the whole of the great marsh to the south is flooded up to Chitambo. The level at that time was made out to be 3750 feet, about 250 feet lower than Livingstone's estimate. After a rest for recovering health the expedition followed the Luapula eastward through fertile country, and leaving it where the curve from the north occurs, struck across for the Kafue, but small-pox reappeared, the land was ravaged by half-caste Portuguese slave-raiders, Mr. Thomson himself fell ill, and the course had to be changed to the south with the hope of turning west again. But matters got worse instead of better, and after touching the borders of Manica, a return had to be made to Lake Nyassa, along the southern margin of the plateau, through deep valleys, and climbing the steep slopes of the Muchinga Mountains, here separated by the great parallel valley of the Lukosashe from the plateau. All the way the land was seen to be of immense possibilities for cultivation, but neglected, and inhabited by a wretched people governed by Mpeseni, himself the vilest of them all. Kotakota on the lake was reached again on January 4th, 1891, after a total journey of 1200 miles, which resulted in many important rectifications of position and much information as to the future possibilities of the plateaux.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—Dr. Hobson, late deputy Lowndean Professor, has been elected a representative of the Mathematical Board on the General Board of Studies.

Plans for a handsome building to serve as the Sedgwick Memorial Museum of Geology have been submitted to the Senate, the estimated cost being £26,000. Four members of the Syndicate appointed to prepare the plans dissent from the report of the majority, chiefly on the ground that the internal arrangements are unsatisfactory, and that the cost, initial and annual, of the proposed building will be excessive. The divergent views held on the subject will be discussed by the Senate on Saturday, December 3.

The Senate have agreed to confer on Sir R. S. Ball, the new Lowndean Professor, the complete degree of M.A., *honoris causa*.

SOCIETIES AND ACADEMIES.

LONDON.

Physical Society, November 11.—Mr. Walter Baily, M.A., Vice-President, in the chair.—The discussion on Mr. Williams's paper, the dimensions of physical quantities, was resumed by Dr. Burton. He remarked that the idea that so-called "specific quantities," such as specific gravity, are pure numbers was an erroneous one, and liable to lead to difficulties. The specific gravity of a substance was of the nature of density, and was only a simple number on the convention that the density of water was taken as unity. If dimensions be given to specific quantities their interpretation would, he thought, be easy when the rational dimensional formulæ were found. Referring to Prof. Fitzgerald's comments, he said, although the contention that all energy is ultimately kinetic could not be gainsaid, the distinction commonly drawn between kinetic and potential energy involved nothing contrary to this view, and was useful and convenient in many cases. As to the dimensions of μ and k he was inclined to favour Mr. Williams's views, for several considerations suggest that the two capacities of the medium are essentially different. Arguments to show that μ was probably absolutely constant in the ether, whilst k might be variable, were brought forward. Of the two systems of dimensions for μ and k suggested by Mr. Williams, that which made μ a density seemed preferable.—Prof. A. Lodge said he was greatly interested in propagating the idea that physical quantities are concrete, and therefore welcomed Mr. Williams's paper. He thought it desirable to keep some names for abstract numbers, and "specific gravity" should be one. If another name involving dimensions was required "specific weight," or "weight per unit volume," might be used. Speaking of the dimensions of the various terms of an equation he did not think it was usually recognized that in ordinary algebra or Cartesian geometry the principle of directed terms was rigidly adhered to, for if directed at all every term of such an equation was directed along the same line. In this respect ordinary algebra was more rigid than vector algebra. Even if circular functions were involved, as in polar co-ordinates, they had the effect of making the directions of the terms the same. Other instances of problems bringing out the same fact were mentioned. Mr. Boys thought Mr. Madden had been arguing in a circle when he spoke of the astronomical unit of mass, and deduced the dimensions of mass as L^3/T^2 from the equation $MLT^{-2} = M^2/L^2$, for it was quite impossible that this equation could be true unless γ, the gravitation constant, was introduced on the right-hand side. Mr. Williams's method was quite the reverse, for he maintained that unless k and μ were introduced in the dimensions of electric and magnetic quantities, their dimensional formulæ could not indicate the true nature of those quantities, and hence were open to objection. Mr. W. Baily, whilst agreeing with Mr. Williams on most essential points, thought the total omission of L from dimensional formulæ made the expressions more complicated and less symmetrical. For example, such expressions as XY/Z, X^2 and XYZ, which respectively represent undirected length, area, and volume, might with advantage be written L, L^2, and L^3 respectively. The restriction of the dimensions of μ and k to those which give interpretable dimensional formulæ for electrical and magnetic quantities seemed scarcely justified. Both the systems proposed could not be right, and he thought it would be more in accordance with our present want of knowledge, if a quantity U of unknown dimensions were introduced such that μ or $k = U^2$. density and k^{-1} or $\mu^{-1} = U^2$. rigidity. This would keep in view the fact that the absolute dimensions of quantities involving U were unknown. A list of the dimensions of the various quantities based on this arrangement was given. Mr. Swinburne, referring to the conventional nature of many units, said great differences exist between the ideas held by different persons about such units. Starting with the convention that unlike quantities could be multiplied together, he might have six ampères flowing in an electric circuit under a pressure of ten volts, and he might say he had sixty volt-ampères. The term "volt-ampère" could be regarded as indicating that the sixty was the numerical result of multiplying a number of volts by a number of ampères, or on the other hand it might be understood as a new unit, a *watt*, compounded of a volt and an ampère. Before Prof. Rücker's paper on suppressed dimensions was published, an electrician might have suggested measuring the length of a bench by sending an alternating current through it and determining its self-induction, which he regarded as a length. Prof. Rücker, however, would say that this could not give the right result, for μ must be taken into account. He was inclined to think that dimensions were liable to mislead. Referring to scientific writers as authorities, he said Maxwell had been careless in some cases, for he had sometimes given dimensional formulæ as zero, which really ought to have been $L^\circ M^\circ T^\circ$, or unity. In French text-books the errors had been corrected. Mr. Williams, in reply to Mr. Madden's remarks about self-induction being a length, pointed out that the subject might be looked at in two different ways, depending on whether one thinks of the *standard* of self-induction as the practical standard of measurement, or the *unit* of self-induction as a physical quantity. In the former case the *standard* was a length, but in the latter the *unit* was a quantity of the same *species* as self-induction, the nature of which was as yet unknown. If its dynamical nature was known, then the absolute dimensions of all other magnetic and electric quantities would also be determined. In answer to Prof. Fitzgerald's remarks he said it was hardly likely that he should be unacquainted with the common view that kinetic and potential energies were ultimately quantities of the same kind, for it was a view with which he was quite familiar. The fact that they have the same dimensions was sufficient to show their identity, and the idea that all energy is ultimately kinetic was fundamental to his paper. This, however, did not imply that electrification and magnetization are of necessity the same, and the suggestion that they may be the same was only one of several "probable suggestions," all of which were entitled to consideration. His chief reason for regarding Prof. Fitzgerald's suggestion as probably incorrect was that it led to a system of dimensional formulæ incapable of rational mechanical interpretation, and containing fractional powers of the fundamental units. Prof. Fitzgerald's system would make resistance an abstract number, and μ and k directed quantities, whereas the former was a concrete quantity and the two latter must be scalar in isotropic media. If he (Mr. Williams) had erred in treating electrification and magnetization as different phenomena he could only plead that he had

