that it was a distinct species.

A discussion on the monkey followed, in which Messrs. Hilton, Shellingford, Wonfor, Wallis, G. D. Sawyer, and Mr. Scott took part.

Mr. F. E. SAYWER, F.M.S., reminded the members that, with reference to a paper which he read in 1872 upon Earthquake Shocks in Sussex, Mr. Wonfor mentioned that in the autobiography of Sir John Bramston, published by the Camden Society, there was a shock mentioned as having occurred in 1692, but it gave no particulars. He found a description of this earthquake in Holloway's History of Rye, which stated that the trembling of the earth under the town did not last a minute, and was felt throughout England, France, Belgium, and part of Germany, as far as Frankfort. He also corrected a statement made in his paper upon the earthquake at Brighton in April, 1873, that it was felt by a gentleman walking along the King's-road. This was not quite correct. According to a letter signed "M. F.," and dated 6th April, 1873, which appeared in the *Times*, repeated trembles were felt in a house in King's-road about ten minutes to eleven o'clock at night by persons capable of distinguishing the vibrations from those of a passing vehicle. The earthquake of 1734 he had represented as being felt only as far east as Shoreham, but he ascertained that it was felt at Lewes, and within twenty miles of the sea coast, thus giving it a much wider range than he had imagined it assumed.

JUNE 25TH.

MICROSCOPICAL MEETING.—A MARINE EVENING. —MR. H. LEE ON "YOUNG LOBSTERS."

Mr. LEE having brought over from the Aquarium living specimens of young Lobsters, coronacti and madrepore, Mr. WONFOR placed one of them under the microscope, and informed the member's present of Mr. Lee's kindness, reminding them how willing that gentleman was to communicate information to them, and expressed their gratitude to Mr. Lee for his attention. He then observed, with reference to the young Lobster, that naturalists believed at first that it was a distinct species of crustacea, but that they had now ascertained what it really was.

Mr. LEE drew attention to the abnormal size of the eye of the young Lobster, the peculiar feet which existed in all larvæ of crustacea, and the spatulate instead of the five-lobed or divided tail, as possessed by the adult. In order to show that the animal really constituted a subject of modern investigation, he remarked that he once entered into argument respecting young Lobsters with Mr. Lord, the late Curator of the Aquarium, and now deceased, and he denied that Mr. Bell, in one of his works, was right in attributing spatulate tails to them; but afterwards, having been shown a specimen through the microscope, he acknowledged that Mr. Bell's opinion was quite correct.

In reply to Mr. Wonfor, Mr. LEE said that the Lobster had been traced from the ovum to maturity. In no Aquarium, however, had any of the young of that shell-fish been reared. In the Brighton Aquarium an endeavour had been made to do so; but he considered that the investigations were still just commencing.

In answer to Mr. Dennet, Mr. LEE said that it was almost always found that the eggs of fish and crustacea were round. The eggs of lobsters, tortoises, and turtles were all of this shape. Eggs of the common snake were oval.

The circulation was well seen, and some small excrescences were noticed on the body, but whether they were parasites or not was uncertain.

Various marine objects, including boze from Atlantic Cable, sponge spicules, young star fish, &c., were exhibited by Messrs. F. E. Sawyer, W. Puttick, R. Glaisyer, and the President, Mr. Haselwood.

Mr. W. WONFOR also exhibited one of Möller's "Diatomaceen typen plattes," lent by Mr. T. Curteis, of 244, Holborn, London, an honorary member of the Society. It consisted of eighty distinct species of diatoms, mounted in circles, with the name of each photographed below the circle, and the whole contained in one-eight of an inch square. The names could be read easily under a low power, while under higher powers the valves were as clean and as perfect as in all the specimens from the same mounting. It was indeed a marvel of manipulative skill and ingenuity.

JULY 2ND.

ANNUAL EXCURSION.

Groombridge, the place chosen for the 19th Annual Excursion, is a good-sized hamlet on the borders of Sussex and Kent, about four or five miles from Tunbridge Wells. To most persons it is chiefly known from the fact of its being a junction, and at first sight there would appear to be little of special interest in the neighbourhood for a Scientific Society, other than that which the natural beauty of the scenery affords. So thought many of the members, and questioned the expediency of such a comparatively uninteresting place being chosen for the Annual Excursion. At the close of the day, however, every one was agreed that a more enjoyable excursion could not have been spent. *The* feature was the charming variety it furnished, each of the spots visited affording new and attractive points of interest : first an old family mansion, with a dash of historical and antiquarian interest connected with it ; then reminiscences of African travels and exploits ; then a beautiful combination of the artistic and the picturesque such is not often met with.

The members and friends left Brighton by the 7.55 a.m. train, and arrived at Groombridge at half-past nine, where they were met by the Rev. B. Whitelock, M.A., the Curate, who kindly acted as cicerone during the greater part of the day, and who at once conducted them to "Groombridge Place," the historical residence of the Rev. J. J. Saint, the Rector of Speldhurst, and Lord of the Manor, by whom they were most hospitably entertained. "To partake of tea, coffee, &c.," was the invitation ; but the *et cetera* formed the most prominent feature in the halt for refreshment ; a repast, in which elegance was united to substantiality, being spread in the quaint old hall of the mansion, and the ladies of the family doing the honours of the table.

The repast completed, and grace having been sung by the Rev. J. H. Cross, Dr. King, and Mr. Dennant, from music composed by Mr. Cross during the journey by train, Mr. Saint gave his guests an account of the history attaching to Groombridge Place.

The present structure, a brick mansion with stone dressings, enclosed within a broad and deep moat, supplied with water from a stream flowing through the garden, was erected in 1660 by a Mr. John Packer, on the site of an old castle that originally belonged to William Russell, who came over from Normandy with William the Conqueror ; it was subsequently alienated, in 1405, to Thomas Waller, of Lamberhurst.

Here Charles, Duke of Orleans, one of the few lyrical poets of noble blood which France has produced, was detained a prisoner. The Duke was taken prisoner by Sir Richard Waller, the then proprietor of Groombridge Place, at the battle of Agincourt, who discovered him amongst a heap of slain. At first he refused both meat and drink, but was persuaded out of his resolution to starve himself to death by Henry V., who declined to accept ransom for him, and gave him into the custody of Waller. How long the Duke remained at Groomsbridge Place is uncertain, but he was subsequently removed to the Tower of London. When the Place was re-built by John Packer, a considerable portion of the panelling was used over again, and this is now to be seen in the Library—where some fine specimens of carved oak are to be found—and Dining Hall. One of the panels in the former room contains the arms of the Duke, and is unquestionably a memento of his confinement at Groombridge Place. Besides the carving and panelling, are some old paintings of previous Lords of the Manor, and a Bible, printed by Buck and Daniel, at Cambridge, in 1638, in excellent condition. The fire backs, too, in the rooms already spoken of are worth noting, both being in an excellent state of preservation ; one is dated 1579, the other 1604. Visitors to the grounds were struck with the peacocks, of which there were no less than 34, all of whom roost in the trees near the house. Having thanked Mr. and Mrs. Saint for their generous hospitality, through their President, the party next proceeded to Hillside, and from ancient, devoted themselves to subjects of modern interest.

