past years, the highest number of candidates who obtained a place in the class list in any previous year being 31 in 1891 and 1886. There are also 51 candidates for the preliminary examinations in Science. Comparing these numbers with those of the candidates in other subjects, we find Literæ Humaniores 136 candidates, History 108, Law 70, Theology 65, and Mathematics 14. Of the 41 candidates who seek Honours in Natural Science 5 offer Physics, 21 Chemistry, 13 Animal Physiology, 1 Botany, and 1 Geology. It is remarkable that there is no candidate offering Animal Morphology.

It is understood, although it is not yet officially announced, that Merton College will give a biological Fellowship in October next, the examination for which will be held at the end of September or early in October.

A meeting of the demonstrators and assistants at the Museum was held on Saturday last to discuss their position as regards the rest of the University, and it was decided to memorialise the Visitatorial Board on the subject.

CAMBRIDGE.—Prof. Foster will deliver the Rede Lecture in the Senate House on June 14 at noon. The subject of the lecture is "Weariness."

Mr. F. Darwin, Deputy Professor of Botany, announces two courses of lectures, to begin during the ensuing Long Vacation, an elementary one by Mr. Willis, of Caius College, and a more advanced course by Mr. Wager, of the Yorkshire College, Leeds.

The Special Board for Medicine have issued new schedules in Physics and Elementary Biology for the First M.B. Examination. In regard to the former a practical examination in Experimental Physics is for the first time explicitly included in the scheme.

By means of the bequest of £300 to the University by the late Mr. Henry Tyson, of Kendal, a gold medal in Mathematics and Astronomy has been founded. The award will be made on the results of the examination for Part II. of the Mathematical Tripos.

The Engineering Laboratory Syndicate have approved Mr. W. C. Marshall's plans for an engineering laboratory, and submitted them to the Senate for adoption. They propose that the most urgent needs of the Department of Mechanism shall be met by proceeding with such portions of the work as it may be possible to execute with the funds at their disposal. About £3500, in addition to the amouut already subscribed, will be required to complete the building, and a further expenditure of not less than £1000 on necessary apparatus should follow. The Syndicate trust that the development of the school may not be long delayed for want of these sums.

The Tripos Examinations Syndicate have put forward a scheme by which nearly all the Triposes will begin after the last Sunday in May, and the Honours lists will be published by the end of June. This will involve the postponement of the general admission to the B.A. degree until the first week of July, which falls in the Long Vacation. The proposal is only tentative, and it will inevitably give rise to animated discussion.

Mr. E. W. MacBride, Scholar, of St. John's College, has been nominated to occupy the University's table at the Plymouth Marine Biological Laboratory in June.

Honorary degrees are to be conferred on the Maharajah of Bhaonagar, Lord Herschell (as Chairman of the Governors of the Imperial Institute), and Lord Roberts of Kandahar and Waterford; Prof. Zupitza, the eminent philologist, and Mr. Standish Hayes O'Grady, the Celtic scholar, are to be similarly honoured.

SCIENTIFIC SERIALS.

The Quarterly Journal of Microscopical Science for April, 1893, contains:—Description of a new species of Moniligaster from India, by W. Blaxland Benham (Pl. xxxii. and iii.). The species is from the Nilgiris and is named *M. indicus*.—Note on a new species of the genus Nais, by W. Blaxland Benham (Pl. xxxiii.). The worm was found in a ditch in the neighbourhood of Oxford; it is of a dull brownish colour, about a quarter of an inch in length, and is called *N. heterochæta*, from the fact that of the normally two chætæ in the dorsal bundles one is of a "crochet" shape, the other is capilliform.—On a new organ in the Lycoridea, and on the nephridium in *Nereis diversicolor*, O. F. Muell., by E. S. Goodrich (Pl. xxxiv. and xxxv.). The new organ consists of a pair of large, highly-differentiated, ciliated patches of cœlomic epithelium, which are found in every segment, except the first and the last few. These "dorsal ciliated organs" seem to occur throughout the Lycoridea, having been found in all the genera of that family examined by the author. Some notes on the minute structure of the nephridia of the Nereids are added.—On the nephridia and body-cavity of some Decapod Crustacea, by Edgar J. Allen, (Pl. xxxvi. vii. viii.). 1. The green gland of Palæmonetes (and Palæmon) at the time of the hatching of the larva has not developed a lumen. When the larva leaves the egg the lumen commences to open and the gland consists of an end-sac and a U-shaped tube, of which the distal portion gives rise to the bladder. The bladder then enlarges greatly, growing at first inwards towards the middle ventral line, then upwards, within the œsophageal nerve-ring and anterior to the œsophagus, to the middle dorsal line, where it meets its fellow of the opposite side. The two bladders grow backwards over the stomach and beneath the dorsal sac, subsequently fusing together in the middle line to form the unpaired nephro-peritoneal sac. 2. The shell-glands are the functional excretory organs at the time of the hatching and during the latter part of the embryonal period. They open at the bases of the second maxillæ, and each consists of an end-sac and a Y-shaped renal tube, which have the typical structure of a crustacean nephridium. 3. A dorsal sac, which is completely enclosed by an epithelial lining, persists in adults of Palæmon, Palæmonetes, and Crangon. 4. At its anterior end the dorsal sac is surrounded by a mass of tissue which appears to have the power of producing blood corpuscles. 5. The dorsal sac is formed as a hollowing-out in masses of mesoderm cells, which lie on either side of the cephalic aorta. 6. The body-cavity of these Crustaceans varies in different regions: (*a*) In the anterior part of the thorax it consists of a true cœlom (the dorsal sac and nephridia) and a hæmocœle; (*b*) in the posterior part of the thorax and in the abdomen, the body cavity is entirely a hæmocœle.—Note on the cœlom and vascular system of the Mollusca and Arthropoda, by Prof. E. Ray Lankester. A reprint of an abstract of an important paper read at the 1887 meeting of the British Association, and published in these pages (vol. xxxvii. p. 498). The author adds a request for specimens of Lernanthropus to enable him to complete his researches. Five species of this genus are recorded from the Mediterranean in Carus' "Prodomus Faunae Mediterraneæ."—Contributions to a knowledge of British marine Turbellaria, by F. W. Gamble (Pl. xxxix.-xli.), records 71 species, of which 28 are now added to the British fauna. Plate xxxix. contains coloured figures of ten species.—Peculiarities in the segmentation of certain Polychætes, by Florence Buchanan (Pl. xlii.).—Review of Bolsius' researches on the nephridia of Lee ches by A. G. Bourne.