done nothing more than follow such authorities as Lord Kelvin, Dr. Lodge, and Mr. O. Heaviside in the matter.—The discussion on Mr. Sutherland's paper, on the laws of molecular force, was reopened by Prof. Perry reading a communication from the President, Prof. Fitzgerald. He objected to discontinuous theories, especially when Clausius had given a continuous formulæ much more accurate over a very long range than Mr. Sutherland's discontinuous ones. The introduction of Brownian motions without carefully estimating the rates required and energy represented, and without giving any dynamical explanation of their existence, was not satisfactory. It would, he said, be most interesting if Mr. Sutherland would calculate the law of variation of temperature with height of a column of convectionless gas, under conduction alone (for Maxwell thought the inverse fifth power law of molecular attraction was the only one that gave uniformity of temperature under these conditions), and if necessary make tests with solid bars. Referring to the statement that molecular attraction at one cm. was comparable with gravitation at the same distance, he thought Mr. Boys would question this, and he suggested an *experimentum crucis* of the inverse fourth power law. Both the inverse fourth and inverse fifth power laws, assumed symmetry which did not exist. He also took exception to other parts of the paper. Dr. Gladstone, referring to the relative dynic and refraction equivalents given in Table XXVIII. of the paper, said he thought it interesting to make a similar comparison between dynic and dispersion and magnetic rotation equivalents. The result as exhibited in a complete table showed a certain proportionality between the four columns but the differences were beyond the limits of experimental error. Mr. Sutherland, however, sometimes reckoned the dynic equivalent of hydrogen as 0·215, and at other times looked upon it as negligible. The analogies between the optical equivalents did not depend on the proportionality of the numbers so much as upon the fact that the refraction, dispersion, and magnetic rotation equivalents of a compound was the sum of the corresponding equivalents of its constituent atoms, modified to some extent by the way in which they were combined. Whilst a somewhat similar relation held true for the dynic equivalents, the effect of "double-linking" of carbon atoms, so evident in the optical properties, was scarcely perceptible. The result of calculating the constants from $M/$ instead of from $M^2/$ was next discussed, the effect of which was to quite upset the proportionality before noticeable. Mr. S. H. Burbury said that on referring to the author's original paper, on which the present one was based, he found that a uniform distribution of molecules was assumed. On this supposition the demonstrations given were quite correct, and the potential was a maximum. If, however, the molecules were in motion the average potential must be less than the maximum, and the deductions in the present paper being based on wrong assumptions were liable to error. Prof. Ramsay remarked that many statements in the paper, on the subject of critical points, were very doubtful. Separate equations for the different states of matter were not satisfactory, neither was the artificial division of substance into five classes. The predicted differences in the critical points due to capillarity, had not been found to exist. Speaking of the virial equation, he said that hitherto R had been taken as constant. Considerations he had recently made led him to believe that R was not constant. The whole question should be reconsidered regarding R as a variable. Mr. Macfarlane Gray said he had been working at subjects similar to those dealt with in Mr. Sutherland's paper, but from an opposite point of view, no attraction being supposed to exist between molecules. In the theoretical treatment of steam he found that no arbitrary constants were required, for all could be determined thermo-dynamically. The calculated results were in perfect accord with M. Cailletet's exhaustive experiments except at very high pressures, and even here, the theoretical volume was the mean between those obtained experimentally by Cailletet and Battelli respectively. Prof. Herschel pointed out that Villarçeau had discussed the equation of the virial, where the chemical and mechanical energies were not supposed to balance each other. Mr. Sutherland's paper all turns on the existence of such a balance, and he (Prof. Herschel) could not understand why this balancing was necessary. The discussion was then closed, and the meeting adjourned.