Hillside is the recently-built residence of Mr. W. C. Oswell, F.R.G.S., the well-known African traveller, and stands at the top of a graceful eminence, about half-a-mile from Groombridge Place, commanding a magnificent view of Tunbridge Wells and the surrounding country. To obtain this alone was well worth the trouble of ascending the hill ; but when once inside the house, one forgot the beauty of its environs in the contemplation of the manifold treasures it contained. When written to by Mr. Wonfor, Mr. Oswell, whose modesty and retirement are proverbial, willingly offered to throw open his house to the members of the Society, but hinted that he did not think they would find much to interest them in it. How greatly he underrated, not only his unique collection of African trophies, but his own descriptive and colloquial powers, may be to some extent comprehended when it is stated that the visit to Hillside formed the most notable and interesting feature of the day's proceedings. Few, if, indeed, any, will ever forget either the anecdotes Mr Oswell told, or the charm with which he told them ; they could have been equalled, though scarcely surpassed, by one only—his old friend and companion Livingstone, in conjunction with whom he explored the southern portion of Africa, and discovered Lake Ngami. Avoiding publicity, and never referring to his exploits " save on compulsion," he on this occasion responded to the general wish and entered freely into his African experiences, which he described in a vivid and picturesque style, yet without the least approach to egotism or boasting. Mr. Oswell is, in fact, an excellent story-teller, putting his points well, and never becoming discursive. Not often, however, even to his immediate friends, is he so freely communicative as he was to the sympathetic audience who fully appreciated all that he had to tell them.

On entering the house, the visitor found himself surrounded by horns and skulls, which, Mr. Oswell said, represented the entire antelope tribe of Africa. In pointing out the peculiar characteristics of some of them, he drew particular attention to a pair of fine straight tapering horns, which, viewed from either side, obscured each other; he had not the least doubt that the animal which wore them, the oryx, was the fabulous unicorn. He also explained the feet of some kinds, showing that they were of great length where the land was swampy, and remarking that these antelopes were easily caught if driven to dry hard ground, being then tripped up by their own toes.

Showing the way into the drawing room, he pointed to a pair of horns which belonged to a red and white ox, that stood over six feet in height. The points of them were 8 feet 9 inches apart, but, measured round their entire length, for they were most beautifully and symmetrically curved, they measured 14 feet. Though he would not presume to talk of natural history in the presence of gentlemen so well up in the science as those present; yet he thought he might veuture to relate a curious fact which he had never seen published. It was for that purpose he had directed attention to the horns of the ox before them. The oxen of which that one was a specimen were to be seen in large numbers in the lake districts, where he saw that one plunging his head down into the long succulent grass, and tearing it up by huge mouthfuls. It was a domesticated animal, and, having obtained possession of it, he started on his journey home with it; but the grass becoming shorter in length, the animal became less capable of getting food, as the horns prevented it from putting its mouth to the ground. The result was that it got daily thinner and weaker, and he at last killed it and cut off the head. But this was the curious point he wished to illustrate: When he and his party first came upon these oxen, the Kaffirs who were with him asked the Chief where he got such monsters? "Stole them from you," was the reply. "Never," said the Kaffir; "we never had anything of that kind." "Don't you remember the last foray," rejoined the Chief, "when we carried off your grandfather's cattle?" "Certainly we do," was the answer; and the Chief said, "Well, since they have been here they have grown like that." The peculiarity was, that the horns of all animals living upon the succulent grasses found by the lakes, grew to gigantic proportions, such as that before them; and, in reply to a question put to him, he added that this great change in these animals came about in less than 30 years!

Singular to relate, in one of the adjacent districts, and almost side by side with these magnificent beasts, were a small diminutive class of cattle, no larger than goats; indeed, he saw a goat on the Brighton Esplanade on the previous day which was a good hand higher. According to the natives these dwarf oxen were taken from a tribe at some distance; a party of slave dealers having first directed their attention to the fact of their being there and assisting them to capture them; the slavedealers securing as many of the wretched people as they could for their own vile purposes, and their native allies taking the herds of cattle as their share of the plunder. In reply to general queries as to how he discovered Lake Ngami, he told a story which may be briefly reproduced, though words would not convey a notion of the forcible style in which it was delivered. In company with Livingstone and several others, while endeavouring to find out the whereabouts of the Lake, they entirely ran out of water, and, after having suffered thirst for several days, he went out on a "voyage of discovery" to see if any was procurable. Suddenly the figure of a woman started up before him in the long grass. She, too, had been in search of water, and, failing this, was mashing up a sort of wild turnip, which is found in the locality, and which serves as a substitute for both meat and drink. Bushmen, indeed, would live three or four months upon it alone; and cattle would also thrive upon this and the bitter water melon, although no other food or drink were given them. In terror of her life the woman agreed to show them where water might be found, and led them through a quantity of timber, when suddenly they came upon a wide expanse; it appeared to be an illimitable stretch of water, but proved to be only an extensive "salt pan," about sixteen miles across. So powerful, however, was the effect of the sun upon the "pan"—ground over which a river or water had passed, leaving a brackish sediment—that it looked exactly like water at a distance. The real lake turned out to be 400 miles from this spot; and as to who saw it first, himself or Dr. Livingstone, he was quite unable to say.

The "tsetze," a small fly, not much larger than the common house-fly of this country, was not met till the tropics were passed, and was most destructive to the whole domesticated animal life. Two of them would destroy the largest ox. Its *habitat* was the bush, spreading only a few yards beyond it, and if cattle strayed into the bush the whole would be speedily destroyed ; that was, the cow, the ox, the horse, dog, or sheep; but the donkey and buffalo it left unhurt. In fact, clinging to the haunches of the buffalo, it was spread only by that means, and would never be eradicated till the whole buffalo tribe was destroyed. He and poor Livingstone had been bitten all over with it, yet they never experienced any great ill effects.

"But," said a visitor, facetiously, "perhaps you were not domesticated then?" to which he, amidst laughter, replied, "That occurred in my wild days." As he had remarked, he had seen two of them kill an ox. It was not by a sting, he believed ; and he did not think it was by depositing an egg ; but the poison, or whatever it was, was communicated by the proboscis. Within a week after it was bitten the muscles and glands of the poor beast's throat would swell; the hollows over the eye fill up ; the whole frame of the animal would become similarly affected, and in three weeks it would be dead, unless rain set in,—then it would be dead in ten days. He lost 24 oxen simply through the bite of the "tsetze."

"Is there no antidote to its bite?" was a question asked. "None that is known;" "but there is one thing which I should mention as a still more curious fact. A calf when it is sucking may be bitten by the tsetze all day long; but a weaned calf, when bitten, is dead in a week. But, as throughout the whole of nature, this fly has its enemies, being attacked by the ichneumon whilst on the wing, who sucks them dry and drops their empty shells in abundance."

In illustrating the ingenuity of the natives, he mentioned that Livingstone and himself had reached the bank of a very deep river, one of the feeders of the Zambesi, and were wondering how they should get their bullocks across, when, suddenly, a man appeared on the opposite side,—one who had never seen a white man before. Having induced him to come across in his boat, they consulted with him as to how the cattle could be got over. He went back, returning with a cow and a calf,—the cow in that part of the country being no larger than a Newfoundland dog,—and, landing the cow, took the calf back in his boat. The cow, after looking at the boat for an instant, took a header, and, plunging into the river, swam after her calf, pursued by the whole of the bullocks, which were thus got safely across. That was ingenuity on the part of the man; and he could give an illustration of extraordinary instinct on the part of the fishing eagle and other birds. He would not say that every time this fishing eagle put his wits into practice he was successful; but he would state that he lived by his wits. The eagle would watch the pelican fishing for his dinner, and, as soon as he had caught a fish in the large pouch of his bill, the eagle would swoop down towards him, when the pelican, if he was young and foolish, would look up and screech, and, whilst his mouth was thus open, the eagle would snatch the fish from it with his talons!