Geological Society, November 9.—W. H. Hudleston, F.R.S., President, in the chair.—The following communications were read:—A sketch of the geology of the iron, gold, and copper districts of Michigan, by Prof. M. E. Wadsworth. After an enumeration of the divisions of the azoic and palæozoic systems of the upper and lower peninsulas of Michigan, the author describes the mechanically and chemically formed azoic rocks, and those produced by igneous agency, adding a table which shows his scheme of classification of rocks, and explaining it. The divisions of the azoic system are then described in order, beginning with the oldest—the cascade formation, which consists of gneissose granites or gneisses, basic eruptives and schists, jaspilites and associated iron ores, and granites. The rock of the succeeding republic formation are given as nearly as possible in the order of their ages, commencing with the oldest:—Conglomerate, breccia and conglomeratic schist, quartzite, dolomite, jaspilite and associated iron ores, argillite and schist, granite and felsite, diabase, diorite and porodite, and porphyrite. The author gives a full account of the character, composition, and mode of occurrence of jaspilite, and discusses the origin of this rock and its associated ores, which he at one time considered eruptive; but new evidence discovered by the State Survey and the United States Survey leads him to believe that he will have to abandon that view entirely. In the newest azoic formation, the Holyoke formation, the following rocks are met with:—Conglomerate, breccia and conglomeratic schist, quartzite, dolomite, argillite, greywacke and schist, granite and felsite (?), diabase, diorite, porodite, peridotite, serpentine, and melaphyre or picrite. The conglomerates of the Holyoke formation contain numerous pebbles of the jaspilites of the underlying republic formation; a description of the Holyoke rocks is given, and special points in connexion with them are discussed. The author next treats of the chemical deposits of the azoic system, gives a provisional scheme of classification of ores, and discusses the origin of ore deposits. The rocks of the palæozoic system are next described, and it is maintained that the eastern sandstone of lower silurian age underlies the copper-bearing or Keweenawan rocks. The veins and copper deposits are described in detail, and the paper concludes with some miscellaneous analyses and descriptions, as well as a list of minerals found in Michigan. After the reading of this paper, the President noted that it presented three sets of questions of much importance, viz., those bearing on the archæan rocks, the iron deposits and jaspilites, and the copper and gold deposits respectively. As regards the classification of the archæan rocks, some might wonder what the terms used by the author meant. The words laurentian and huronian used in Canada seemed not to be tolerated in Michigan. The officers of the United States Geological Survey have described all the archæan formations noticed by the author; the cascade as the fundamental complex, the republic as the lower marquette, and the Holyoke as the upper marquette. Was each State of the Union going to divide these archæan rocks after its own fashion? With regard to the iron rocks, he would observe that the author, after enumerating all the views in favour of their volcanic origin, now admitted that he was wrong, and that Irving and others were correct. The most important question was how the iron ores were really formed, and to this it was difficult to find a complete answer in the paper. Sir Archibald Geikie remarked that it was hardly possible to criticize a voluminous paper of this nature, in the reading of which much of the detailed statement of facts was necessarily omitted. One of its most interesting points related to the nature and classification of the rocks intermediate between the base of the Cambrian system and the oldest or fundamental gneisses. The plan which Prof. Wadsworth followed of adopting local names for the several subdivisions of the series in each region was no doubt in the meantime of advantage, until some method of correlation and identification from region to region could be discovered. But it unavoidably led to temporary confusion, for the same rock-group might turn out to have received many different names. He thought it would be of service if geologists could agree upon some general term which would denote the whole of the sedimentary groups or systems which intervene between the old gneisses and the *Olenellus*-zone. Various names had been proposed, such as azoic, eozoic, proterozoic, algonkian, to each of which some objection may be raised. The existence of a number of very thick systems of sedimentary deposits between the base of the Cambrian formation and the gneisses was now well established in this country and in North America. In the upper members of this series fossils had been found, and it might eventually be possible to group the rocks by means of palæontological evidence. But in the meantime it would be convenient to class them under one general name which would clearly mark them off from the true archæan gneisses, &c., below them and the palæozoic rocks

above. Dr. Hicks congratulated Prof. Wadsworth on his important communication; but he strongly objected to the application of the term Silurian, instead of Cambrian, to the lower palæozoic rocks of America. Dr. Hicks did not think that the author had proved his case with regard to the Keweenawan rocks, and he was still inclined to believe that they would prove to be, as suggested by other American geologists, of pre-Cambrian age—the apparent superposition being due to over-thrust faults. The term eozoic, now that worm-tracks have been discovered in the pre-Cambrian rocks, is more correct than azoic for the sedimentary rocks of that age. Moreover, other organic remains will certainly be found, for it is inconceivable that ancestors of the forms comprising the rich fauna at the base of the Cambrian should not have been entombed in earlier rocks. Mr. H. Bauerman, considering the three hypotheses as to the origin of the iron ores—namely, dehydration of limonites in sandy beds, transformation from siderite, and the breaking-up of highly ferriferous igneous masses into quartz and hæmatite—thought that the first was the most likely, although there were certainly difficulties in connexion with it which made it desirable that the newer views upon the subject should be presented. He was therefore glad that they were likely to have a detailed exposition of the author's views in the journal. As regards the origin of the copper deposits, he believed that Dr. Wadsworth agreed with the views brought before the society several years since. In conclusion, he called attention to the gold deposits, which were of comparatively recent discovery, and interesting from the large number of minerals associated with the auriferous quartz veinstuff. Sir Lowthian Bell and Mr. Marr also spoke.—The gold quartz deposits of Pahang (Malay Peninsula), by H. M. Becher.—The Pambula gold-deposits, by F. D. Power.

Zoological Society, November 15.—Dr. A. Günther, F.R.S., Vice-President, in the chair.—The Secretary read a report on the additions that had been made to the Society's Menagerie during the month of October 1892, and called special attention to a very fine male Ostrich (*Struthio camelus*) presented by Her Majesty the Queen, and to a specimen of what appeared to be a new and undescribed Monkey of the genus *Cercopithecus*, obtained by Dr. Moloney at Chindi, on the Lower Zambesi, for which the name *Cercopithecus stairsi* was proposed. Attention was also called to the receipt of a series of specimens of mammals, birds, and reptiles, brought by Mr. Frank Finn, on his recent return from a zoological expedition to Zanzibar, and received from several correspondents of the Society at Zanzibar and Mombasa.—The Secretary exhibited (on behalf of Mr T. Ground) a specimen of the Siberian Pectoral Sandpiper (*Tringa acuminata*) killed in Norfolk.—Mr. G. A. Boulenger read a paper describing the remains of an extinct gigantic tortoise from Madagascar (*Testudo grandidieri*, Vaill.), based on specimens obtained in caves in South-west Madagascar by Mr. Last, and transmitted to the British Museum. The species was stated to be most nearly allied to *Testudo gigantea* of the Aldabra Islands.—Mr. W. Bateson and Mr. H. H. Brindley read a paper giving the statistical results of measurements of the horns of certain beetles and of the forcipes of the male earwig. It appeared that in some of these cases the males form two groups, "high" and "low"; the moderately high and the moderately low being more frequent than the mean form in the same locality. It was pointed out that this result was not consistent with the hypothesis of fortuitous variation about one mean form.—A communication was read from Mr. O. Thomas containing the description of a new monkey of the genus *Semnopithecus* from Northern Borneo, which he proposed to call *S. everetti* after Mr. A. Everett, its discoverer.—Mr. G. A. Boulenger read a description of a Blennioid fish from Kamtschatka belonging to a new generic form, and proposed to be called *Blenniophidium petropauli*. The specimen had been obtained in the harbour of Petropaulovski by Sir George Baden Powell, M.P., in September 1891.

Royal Meteorological Society, November 16.—Mr. A. Brewin, Vice-President, in the chair.—An interesting paper by Mr. J. Lovel was read on the thunderstorm, cloudburst, and flood at Langtoft, East Yorkshire, July 3, 1892. The author gives an account of the thunderstorm as experienced at Driffield on the evening of this day; the full force of the storm was, however, felt in the wold valleys, which lie to the north and north-west of Driffield, where great quantities of soil and gravel were removed from the hillsides and carried to the lower districts, doing a large amount of damage. Many houses in the lower parts of Driffield were flooded, and a bridge considerably injured. The storm was most severe in a basin of valleys close to the village of Langtoft, where three trenches, sixty-eight yards in length and of great width and depth, were scooped out of the solid rock by the force of the water from the cloudburst. From the appearance of the trenches it is probable that there were three waterspouts moving abreast simultaneously. This particular locality seems to be favourable for the formation of cloudbursts, as there are records of great floods having previously occurred at Langtoft, notably on April 10, 1657, June, 1857, and June 9, 1888. The author gives, in an appendix, a number of observations made on similar occurrences, together with particulars and opinions as to the cause of such outbursts by several eminent authorities.—Mr. W. H. Dines also read a paper, remarks on the measurement of the maximum wind pressure, and description of a new instrument for indicating and recording the maximum. For some years the author has been conducting a large number of experiments with various forms of anemometer; and in the early part of the present year recommended the adoption of the tube anemometer for general use, as it appeared to possess numerous advantages. The head is simple in construction, and so strong that it is practically indestructible by the most violent hurricane. The recording apparatus can be placed at any reasonable distance from the head, and the connecting pipes may go round several sharp corners without harm. The power is conveyed from the head without loss by friction, and hence the instrument may be made sensitive to very low velocities without impairing its ability to resist the most severe gale. In the present paper the author describes an arrangement of this form of anemometer which he has devised for indicating very light winds as well as recording the maximum wind pressure.