But the most striking instance of instinct that he had ever met with, and he had never seen a similar instance recorded in works on Natural History, was shown by the Toucan. One day he was standing by the river side, when Livingstone came to him and said, "What is the most striking instance of instinct and conjugal affection that you ever met with?" Being out of sorts about something, he replied, "Oh, bother instinct and conjugal affection too;" but poor Livingstone repeated his question and pressed him to come and look at what he had discovered in a neighbouring tree. "Look there!" he said, "what is that?" "A bird feeding its young ones, I suppose." "Aye," replied Livingstone; "the young ones are not only in there, but the mother too; and the father is feeding the whole family." The male bird was flying to and fro, collecting food which he was passing through a chink in the tree. It turned out that the female toucan had allowed herself to be plastered up in a hole in the tree, to be liberated only when the young ones were able to take care of themselves; and this was an instinctive precaution on the part of the parents to preserve them from wild cats, for, wherever the cats had been destroyed or driven away from around a native settlement, the toucan built as openly as any other bird.

The commencement of slaving operations in a district was next very ably described. Having promised to wait and watch for Livingstone, who had laid down to sleep one day, he fell asleep himself, and was awoke by a voice saying "I salute you." Casting his eyes up he saw a man standing over him dressed most fantastically in a red *robe de chambre;* and, bursting into a laugh, said, "Why, man, you look like a woman. Wherever did you get that dress from?" The reply was, "Well, I gave a woman for it." In conversation upon the subject, he ascertained that a man had been to the Chief and asked for slaves, showing him a quantity of clothes which he would give in exchange. Having taken several men and women prisoners in a late foray, the Chief gave these for the things shown him; when the man came again demanding more slaves. "He brought us this time," said the native, "such beautiful things, that you would have sold your mother." They had no men or women to sell, and, remarked the native, "to sell your children is an ugly thing." They refused to do this, whereupon the trader said, "You want cattle?" "We do," was the response; and "here (said Mr. Oswell) is the devilry of slavery." The slave-dealers said, "You help us to attack that tribe, and, as you want cattle, you can have the cattle and we will take the men." The bargain was struck, and the scheme successfully carried out.

Passing now into the Hall, he next proceeded to explain the habits and characteristics of the many trophies of his bravery and skill which were there exhibited. Here were the horns of almost every known kind of rhinoceros, buffalo, elephant, antelope, pallah, bok, koodoo, goat, &c., the whole of which had fallen under his deadly rifle. Among the rhinoceros horns was one curving downwards instead of upwards. These were very rare; he only met with five in the course of his travels.

Forming part of the same collection were a number of African weapons and other implements, amongst which was a novel pocket handkerchief. This was nothing more nor less than a piece of metal, about the size of a dessert knife-blade, with which the Kaffirs scoop the snuff from their noses after having taken it.

The next point of interest was the sitting room, where some twelve or fifteen sketches were hung, illustrating some of the principal scenes and incidents met with by Mr. Oswell during his travels. They were done in crayon, by Wolf, from Mr. Oswell's own sketches. These were viewed with more than ordinary interest, as several of them showed that he had experienced some really remarkable escapes of his life.

The first was a flat open piece of country, and he said that such was the characteristic feature of Africa for the first 800 miles; when the traveller came upon a mountainous piece, covered with dense forests ; and in like manner every district had its distinctive feature. Africa was not a barren country : it was most luxuriant in vegetation, and was teeming with animal life ; but the peculiarity of the country was that there were extraordinary lines of demarcation. On the opposite sides of a narrow strip of sand, only 20 or 30 yards in width, the vegetation would be found entirely different ; so materially changed that the Kaffirs, who were excellent botanists and had an extensive knowledge of the use of plants, knew nothing of the productions which were found in passing from one district to another.

The vegetable and animal life in these districts were illustrated by the series of drawings alluded to. Pointing to a man and horse lifted from the ground, the rider flying through the air and the horse poised on the horn of a rhinoceros, one of the company asked if such an incident had actually occurred? "Yes," was the reply, "I saw it." "And who was the unfortunate man?" "Oh, that was my horse, the best in the world : I wouldn't have taken a thousand guineas for him the moment before that happened ; but I avenged his death, and the horn of the brute that killed him you have seen in the hall." Being asked if the rider was hurt, he quietly replied, "I was stunned for the moment." There were two sketches of his being attacked by lions ; one in which the animal had sprung upon the back of his horse. He had seen a cub running in the grass. It was only about the size of a puppy, and, giving chase to it, he heard the unmistakeable growl of the lioness, and rose in his stirrups to catch a sight of her, intending to dismount to shoot her, for it was waste of ammunition to shoot on horseback. He saw her charging after him, and clapped spurs to his horse to get away "when," said Mr Oswell, "I heard her paws go pat, pat, pat, upon the ground behind me, and at the third bound she was on the horse's haunches. Fortunately for me, she did not get forward enough to reach the saddle ; but with her fore-claws fixed in the hind-quarters of the horse, her chin pressed firmly upon his back, and her hind-claws fixed in the thigh, she was carried along by the horse. Passing under a tree, one of the boughs caught me across the chest and rolled me and the lioness off together ; when, snapping up my hat, she bounded off with it." "Then you escaped unhurt?" asked one of the company. "Not quite;" and, pointing to a scalp-wound, he showed where the bough of the tree stripped his scalp down over his ear.

That was the only instance, he said, of a lion attacking him in the day-time; adding that his experience of them convinced him that they were perfect cowards. In reply to a question as to whether they gave tongue when hunting, he remarked that the lion only gave utterance to two cries. They were a low soughing sound, one when he was in quest of food and the other when he was returning to his lair satisfied; they were similar, but easily distinguished on acquaintanceship with him.

In the corner stood the gun which served him in such good stead on many a critical occasion—a fine double-barrelled rifle, which Sir Samuel Baker borrowed of Mr. Oswell during one of his recent campaigns.

After partaking of refreshments the party left Hill-side for Glen Andred, the picturesque residence of Mr. E. W. Cooke, R.A., touching on their way the church at Groombridge, a small structure, built by Thomas Parker, the father of the gentleman who built Groombridge Place. In the churchyard is an ancient tree, which tradition says was planted by a despairing lover of Cecily Nevill, Duchess of York, afterwards mother of Richard III. In the church is a peculiar coincidence. Painted on the coloured glass are the arms of the Duke of Orleans already referred to, upon whom the Battle of Agincourt brought such disaster; and on one of the memorial slabs let into the wall is recorded the demise of the wife of Rear-Admiral Eardly-Wilmot, the present commander of the iron-clad Agincourt.