Linnean Society, November 17.—Prof. Stewart, President, in the chair.—The President having announced a proposal by the council to present a congratulatory address to the Rev. Leonard Blomefield (formerly Jenyns) on the occasion of the seventieth anniversary of his election as a Fellow of the Society, and in recognition of his continuous and useful labours as a zoologist, it was moved by Sir Wm. Flower and seconded by Dr. St. George Mivart, that the address be signed and forwarded as proposed. This was carried unanimously. In moving the resolution, Sir Wm. Flower took occasion to sketch the scientific career of Mr. Blomefield, who is now in his ninety-third year, and to recapitulate the works of which he is the author under his earlier and better known name of Jenyns. The address, which was beautifully illuminated on vellum, was then signed by those present.—Mr. George Murray exhibited and made remarks upon a genus of Algæ (*Halicystis*) new to Britain, the species shown being *H. ventricosa* from the West Indies, and *H. ovalis* from the Clyde Sea area.—Mr. Buxton Shillitoe exhibited an artificial cluster of the fruit of *Pyrus sorbus*, as put up for ripening by cultivators in Sussex.—A paper was then read by the Rev. Prof. Henslow on a theoretical origin of endogens through an aquatic habit based on the structure of the vegetative organs. The lecture, which was very fluently delivered, was profusely illustrated, and drew forth some interesting criticism from Prof. Boulger, Messrs. Henry Groves, H. Goss, and Patrick Geddes, to which Prof. Henslow replied.—On behalf of Mr. George Lewes, who was unable to be present, a paper was read by Mr. W. Percy Sladen on the *Buprestidæ* of Japan, upon which some criticism was offered by Mr. W. F. Kirby.

Royal Microscopical Society, November 16.—Dr. R. Braithwaite in the chair.—Mr. T. F. Smith read a note on the character of markings on the *Podura* scale.—An account of Mr. W. West's paper on the freshwater algæ of the English lake district was given by Mr. A. W. Bennett, who thought it was an exceedingly important contribution to our knowledge of the algæ of that district.—Mr. F. Chapman gave a *résumé* of Pt. 3 of his description of the foraminifera of the Gault of Folkestone.—Mr. C. Haughton Gill read a paper on a fungus internally parasitic in certain diatoms, illustrating his subject with specimens and photomicrographs. Mr. Bennett said that he had observed structures which might be of a similar character in desmids. He should like to enquire if by the term "spores" Mr. Gill did not mean zoospores? Had he observed them to be possessed of vibratile cilia? And could he form any idea as to how they came to be inside the diatoms? It was possible that they might be transmitted in some way by inheritance, and if so that might account for their great abundance in particular species. Mr. Gill said

that the question how these things got into diatoms was one still under consideration. As to the movements of the spores he was not at present perfectly certain that they moved at all more than a very short distance from the orifice of the beak, but he had not yet had time to examine them sufficiently to be able to answer the question as to whether they were ciliated. Diatoms were by no means the tightly shut-up boxes which they were supposed to be; they could not live or absorb nutriment unless there was some sort of passage, and he thought there was very likely a means of penetration all over them to admit of the diffusion of fluid throughout.—Mr. E. M. Nelson called attention to the fine adjustment of Messrs. W. Watson's Van Heurck microscope, which he said had been wrongly described as being on Zentmayer's plan; he found that Messrs. Watson's adjustment was provided with spring stops, which obviated all the evils complained of in Zentmayer's system; the adjustment-screw was also left-handed, so that the apparent and real motions were made to coincide, which was a great advantage when working with high powers.

OXFORD.

University Junior Scientific Club, November 9.—The President, Dr. J. Lorrain Smith, in the chair.—The President gave an exhibit to illustrate the relation of ventilation to respiratory products, after which he called on the Rev. F. J. Smith for his paper on the inductoscript and spark photography. The paper, which was illustrated with experiments, and a large and varied selection of lantern slides, dealt with the recent researches of the writer and others in an exhaustive manner. It was shown how impressions of coins, &c., could be taken on photographic plates and paper by means of the electric spark, and the various results produced by changes of pressure, &c., in the atmosphere. The second part of the paper dealt more with the instantaneous photography produced by the electric spark, and the exhibits included photographs of bullets and other rapidly-moving objects, which had been taken by the reader of the paper.—Mr. G. C. Bourne read a paper on Bütschli's researches on protoplasm, which was followed by an animated discussion in which Prof. Burdon-Sanderson and others took part.

CAMBRIDGE.