Mr. Cooke was sketching in the Isle of Wight; and as Miss Cooke was dangerously ill the party were unable to thoroughly inspect the wealth and beauty which is treasured up in the house. The lower rooms, however, were thrown open for their inspection, and all gladly availed themselves of the privilege of looking over Mr. Cooke's exceptionally choice and varied museum of articles of vertu, curiosities of all kinds, and his splendid collection of paintings in oil and water-colours. Time would permit of only a hasty stroll through the grounds, but it was sufficient to give some idea of their remarkable beauty and picturesqueness. They owe this to the masses of Tunbridge Wells sandstone, beautiful in themselves, but rendered far more beautiful by the artistic manner in which they had been surrounded by ferns and other plants.

Driving back to the station, the party devoted the remaining time to inspecting the collection of West African weapons and instruments belonging to the Rev. Benjamin Whitelock, whose residence overlooks the line. Most of these were brought from Ashantee by Mr. Whitelock's son-in-law, Captain Malin, who is secretary to the Governor of Sierra Leone ; and sketches of which have appeared in the illustrated journals. At half-past four o'clock the party re-entered the train at Groombridge.

The return journey was broken at Lewes, where the party alighted and adjourned to the Star Hotel for dinner. The after-dinner proceedings were of a complimentary character, the manner in which the Society had been received by the Rev. Mr. Saint, Mr. Oswell, and the Rev. Mr. Whitelock being specially noticed in the speeches,—a vote of thanks being awarded them, as well as to Mr. Haselwood, the President, and to Messrs. Wonfor and Onions, the Honorary Secretaries. by whom the arrangements had been made and so ably carried out. The journey was resumed at ten minutes to nine o'clock, and Brighton reached at a quarter-past nine, everyone highly delighted with the very pleasant day which they had spent.

JULY 9TH.

ORDINARY MEETING.—MR. PANKHURST ON THE GEOLOGY OF DERBYSHIRE.

"When we looked on a Geological map and marked the many different tints which denoted the varied rocks of which our island was composed, we could the more readily understand the expression "England is the paradise of the geologist." In no tract of ground of equal size on the globe was there presented such an epitome of the long life-history of the world as the fundamental rocks of our own island presented to us. Almost every tablet of the great stony record found here to a greater or less degree its representative. To be familiar with the names and character of all the multitudinous fossils which the strata disclosed, was possible only to a few ; but it was given to all to take an intelligent interest in the rocks themselves ; to learn something of the substances which composed them, of the manner in which they were formed, their relation to the scenery to which they lent a character, and their influence on the plants which covered them. It was in this respect that he appeared before them as a geologist, "to this extent, no more." And yet from such study, by no means profound or difficult, so large an amount of pleasure was to be derived that he was induced to lay before them the manner in which it contributed to make a fortnight's holiday at Easter as instructive as it was delightful.

Standing on some dominant point and noting the ridges of hills ending in a steep escarpment, and the multitudinous windings of the valleys at their base, the mind naturally inquired what forces had worked to sculpture the earth into this variety of form. The action of water immediately suggested itself. The streams trickled along the valleys, but the cause, if they were the cause, was out of all proportion to the effect. But the streams of to-day were but the ghosts of their former selves, and the hills but the degenerate successors of the primeval mountains. To solve the problem we must look to the action of larger and more impetuous rivers than our island afforded. He had represented on a diagram the lesson which Professor Ramsay said he learnt from studying the Moselle. A stream commenced its course on a high table-land; *a table-land higher than the present summits of Derbyshire hills.* In process of time it dug for itself a trench. The natural slope of the land would initiate the direction in which its waters acted with greatest effect. Gradually, a high bank would be formed on the side on which the land sloped. In its rebound it would wash with force and in process of long centuries the banks would eventually become the steep escarpments of the hills. The course of the Seine, near Rouen, was a splendid example of such action. But the manner in which a table land could be cut up into ridges by the action of streams was illustrated in the most remarkable manner he had ever seen by a rivulet which fell into the sea near Redcar, on the coast of Yorkshire. There, in miniature, was a table-land being cut up as it were before the eyes into the very forms of hill-sides, escarpments, and valleys, which on a grander scale he had been lately admiring in Derbyshire.

This was not what gave to the scenery of Derbyshire its peculiar characteristic. That which most struck the tourist, was the strange fantastic forms in which the rocks were worn. On the summits the stony crests of the hills were weathered into castellated turrets, honey-combed as if they were made of sugar or salt, instead of hard stone. On the slopes of the hills they were sculptured into strange and fantastic forms, tapering spire and minaret, huge towers, bastions, and buttresses of rock that imitated as it were the ideas of the mediæval architect. It was the same more or less in all hilly limestone districts.

Chemistry afforded us the clue to this. On a small scale he could imitate Nature with this bottle and test tubes. The rain falling through the atmosphere absorbed the carbonic acid gas which was always present there. The water, thus become acid by the presence of this gas in it, exerted a much greater solvent power on the rocks. Their softer parts yielded to it the more easily, the harder ones remained, constituting the varied forms of which he had spoken. The experiment would also illustrate the deposition of lime by the dropping wells which were among the curiosities of Matlock. As the carbonic acid evaporated, the stony matter which the water held in solution by virtue of the presence of the gas in it was precipitated. Thus the tufa was formed also, which constituted large beds in the neighbourhood of these streams of acidified water. Of such masses of water-deposited rock Rome itself was built. But the action of carbonic acid was one of the most potent forces at work in disintegrating the surface of the land. Filter, for instance, the mud from the waters of the Thames, and the limpid clear liquid that remained still held in solution a large quantity of matter dissolved in it. In this way that river carried down to the sea, according to Ramsay, 300,000 tons of carbonate of lime every year. Thirty million tons were thus dissolved out of the valley of the Thames every century by the chemical action of the stream.

A section of the High Tor at Matlock afforded a good example of the character of the mountain limestone in the neighbourhood. That the mountain limestone was of marine origin all were aware. The presence of corals, spirifers, terebratulæ, were abundant proof of this. But there were some peculiarities which were interesting. He had imagined that chert flints, for instance, were peculiar to the chalk. But, on the summit of the High Tor, was the familar face of the black flint nodules and the white chert. The silicious matter existed in the ocean beds of those primeval times as in the latter ones of our chalk. Before them on the table were some specimens of what the miners termed toad-stone. Its murky dismal colours, interspersed with spots, had doubtless acquired for it such a name, and yet it was the most interesting of this series of rocks. The curved lines of the strata in the High Tor told their tale of the enormous forces which upheaved and bent nearly double these vast masses of rock. Not the less had the toad-stone a history of its own, bearing witness to the intensity of the internal forces of the earth. It was the lava of an ancient volcano. Comparing it with a bit of modern lava, a porous mass, blown up into this form by the escaping steam and gases, it would be seen that in the toad-stone the holes were filled with a carbonate of lime. The molten mass was evidently poured out from the volcano on to dry land ; thus it became a porous lava, for steam and gases could easily escape from it. Again the surface of the earth sunk, the waters of the limy oceans covered it, and deposited in its interstices the white masses which gave it its singular spotted appearance. Such was the history of a piece of toad-stone.