Philosophical Society, November 14.—Prof. T. McKenny Hughes, President, in the chair.—The President exhibited (1) a live tarantula, (2) quartz crystals of unusual form. The following communications were made:—(1) Preparations were exhibited showing the division of nuclei in the sporangium of a species of *Trichia*, one of the Myxomycetes. The nuclei divide throughout the sporangium, with clearly recognizable karyokinetic figures, immediately before the formation of the spores, by J. J. Lister. (2) On the reproduction of *Orbitolites*. Mr. H. B. Brady has described specimens of Orbitolites, which he obtained in Fiji, showing the margin of the disc crowded with young shells. Mr. Brady's material was worked at in the dry state, and it was at his suggestion that the author collected specimens preserved in spirit from the Tonga reefs. Examination of this material shows that large brood chambers are formed at the margin of the disc during the later stages of growth. These are at first lined with a thin layer of protoplasm. At a later stage the central region of the disc is found to be empty, and the whole of the protoplasm is massed in the brood chambers in the form of spores. The spores have the structure of the "primitive disc," which during the early stages of growth of the Orbitolites occupies the centre of the shells. They are liberated by absorption of the walls of the brood chambers, and each becomes the centre of a new disc, which is built up by additions of successive rings of chamberlets at the margin. The reproduction of Orbitolites therefore takes place by spore formation. The spore contains a single nucleus, lying in its "primordial chamber." After several rings of chamberlets have been added, a stage is reached at which the nucleus appears to be represented by numbers of irregular, darkly staining masses scattered through the protoplasm of the central part of the disc. In the later stages numbers of oval nuclei are found in the protoplasm, often arranged in pairs, and in favourable preparations they may be seen to be undergoing amitotic division.—The fragmentation of the oosperm nucleus in certain ova, by S. J. Hickson.—On Gynodiœcism in the Labiatæ (second paper), by J. C. Willis.—The observations made in 1890–91 on *Origanum* (see *Reporter*, No. 937, June 7, 1892) were continued, chiefly on female plants. Six of these, derived from seed of the hermaphrodite plants of 1890, were observed, and their variations noted. It seems possible that some of the six, at any rate, were derived not from the normal, but from the abnormal (female) flowers of the parent. Attempts were made to determine if the occurrence of female flowers or flowers with one, two or three stamens only, on hermaphrodite plants, was due to lack of nourishment. A string was tied tightly round the main stalk of an inflorescence, about the middle, and it was found that more variations (12 : 1) occurred above than below. Analysis of the three years' observations shows that the abortion of the stamens tends to occur symmetrically rather than not, *i.e.* most commonly all four abort, and next in frequency is the abortion of the two anteriors: then of the two posteriors. These observations are still in progress, and it is hoped to publish full details in 1896 or later.

PARIS.

Academy of Sciences, November 21.—M. d'Abbadie in the chair.—Observations of the minor planets, made with the great meridian instrument of the Paris Observatory, from October 1, 1891, to June 30, 1892, by M. Tisserand.—Determination of the centre of the mean distances of the centres of curvature of the successive developments of any plane line, by M. Haton de la Goupillière.—Observations of Holmes' comet (November 6, 1892) made at the great equatorial of the Bordeaux Observatory, by M. G. Rayet.—Exploration of the higher regions of the atmosphere by means of free balloons provided with automatic recorders, by M. Gustave Hermite. Small balloons were filled with coal gas and provided with recording barometers and minimum thermometers. The former consisted of metallic aneroid boxes on Vidi's system, recording the pressure by the motion of a smoked plate in front of a glass style. These aneroids weighed less than 100 grs. The writer hopes to reduce their weight to 10 grs. Some of the balloons were lost or de troyed, but most of them were returned, after a journey exceeding in many cases 100 km. Two successful registrations of temperature have been made so far, giving a fall of 1° C. for every 260 m. and 280 m. respectively.—Observations of Holmes' comet made at the Algiers Observatory (*equatorial coudé*), by MM. Trépied, Rambaud, and Sy.—Observations of Holmes' comet (November 6) made with the *equatorial coudé* of the Lyon Observatory, by M. G. Le Cadet.—Elliptic elements of Holmes' comet of November 6, 1892, by M. Schulhof (see our Astronomical Column).—On the calculation of inequalities of a high order. Application to the long-period lunar inequality caused by Venus, by M. Maurice Hamy.—Distribution into four groups of the first n numbers, by M. Désiré André.—On electric oscillations, by M. Pierre Janet. A gap in a circuit containing a high resistance of some 20,000 ohms is bridged by another containing a coil resistance with self-induction and a bridge resistance without. The terminals in the same gap are also connected with a condenser, and a Mouton's *disjoncteur* is introduced in the circuit, rotating at a high speed. The differences of potential between the terminals of the two resistances are measured by an auxiliary condenser and a ballistic galvanometer. It is thus possible to determine the form of the oscillations. On suddenly breaking the short circuit in the gap, it was found that the ends of the resistance without self-induction reached a constant difference of potential in a series of oscillations which were always of the same sign, whereas those of the other showed a series of positive and negative oscillations.—On some results furnished by the formation of soap bubbles by means of a resinous soap, by M. Izarn. Very thin and permanent bubbles are obtained by pounding together 10 gr. each of colophonium and potassium carbonate, adding 100 gr. of water and completely dissolving by boiling. For use, it must be diluted with four times its bulk of water.—Action of piperidine upon the haloid salts of mercury, by M. Raoul Varet.—On the exchanges of carbonic acid and oxygen between plants and the atmosphere, by M. Th. Schlœsing, jun.—A new case of living *Xiphopage*, the Orissa twins, by M. Marcel Baudouin.—Notes on the feet of batrachians and saurians, by M. A. Perrin.—On asymmetric growth in polychætous annelids, by M. de Saint Joseph.—Influence of moisture on vegetation, by M. E. Gain. Experiments with soils kept in a given state of humidity have led to the following conclusions: For each plant there exists a certain proportion of moisture most favourable to its growth. A high comparative moisture in the soil accelerates the growth, especially of the stem and leaves. The air being dry, fructification is slower with a dry than with a humid soil. Inflorescence is retarded either by dry soil or by moist air, and is hastened by the reverse con-

ditions. The most favourable conditions for exuberant growth of flowers are a moist soil and dry air, especially the latter.—Researches on the mode of production of perfume in flowers, by M. E. Mesnard. By the action of pure hydrochloric acid on sections immersed in strongly-sweetened glycerine, the essential oils are easily separated. It is found that the oil is generally located in the epidermic cellules of the upper surfaces of the petals or sepals. In every case the oils appear to have been derived from chlorophyll. The perfume is not given off until the oil is sufficiently freed from the intermediate products, and it exhibits some inverse relation to the amount of tannin and pigment produced in the flower.—On the existence of a conidian apparatus in the *Uredinei*, by M. Paul Vuillemin.—On the presence of *Actinocamax* in the Pyrenæan chalk, by MM. Roussel and de Grossouvre.—Stratigraphic consequences of the preceding communication, by M. A. de Grossouvre.—On the formation of the Arve valley, by M. Emile Haug.—On an experiment which appears to produce an artificial imitation of the doubling of the canals of Mars, by M. Stanislas Meunier.

DIARY OF SOCIETIES.

LONDON.

THURSDAY, DECEMBER 1.

LINNEAN SOCIETY, at 8.—Notes on Œcodoma cephalotes and the Fungi it Cultivates: J. H. Hart.—On a Small Collection of Crinoids from the Sahul Bank, North Australia: Prof. F. Jeffrey Bell.—Descriptions of Twenty-six New Species of Land Shells from Borneo: E. A. Smith.

CHEMICAL SOCIETY, at 8.—On the Formation of Orcinol and other Condensation Products from Dehydracetic Acid: J. Norman Collie.—Isolation of Two Predicted Hydrates of Nitric Acid: S. U. Pickering.—Anhydrous Oxalic Acid: W. W. Fisher.—Observations on the Origin of Colour and of Fluorescence: W. N. Hartley.—The Origin of Colour—Azobenzene: H. E. Armstrong.—The Reduction Products of $\alpha\alpha'$ dimethyl $\alpha\alpha'$ diacetylpentane: Dr. Kipping.—The Products of the Action of Sulphuric Acid on Camphor: Drs. Armstrong and Kipping.—Methods for Showing the Spectra of easily Volatile Metals and their Salts, and of Separating their Spectra from those of the Alkaline Earths: W. N. Hartley.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—Experimental Researches on Alternate Current Transformers: Prof. J. A. Fleming, F.R.S. (Discussion.)

LONDON INSTITUTION, at 6.—Photographs of Flying Bullets, &c. (Illustrated): Prof. C. V. Boys, F.R.S.

SUNDAY, DECEMBER 4.

SUNDAY LECTURE SOCIETY, at 4.—Bacteria and Infectious Diseases (with Oxy-hydrogen Lantern Illustrations): Dr. E. E. Klein, F.R.S.

MONDAY, DECEMBER 5.

SOCIETY OF ARTS, at 8.—The Generation of Light from Coal Gas: Prof. Vivian B. Lewes.

VICTORIA INSTITUTE, at 8.—Principles of Rank among Animals: Prof. Parker.

SOCIETY OF CHEMICAL INDUSTRY, at 8.—A New Form of Filter Press for Laboratory Use: C. C. Hutchinson.—The Production of Acetic Acid from the Carbohydrates: Messrs. Cross and Bevan.—Electrolytic Soda and Chlorine; the Present Aspects of the Question: Messrs. Cross and Bevan.

LONDON INSTITUTION, at 5.—Reading as a Recreation: Edmund Gosse.

ROYAL INSTITUTION, at 5.—General Monthly Meeting.

ARISTOTELIAN SOCIETY, at 8.—Symposium—Does Law in Nature exclude the Possibility of Miracle? R. J. Ryle, Rev. C. J. Shebbeare, A. F. Shand.

TUESDAY, DECEMBER 6.

ZOOLOGICAL SOCIETY, at 8.30.—A Revision of the Genera of the Alcyonaria Stolonifera, with Descriptions of One New Genus and several New Species: Sydney J. Hickson.—Upon the Convolutions of the Cerebral Hemispheres in Certain Rodents: F. E. Beddard, F.R.S.—On a New Monkey from South-East Sumatra: Prof. Collett.

INSTITUTION OF CIVIL ENGINEERS, at 8.—Monthly Ballot for Members.—The Manufacture of Small Arms: John Rigby. (Discussion.)

WEDNESDAY, DECEMBER 7.

GEOLOGICAL SOCIETY, at 8.—Note on the Nufenen-stock (Lepontine Alps): Prof. T. G. Bonney, F.R.S.—On some Schistose "Greenstones" and Allied Hornblendic Schists from the Pennine Alps, as Illustrative of the Effects of Pressure-Metamorphism: Prof. T. G. Bonney, F.R.S.—On a Secondary Development of Biotite and of Hornblende in Crystalline Schists from the Binnenthal: Prof. T. G. Bonney, F.R.S.—Geological Notes on the Bridgewater District in Eastern Ontario: J. H. Collins.