The presence of the metals and their ores in veins through the rocks was still one of the most interesting and the profoundest subjects of geology. In how far heat, magnetism, electricity, &c., were concerned in producing ores, or in giving a direction to them, was still problematical. But what particularly struck him with regard to the metalliferous veins of Derbyshire was that they were all perpendicular to the horizon and obviously deposited in chinks of the rocks from a liquid solution containing them. They, as much as the carbonate of lime, were the results of infiltration. Take a mass of sulphate of barytes, which thus filled up a crack, and in the centre of the barytes were the glittering crystals of sulphide of lead. The rocks and metals of Derbyshire, which built up its limestone hills, were beautiful indeed, but not the less were they a subject of wonder, when they linked those solid masses in their ideas with the singular delicacy of the stems of the Encrinites which formed them, waving their feathery arms in countless myriads on the floor of the primeval ocean, and building with their remains the most romantic, the most lovely, of all our English hills. Between this Mountain Limestone and the coal-bearing strata, lay a vast series of sandstone rocks, in some places 1,000 feet thick. This yellowish sandstone capped the hills in the neighbourhood of Matlock, and stretched away in enormous masses towards the hilly district of the Peak. These limestone and sandstone hills were inferior to the Carboniferous strata, but all up through them Nature was, as it were, trying her 'prentice hand at producing the wealth of vegetation which followed. That limestone had in it masses of our black diamonds, strangely mixed with the glittering crystals of calcite.

The ripple marks on millstone grit told a tale of a shallow sea bed alternately dried by the sun and washed by muddy waters. The leaves and fronds which were plentifully interspersed in its layers, spoke of overhanging banks covered with the plants which found at last a resting place in its quiet waters. A vast inland sea perchance it was, the uplifted bed of which now stretched in almost unbroken line from Derbyshire to Northumberland. That ancient sea-bed, now lifted high into tors, fells, peaks, and moors, formed the "back-bone" of England; the great central water-shed from which flowed the streams on each side of it, either into the Irish Sea or German Ocean. Looking into the substance of the millstone grit, its small smooth fragments of rolled quartz, its glittering spangles of mica, with the felspar between all, told of vast mountains of granite, which must have been broken up in order to form it. Were the Cheviots once 60,000 feet high, as Ramsay told us the Scotch mountains were? or had the Cumberland hills lost some five miles in perpendicular height, as the Mendips had? He would not pretend to say; but, gazing at these enormous masses of sandstone, which must have been brought as sediment by in-pouring rivers and deposited along the bottom of some great sea, the mind was oppressed with a sense either of the vast forces which must have been once at work, or of the long eternities through which smaller ones must have persisted. Here imagination might find ample scope for its powers, and a "use" also which should be, in the best sense of the word, "scientific."

The PRESIDENT (Mr. Haselwood), in proposing a vote of thanks, said that personally he had felt deeply interested in the lecture, for in his youth he went over all the district on foot, seeing the wonderful rock, valleys, and everything, but he had not the scientific knowledge to appreciate it.

Mr. WONFOR said that Derbyshire was the first ground on which he studied the subject of geology; and on first looking at the place he was under the impression that he was looking at castles, towers, and ruins. On arriving he went out at night, and on going indoors expressed his intention of going to look at an old ruined abbey; but in the morning he found that what he had supposed to be ruins was castellated rock. As regarded the formation of tufa, which was still going on, it was much more rapid than people generally thought; and some of the arguments in favour of the great antiquity of certain cave deposits, left out of consideration the fact that drainage and cultivation had diverted the water bearing the stalactitic deposit; hence in those places the comparative modern slowness of deposit. The mountain limestone of Derbyshire, the chalk downs of Sussex, and the bed of the Atlantic Ocean all represented the same kind of organic formation, while the clefts in chalk corresponded with the caves of the mountain limestone.

Mr. HOWELL thought the so-called flint in one of the specimens produced was more like the chert which they met with in Sussex. Though not in his opinion flint, it helped to bear out the analogy traced by Mr. Wonfor.

The paper was illustrated by maps, drawings, photographs, and specimens, and by chemical experiments, showing the action of carbonic gas on lime, &c.

JULY 23RD.

MICROSCOPICAL MEETING.—MR. T. W. WONFOR ON THE HAIRS OF CATERPILLARS.

If either works on the microscope or on entymology were consulted, very little, if any, information could be obtained on the hairs of caterpillars or larvæ, either as regarded their structure or the variety and beauty of their forms ; but here and there a few words might be found upon the urticating or stinging properties of the hairs of some caterpillars.

This urticating property was noticed in very early days, for according to Pliny,* the Cornelian law, *De Sicariis*, was extended to those persons who administered the hairs of the fir moth, *Cn. Pityocampa*, and which were supposed to be a very deleterious poison. Even when applied externally they occasioned a very intense degree of pain, itching, fever, and restlessness.

Occasionally allusion was made to other members of the same family, as possessing similar disagreeable effects, viz., *Cn. pinivora*, stone pine moth, and *Cn. processionea*, the processionary moth, the last named so called on account of the habits of the larvæ, when moving in the evening in search of their food. One caterpillar led

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* Hist. Nat., I., xxxviii., cap. 9.

the way, followed for some two feet by single caterpillars in Indian file, then came ranks in twos, succeeded, at about the same distance, by threes, fours, fives, &c., until the main body advanced twenty abreast, in so orderly and compact a manner that no human army could move with greater regularity or be more obedient to the word of command. As soon as the leading caterpillar stopped, the whole army halted ; when he advanced, they advanced, until a fresh pasturage had been found, then they all dispersed, until some signal called them all together again.

Woe betide the luckless individual who approached them while on the march, or incautiously handled them, for the tufts of short hairs, with which they were covered, possessed the power of producing an inflammatory irritation, worse even than the sting of a nettle. It is reported that in some cases, where persons have been stung severely, serious and sometimes fatal illnesses have resulted.

Not only when living, but even when dead, the hairs of this caterpillar possessed the same urticating properties. Thus Reamur, who had written a monograph on this moth, stated that he suffered, after handling the dead caterpillar, for days with an itching, in consequence of some of the short stiff hairs sticking in his skin, and being, at first, ignorant of the cause, and rubbing his eyes with his hands he brought on such a swelling of the eyelids that he could scarcely open them. Bonnet, too, who lifted some of these caterpillars from water in which they had been drowned, felt a numbness of the fingers, followed by an itching and burning sensation.

Fortunately or unfortunately, he had not come across this caterpillar, which abounded in France, and in 1865 was the cause of so much annoyance to promenaders in the neigbourhood of Paris that parts of the Bois de Boulogne were closed to prevent discomfort to those who incautiously approached the trees, where the larvæ were, so that he only knew the hairs from published drawings of them.

We had in this country several caterpillars, whose hairs produced the same or similar effects with some people, and as these hairs presented, microscopically, diversity of form he would specially direct attention to them. Among the most notable were *L. quercifolia*, the lappet ; *O. Potatoria*, the drinker ; *B. neustria*, the lackey ; *B. quercus*, oak eggar ; *E. lanestris*, small eggar ; *O. pudibunda*, hop dog ; *O. antiqua*, vapourer ; *L. dispar*, the gipsy ; *L. salicis*, the satin ;

L. auriflua and *L. chrysorrhœa*, gold and brown tails ; together with *C. caja*, and *C. villica*, the garden and the cream spot tiger. All these with some persons produced, when handled, either in the living or dead state, itching, inflammation, and swelling of the parts affected for days.

There was one very extraordinary fact connected with these hairs, viz., that while some were affected even if only the fingers touched the hairs, others could handle some with impunity, and could not come near others without experiencing discomfort. He had known cases where even the most careful handling of the brown tail had caused pain, and the person so affected, incautiously like Reamur, rubbing the face, could scarcely see out of his eyes for days after. When the hairs of this caterpillar were examined under the microscope the wonder ceased, as it would be seen they were admirably adapted to penetrate, whichever end touched the skin, while the jagged portion, barbed like an arrow, remained firmly fixed in the wound.

The typical form of hair among caterpillars was cylindrical and terminating in a sharp point ; the hair itself being composed of the same chitonous substance as the skin of the animal, generally hollow and lined with a substance, which seemed to resemble *cutis*. Many, if not all, hairs, in the living state, contained fluid matter, possibly of the same nature as the circulatory fluid of the animal. Instead of springing from a bulb, as in mammals, the base of the hair was inserted in a socket, a ring-shaped projection, from which the hair easily parted company. Examples of simple hairs of this character might be obtained from the larvæ of the oak eggar and lappet, both of which irritated some persons. The larvæ in each case utilized their hairs in forming their cocoons, as was often painfully evident to some, when handling them. A member of his family could not touch a cocoon of the oak eggar, however old it might be, without annoyance, while he could handle them with impunity.

In the case of the garden tiger, hop dog, and some others, the hairs are deeply spinous from point to base. In the satin, sycamore tussock, and some others, the spines were thickly studded along the whole hair. In the case of the gipsy, the drinker, and the lackey, all of which, and especially the last named, punished some very severely, the hairs were very fine and beset throughout their length by very minute spines. In the brown tail, among longer spinous hairs, were immense numbers of very minute ones jointed throughout their length, and readily separating into barbs sharply pointed at one end and trifid at the other. These hairs parted from the caterpillar so readily that persons looking at them, while they were feeding, had felt annoyance, as though the mere movement of the caterpillar separated the hairs, which, like those of the processionary moth, were wafted by the wind. Some very peculiar hairs were found on the vapourer, knobbed and plumed at the end ; a similar, but more extensive, knob was seen on the hairs of a South American caterpillar. The hairs on the tortoiseshell and other Vanessidæ were very stout and jointed, while those from the white-plume moth caterpillar were imbricated and had somewhat the appearance of wool. Sufficient had been said to show there was such variety and beauty among caterpillar hairs as to recommend them to the notice of microscopists, who had simply studied, as far as he could gather, those from the larvæ of Dermestes and the pencil tail, which were well known as test objects of great beauty.

A question might arise—Whence the urticating power? In the hair alone, or some irritating substance within the hair? He inclined to the former, because hairs from cast skins kept for years, and from cocoons two or three years old, were equally urticating with those from a living caterpillar, as were also the hairs mingled with the webs spun by some of the sociable larvæ. He looked upon it as a merely mechanical action, similar to that produced by the hairs of the prickly pear, those from the interior of the fruit of the wild rose or *Cowage*, *Dolichos urens*, all of which were equally productive of irritation, inflammation, and feverishness.

To make out their structure caterpillar hairs should be mounted dry, in fluid and in balsam. Anyone turning his attention to them and not minding the risk of an occasional annoyance would be well rewarded for his *pains*, and possibly wonder why more attention had not been paid by microscopists to so interesting and instructive a class of objects. He could only account for the apparent neglect on the ground that few entomologists worked with the microscope, and that microscopists generally had thought the hairs of all caterpillars alike, whereas, as with the scales of the lepidoptera, so with the hairs of their larvæ, there was great variety of form and markings.

Finding so little said about them, and having, moreover, worked at them for some years, he considered the subject of sufficient interest to bring before the Society, with the hope that some members might be induced to carry it further than he had done at present, and to show to lepidopterists that there was much in the economy and physiology of their branch of study worthy of being critically examined.

Mr. WONFOR rendered the subject more attractive by availing himself of chalk and a black board in order the better to illustrate many of his remarks.

In the discussion that ensued, the PRESIDENT (Mr. Haselwood) asked, if the irritation caused by the hairs were merely mechanical, how it was that all persons were not equally affected by it? He suggested that the irritation could hardly be caused by mechanical action, but was rather the result of a poison communicated in a fluid state.

Mr. WONFOR, in support of his theory, that the pain was caused by the sharp point of the hair, repeated what he had stated with regard to the dried hairs found in old cocoons still retaining their urticating properties.

A suggestion having been made in support of the PRESIDENT'S view, to the effect that the dried fluid in the hairs of old cocoons might become liquified by the blood or even perspiration, Mr. Wonfor said the sting-nettle, the irritation caused by which was known to be a fluid, did not affect all alike ; and he remembered also that he had experienced similar pains from the points of sponges, which had been boiled in acids and so thoroughly well-washed that it was almost impossible for any fluid to remain in them.

Regarding the destructiveness of caterpillars, Mr. C. F. DENNET alluded to the ravages which were made by one species among the cotton crops in the Southern States of America. He thought that Mr. Wonfor deserved great credit for the attention which he had given to a matter so interesting and important, though regarded as being otherwise by many people. In reply to this gentleman,

Mr. WONFOR subsequently explained that caterpillars changed their skin several times, and that they were devoured by certain birds, such as sparrows. A hint that the irritating properties of the hairs of these animals might be protective, was thrown out by the Chairman. Mr. Wonfor remarked that since, according to Kirby, small doses of the hairs might be beneficial in the case of intestinal worms, the caterpillars might serve as medicine to those birds which ate them. Anyhow the hairs were not protective against some birds, and other enemies of the caterpillars—the ichneumon fly, for instance.

As regarded the mechanical or fluid action of the hairs, it was considered by Mr. Scott that they should not call upon Mr. Wonfor to name some irritating fluid, when he had given so many irritating *points* (laughter).

Mr. WONFOR said that he should like some chemist to take charge of a few caterpillars in order to examine them, and ascertain whether or not there was an irritating fluid. He would certainly be rewarded for his *pains* (laughter). In reply to Mr. F. E. Sawyer, Mr. Wonfor explained that hairs came from off the body of the caterpillar without being touched.

The meeting then became a conversazione, when hairs of the caterpillars alluded to, with papers, and others, were exhibited by the President, Messrs. Wonfor, R. Glaisyer, Puttick, and F. E. Sawyer.

AUGUST 13TH.

ORDINARY MEETING.—MR. H. PRATT ON COGGIA'S COMET.

After referring to the early observation of comets, which had been found even in the Chinese annals ; to their almost infinite number,—Kepler declaring that the ocean was not fuller of fishes than the œther of comets ; and to the existence, as demonstrated by mathematical astronomy, of a connection between comets and the various meteor streams ; attention was drawn to the various theories as to the office of comets : namely, that they restored to the planets the electrical equilibrium which they, in turn, continually displaced ; that they might deluge a world with water or melt it with heat, or drive our earth from her orbit or set a star on fire.