SOCIETY OF ARTS, at 8.—The Chicago Exhibition, 1893: James Dredge.

ENTOMOLOGICAL SOCIETY, at 7.—Further Observations upon Lepidoptera (Illustrated by the Oxy-hydrogen Lantern): Edward B. Poulton, F.R.S.—The Effects of Temperature on the Colouring of Pieris napi, Vanessa atalanta, Chrysophanus phlœas, and Tephrosia punctulata: Frederic Merrifield.—Notes on Hydroptilidæ belonging to the European Fauna, with Descriptions of New Species; Kenneth J. Morton. (Communicated by Robert McLachlan, F.R.S.)—On some Neglected Points in the Structure of the Pupa of Heterocerous Lepidoptera, and their Probable Value in Classification; with some Associated Observations on Larval Prolegs: Dr. Thomas Algernon Chapman.—Description of a New Species of Butterfly, of the Genus Calinaga, from Siam; James Cosmo Melvill.

THURSDAY, DECEMBER 8.

ROYAL SOCIETY, at 4.30.—On the Photographic Spectra of some of the Brighter Stars: Prof. J. Norman Lockyer, F.R.S.—Experiments in Examination of the Peripheral Distribution of the Fibres of the Posterior Roots of some Spinal Nerves: Dr. Sherrington.—Preliminary Account of the Nephridia and Body Cavity of the Larva of Palæmonetes varians: Edgar J. Allen.

MATHEMATICAL SOCIETY, at 8.—Note on Cauchy's Condensation Test for the Convergency of Series: Prof. M. J. M. Hill.—Additional Note on Secondary Tucker Circles: I. Griffiths.—Notes on Determinants: J. E. Campbell.—A Geometrical Note; R. Tucker.

LONDON INSTITUTION, at 7.—A Plea for Catholicity of Taste in Music (Illustrated): Sir Joseph Barnby.

SATURDAY, DECEMBER 10.

INSTITUTION OF CIVIL ENGINEERS, 2 to 4.—Students' Visit to the Machinery and Inventions Division, South Kensington Museum.

BOOKS, PAMPHLETS, and SERIALS RECEIVED

BOOKS.—Berzelius und Liebig, Briefwechsel 1831-1845 (München, Lehmann).—A Short Manual of Orthopœdy, Part I.: H. Bigg (Churchill).—Congrès International de Zoologie, Deux Session à Moscou: Première Partie (Moscou).—Congrès International d'Archéologie. 11-ème Session à Moscou, vol. 1 (Moscou).—A Catalogue of British Jurassic Gasteropoda: W. H. Hudleston and E. Wilson (Dulau).—Annuaire de l'Observatoire Municipal de Montsouris, 1892-93 (Paris, Gauthier-Villars).—Les Textiles Végétaux: H. Lecomte (Paris, Gauthier-Villars).—Essais d'Or et d'Argent: H. Gautier (Paris, Gauthier-Villars).—Past and Future: C. M. Jessop (K. Paul).—Toothed Gearing: A Foreman Pattern Maker (C. Lockwood).—Modern Views of Electricity, 2nd edition: Prof. O. J. Lodge (Macmillan).—The Universal Atlas, Part 21 (Cassell).—Grasses of the Pacific Slope, Part 1: Dr. G. Vasey (Washington).—Das Keimplasma, Eine Theorie des Vererbung: Prof. A. Weismann (Jena, Fischer).—Die Zelle und die Gewebe: Prof. O. Hertwig (Jena, Fischer).—Extinct Monsters: Rev. H. N. Hutchinson (Chapman and Hall).—The Algebra of Coplanar Vectors and Trigonometry: R. B. Hayward (Macmillan).—Science in Arcady: Grant Allen (Lawrence and Bullen).—The Chemical Basis of the Animal Body: Dr. A. Sheridan Lea (Macmillan).

PAMPHLETS.—Quelle est la Race la plus Ancienne de la Russie Centrale: A. Bogdanow (Moscou).—Descriptive Notes on certain Implements, Weapons, &c., from Graham Island, Queen Charlotte Islands, &c.: A. Mackenzie.—Notes on the Shuswap People of British Columbia: G. M. Dawson.—Some Laws of Heredity and their Application to Man: S. S. Buckman (Gloucester).—Sur la Constitution des Dépôts Quaternaires en Russie et leur relations au Trouvilles Résultant de l'Activité de l'Homme Prehistorique: S. Nikitin (Moscou).—Ueber die Entwicklung von Milz und Pankreas: Dr. C. von Kupffer (München).—Verg.-Anatomische Studien über die Nerven des Armes und der Hand: Dr. W. Höfer (München).—Die Lendennerven der Affen und des Menschen: Dr. A. Utschneider (München).—Ueber das Vorkommen Offener Schlundspalten: Dr. E. Tettenhamer (München).

SERIALS.—Mittn. der Deutschen Gesellschaft für Natur und Völkerkunde Ostasiens in Tokio, 50 Heft (Tokio).—Traité Encyc. de Photographie, Premier Supplément: *A cinquième fascicule*, C. Fabre (Paris, Gauthier-Villars).—Natural Science, Decr. (Macmillan).—A Monograph of Oriental Cicadidæ, Part 7: W. L. Distant (London).

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