None of these hypotheses had been established, and even the nomenclature of the comet was very imperfectly settled. There was an increased interest awaiting the visit of a comet, owing to the facilities which the spectroscope furnished for ascertaining their physical nature. The first application of the spectroscope to a comet was made by Mr. Huggins in 1866, and again in 1867 and 1868, but not of such a satisfactory character as to diminish the interest with which the announcement was received of the discovery, on the 17th of April, by a Marseilles observer (M. Coggia), of a comet, the orbit of which was determined by Mr. Hind, who was of opinion that the comet could not have visited our system for many centuries ; its curve was elliptical ; the period of revolution of such length as to be uncertain ; the semi-axis major rather more than 430 times the earth's mean distance from the sun ; and the corresponding length of revolution nearly 9,000 years. By the 23rd June the comet became easily visible to the eye, with a tail of about one degree in length. On the 1st July the tail had increased to fully 1.5 degrees ; on 4th July to 3.5 degrees ; and on 6th July to five degrees, in two streams, divided by a darker space ; on 7th July to seven degrees. Stars were seen distinctly through the comet, and on the 7th a small star was easily seen through its brightest portion. On the 8th July the tail measured ten degrees, and the nucleus scintillated almost like a star, arising, perhaps, from unsteadiness in our own atmosphere. By 10th July the tail was more than ten degrees, and its sides were of equal brightness.

On the 14th July he observed the comet from Dr. Prince's Observatory, near Uckfield. Its tail was then between 25 and 26 degrees, and the whole comet much increased in brilliancy. The sector, in close contact wlth the nucleus, was only to be distinguished from it by the superior brilliancy of the planet-like disc, there being no dark space between the nucleus and the sector. The ends of the sector were deflected on each side, and connected by streaks of light with the tail ; while parallel to these streaks and outside of them were others running towards the head, where they merged into a luminous hazy arc of light surrounding the sector at a short distance from it ; and, as far as could been seen, unconnected with it. This arc of light was what was termed an envelope—and a conspicuous one. Behind the nucleus, and commencing close to it, was a dark space, in form symmetrical with the outline of the comet, and traceable for some distance ; it was suffused with a hazy luminosity and merged into the general undefined light of the tail. On the 14th July, when he saw the comet for the last time, its tail seemed to be fully thirty degrees long, and Mr. Hind had given its length on the 19th July as 43.5 degrees, or an actual length of 25,000,000 miles.

The spectroscopic analysis of its light was very important. On the 14th July, with the kind assistanee of Dr. Prince, he attached his automatic spectroscope to that gentleman's telescope, and was enabled to see the spectrum of the different portions of the comet near the nucleus, and to measure the position of the bands observed. The tail exhibited a faint continuous spectrum as a background, with two bright lines, or rather diffused bands, lying across it, each of them fading off more abruptly on the red side. He might have overlooked a third and fainter one, which had been seen by Dr. Huggins, but not by Mr. Christie, first assistant at Greenwich Observatory. Immediately noting the readings of the micrometer of his spectroscope for the position of the bands he had observed, he waited with some impatience to compare them with measures of lines of some of the elements. Several months previously, he had entered in his notebook measures of all the lines visible in the flame spectrum of carbon, and he now found two of these lines coincide with the brightest parts of the two bands of the comet's spectrum. The lines were situated, the one in the olive group half-way between D and E; the other in the green group between E and F, and both occupied the second place in their respective groups, reckoning from the red end. This would give a high probability that the lines in the spectrum of the comet were due to the presence of carbon in the state of vapour, in agreement with the announcements of Messrs. Huggins, Secchi, and Christie. But it was important to keep in mind that greater certainty in the matter would be attainable could the comet's spectrum of bands be reduced to one of lines. Hitherto no one had announced that he had been able to do this. The spectrum of the coma was similar to that of the tail. The sector and the envelope gave spectra of a different order, being continuous, and suggesting the presence of incandescent solids, or the reflection of light from such.

The most conspicuous part of the comet's spectrum was that of the nucleus, which was bright and continuous, giving, as far as he could observe, no bright lines or bands. He saw it fade off gradually, but completely, before reaching the blue rays, and that at the red end there was a sudden diminution of its brightness, after which it could be traced for some distance, as if the red end was crossed by absorption bands, and that the light was too much weakened to render them clearly visible as bands. He placed the micrometer on the sudden beginning of the partially-absorbed rays, and at once saw it was close to D on the less refrangible side, and, in order to make assurance double sure, he passed the light from a candle through the spectroscope, and saw the bright sodium lines very near to the cross.

Subsequently, Mr. Christie, of the Greenwich Observatory, had announced his own observation of the partial covering up of the red end of the spectrum by absorption bands, and the distribution of similar ones over other parts of the continuous spectrum, but that he could not fix their position. D'Arrest and Huggins had also seen them. Mr. Lockyer remarked that the blue rays were absent. So the testimony of different astronomers respecting absorption bands in the spectrum of the nucleus amply confirmed what he observed under greater difficulties.

There were but few records as to the colour of the light of comets. Lockyer observed that the nucleus and head of their late visitor were orange-yellow. With different telescopes, he had noticed that the nucleus was a brilliant white, very slightly tinted with yellow, and the coma very delicately tinted with bluish-green. It appeared to him that the spectroscope was the best umpire in such matters. And it was well-attested that the brightest band of the spectrum of the coma was the green one, while the brightest part of the continuous spectrum of the nucleus was between the yellow and the green, from which one would infer a whitish light just tinted with yellow ; and, as the rays on the red side of D were absorbed, they should not expect the light of the combined rays remaining to be orange.

There yet remained unanswered a question of great interest. Was the light of comets their own light, or was it reflected from another source? The first part was answered in the affirmative by the spectroscope, for, in respect of the band spectrum, doubtless its source must be in the comet itself. But as to the continuous spectrum the reply had yet to come. The polariscope, in the hands of Messrs. Huggins, Christie, Ranyard, and others, gave an unanimous verdict that a part of the comet's light was reflected light. Huggins had estimated its proportion at one-sixth. But reflected from what? In connection with this question, Mr. Hind's recent remark was of great value. He had said that the impossibility of seeing the late comet by day, even in the most powerful telescopes, had afforded additional evidence that proximity to the earth is not so important a condition for visibility of a comet in the daytime as close approach to the sun.

Two more comets had been discovered since that of Coggia, one of which was in our vicinity at the time of the solar eclipse on December 12th, 1871, and the outlines of which had been depicted, faintly but persistently, upon several photographs of that eclipse, taken at three different stations widely separated from each other. If, as there was every probability, this was a large comet between us and the sun—very near the latter, and making its presence known by stopping out a portion of the solar picture—then this was indeed one of the most remarkable discoveries in cometary history.

Mr. DENNANT, in moving a vote of thanks to Mr. Pratt, pointed out the benefit accruing from a gentleman devoting his attention to one particular branch of science.

The motion was seconded by Mr. W. M. HOLLIS, and carried by acclamation.

Mr. PANKHURST wished to know whether the growth of the comet, observed by Mr. Pratt, was a real one or not, and also whether the growth was continuous ?

Mr. FRANCIS PHILLIPS suggested that, as the parabola might be considered as a limiting form of the ellipse, it was just possible that those comets which are said to have parabolic orbits might really (like the planets) move in ellipses, but of such a form that they could not, from our present observations, be distinguished from parabolas.

Mr. B. LOMAX favoured the elliptical theory.

Mr. PAYNE said, if the movement was parabolic, the comets could not return.

Mr. PHILLIPS explained. The question he submitted was, whether the comets said to move in parabolas might not move in ellipses approximating to the parabolic form, in which case they would return, but after a time which might practically be considered infinite.

The Rev. J. H. CROSS thought, as it was evident that light was given from the comet, heat must also be given,—he considered, to a large amount.

Dr. HALLIFAX recollected that, at the appearance of the comet in 1811, the heat was unprecedented.

The Rev. J. H. CROSS pointed out that the carbon lines would indicate the probability of heat being given forth.

Mr. G. SCOTT thought that the nebulous condition of a comet, added to its gradual absorption, would lead to the conclusion that heat was given off.

In reply to Mr. Pankhurst, Mr. PRATT said the real diameter of the nucleus of the comet was 3,700 miles.

Mr. PANKHURST thought, then, that the comet being 430 times further distant from the earth than the sun, it could hardly affect the earth's atmosphere.

Mr. SHELTON said, as it had been calculated that, before some comets returned to our system, 102,000 years must elapse, it showed that the ellipse must be a very eccentric one indeed. He thought comets' motions were greatly influenced by the planetary system.

Mr. PAYNE believed that the increased heat of a summer when a comet appeared was only supposititious, the recollection of a warm summer being impressed upon persons by the fact of a comet being visible in such year.

Mr. B. LOMAX thought that almost everything was put down to comets. He had seen a severe frost attributed to one. (A laugh.)

Mr. PRATT quoted instances to show that the actinic influence of a comet was small, for it made scarcely any impression on a photographer's plate.

AUGUST 27TH.

MICROSCOPICAL MEETING.—"GNATS OR MOSQUITOS?" AN ENTOMOLOGICAL DISCUSSION.

An abstract of the previous meeting having been read, Mr. G. D. SAWYER related a circumstance which he noticed about forty years ago, viz., a wall in the Ditchling Road nearly covered with chrysalides.

Mr. T. W. WONFOR explained that it was familiar to entomologists that some caterpillars did select certain places in which to pass into the chrysalis state; and sometimes when they did so they were not in their natural condition, but were very often ichneumoned.

Mr. C. F. DENNET took occasion to pass a very high compliment upon Mr. Wonfor for the lucid way in which he had placed the hairs of caterpillars before the Society at their last meeting. He also incidentally referred to the fact of the paper having been reported, and mentioned that he had availed himself of this means to send a copy of it to a friend—an entomologist of no mean order—who had since cordially thanked him for calling his attention to a matter which had hitherto escaped his notice, but which had been dealt with in such an interesting and masterly style by Mr. Wonfor.

Mr. WONFOR then introduced the question, "Gnats or Mosquitos"—a subject which was creating some interest in London and elsewhere. That afternoon his wife read a paragraph in one of the papers about a visitation of mosquitos on Plumstead Marshes. In 1868, the good people of Plumstead Marshes, Woolwich, and Portsea, near Portsmouth, in a similar way cried out terribly about a visitation of mosquitos, and exactly the same misrepresentations concerning the visitors appeared in the public press then as now. He thought, under these circumstances, he might set some of those outside right in regard to the creature that had been stinging them. It was undoubtedly the English mosquito, and it was not a creature that had come over from the East Indies or South America, either in the egg or larval state, on the sails of ships. The life-history of the creature would prove that it was nothing more nor less than one of the twenty or twenty-five English gnats that we possessed.

The insect in the larval and chrysalis state lived in the water, and the only period of its life passed in the air was as the perfect insect, the gnat or the mosquito. They would, therefore, see how impossible it was for a mosquito of South America, spending nineteen-twentieths of its existence in the water, to come over in the larval state, on the sail of a ship, especially when it was stated that few gnats lived longer than a week. It seemed that, whenever we had a very hot summer, the bloodthirsty instinct of the female English gnat, or mosquito, was intensified, so that it was led to attack man with far greater vigour than in an ordinary summer. When they considered the millions of gnats that were to be seen flying over a large river just as they had escaped from the pupal state, it was not to be wondered at that such places as Plumstead Marshes and Portsea, having large expanses of water near them, should be largely visited by these insects. Specimens of the Plumstead or Portsea mosquito sent to him by friends were found to be identical with the *culex pipiens*, or ordinary English gnat. These insects could produce a shrill sound ; but he believed imagination often made people believe in its similarity to that of the American mosquito. They were capable of giving very intolerable pain, as one of his own family had experienced a few days since when at Dorking. An insect came flying in at his bedroom window, and he identified it as the cause of his annoyance. It was the same as the Portsea mosquito, identical with our English gnat, and nothing more nor less than the *culex pipiens.* The insect inserted its six or seven lancets into the flesh and pumped out the blood, thus causing the pain and irritation experienced from it. Fearing he should not be able to show them the seven lancets which each insect was said to possess, he had brought a specimen of the gadfly, or *tabanus*, which also had stinging properties.

The plumed antennæ and the scales of gnats were favourite objects with microscopists, these together with English gnats and so-called mosquitos from Portsea and Plumstead he would exhibit so that they might see they were indentical insects.

Dr. HALLIFAX mentioned that he had, that very day, been stung while writing by a gadfly, and that the puncture produced was for a time very painful. The insect which attacked him was of about the size of the common house fly, though of the same species as that which caused so much trouble to horses and cattle in the meadows. In reply to Dr. Hallifax, Mr. WONFOR said that the life history of the Indian mosquito and of the English gnat was the same; the mosquito being to all intents and purposes a gnat. A case of recent mosquito stinging having been mentioned, and the pain having been described as severe, Mr. DENNET said it was a singular fact that, if the insect had been allowed to drink the blood to repletion, no pain would have been felt. Mr. G. D. SAWYER confirmed this statement, remarking that it seemed to be the driving away of the mosquito that caused it to sting.

Mr. WONFOR incidentally mentioned that the gnats or mosquitos did good, inasmuch as they purified the water in which they might be deposited by eating up garbage and decayed vegetable matter. Therefore while they found fault with them, they could not wonder at the enormous number of them in such places as Plumstead Marshes, the banks of the Mississippi, and the swamps of North America or the West Indies.

Mr. HENNAH then raised the question whether the irritation produced by mosquitos and such insects was caused by extraneous or other poison. As to the stinging properties of gnats, he thought it probable that the irritation they caused resulted from their lancets retaining and imparting poison received from their last meal. Flies which had been in a dissecting-room and afterwards bitten persons, had been known to cause gangrene of the part attacked. There was another thing, though not exactly microscopical, which he might then mention. It was the way in which the mosquitos were kept away from the dinner table in some districts of North America; blocks of ice were placed on the centre of the table and the mosquitos would not approach within a considerable distance of them.

It was suggested by Mr. LOMAX, that living as well as dead specimens of insects should be placed under the microscope at their meetings for the benefit of those members who had not microscopes of their own; but he was informed by Mr. Wonfor that live specimens had been shown two or three times, and would be again.

At the same time, it was observed by Mr. HENNAH, that living specimens could not be examined or even shown with advantage to members who did not previously know anything about them.

It was announced that Mr Brazenor had sent for distribution amongst the members :—The lower jaw of a rock python, the barb of a sting ray, scales of the armadillo, quills of the Brazilian porcupine, a skin of an English snake, and scales of the river crocodile.

The meeting then became a conversazione, when the President (Mr Haselwood), and Messrs. Wonfor and Sawyer exhibited objects illustrative of the discussion, including gnats, tabanus, and preparations of the organs of these insects.

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Willett, H.
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Examined and found correct,—

GEO. D. SAWYER, }
ROBERT GLAISYER, } Auditors.