In the notice of the January number of the *Q.J.M.S.* the too brief account of Mr. Arthur Willy's paper on the Protochordata is we regret deemed calculated to produce a mistaken impression; it should read "that the author in consequence of new observations on the Ascidians, found it necessary to repudiate the theory of van Beneden and Julin, as to the prechordal vesicle of Ascidians and Amphioxus, which he had previously, without having made personal observations on the Ascidians, provisionally adopted."

THE number of the *Nuovo Giornale Botanico Italiano* for April contains three papers:—Sig. S. Sommier gives the results of a botanical tour in the region of the Lower Obi, in Siberia, including lists of the flowering plants, Vascular Cryptogams, Muscineæ, Lichens, Fungi, and Algæ obtained. A new species of fungus is described, *Helotium Sommierianum*, parasitic on *Lycopodium clavatum*. Dr. N. C. Kindberg contributes a list of mosses gathered in Southern Switzerland and Italy. Dr. E. Baroni gives measurements of the pollen-grains of various species of *Papaver*, *Chelidonium*, and *Eschscholtzia*.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, May 4.—"On the Thickness and Electrical Resistance of Thin Liquid Films." By A. W. Reinold, M.A., F.R.S., Professor of Physics in the Royal Naval College, Greenwich, and A. W. Rücker, M.A., F.R.S., Professor of Physics in the Royal College of Science, London.

The paper gives an account of experiments made for the pur-

pose of determining the thickness of black soap films formed of solutions of varying composition. Two methods of experiment were employed: (1) an optical method, in which the mean thickness of about 50 plane black films contained in a tube was deduced from observations of interference phenomena; and (2) an electrical method, in which the thickness of a cylindrical black film was derived from a measurement of its electrical resistance. The optical method involves the assumption that the refractive index of a thin film of liquid is the same as that of a large quantity of the same liquid.

Reasons are given for the belief that the refractive indices in question, if not identical, differ only slightly, and hence that the thickness of a film as determined by the optical method is the true thickness.

In the electrical method the assumption is made that the specific conductivity of a liquid does not alter when the liquid is drawn out into a thin film.

If the results obtained by the two methods agree, the conclusion is that the specific resistance of a film is not affected by its tenuity; if they differ widely from each other, a change in the specific conductivity of the liquid must have taken place.

The authors showed, in 1883, that for a solution of hard soap containing 3 per cent. of KNO_3, with or without the admixture of glycerine, the mean thicknesses of black films, as measured by each of the two methods, were in close agreement. For such solutions, then, the specific conductivity is the same whether the liquid be examined in considerable bulk or in the form of a film $12\mu\mu$ in thickness. The accuracy of this result has been confirmed by a large number of observations made during the last three years.

If the proportion of KNO_3 added to the solution be diminished, the thickness of a black film, whether measured optically or electrically, is found to undergo a change.

The results obtained by the optical method show that

(1) For a given solution of hard soap the thickness of a black film increases as the percentage of KNO_3 is diminished, being $12{\cdot}4\mu\mu$ for a 3 per cent. solution, and 22·1 for a solution containing no salt. This is confirmed by experiments on soft soap.

(2) When no metallic salt is dissolved in the solution the thickness of a black film increases as the strength of the soap solution diminishes. The thicknesses are 21·6, 22·1, 27·7, and $29{\cdot}3\mu\mu$ when the proportions of soap to water are respectively 1/30, 1/40, 1/60, 1/80.

(3) If the solution contain 3 per cent. of KNO_3, variation in the proportion of soap dissolved produces very little change in the thickness of a black film.

Electrical Method.—It has been stated that for a soap solution containing 3 per cent. of KNO_3 the thickness of a black film as measured electrically is practically the same as that measured optically. If, however, the proportion of KNO_3 be diminished, the thickness (measured electrically) increased in a far larger ratio than would be inferred from the optical method. If the proportion of salt be diminished to zero, the thicknesses thus calculated are much greater than the greatest thickness at which a film can appear black. In such cases, therefore, the electrical method does not give the true thickness of the black, and the hypothesis that the specific conductivity of the film and of the liquid in mass are identical is untenable.

The following table shows the change in apparent thickness due to diminution in the quantity of dissolved salt:—

Hard Soap.

Percentage of KNO_3.	3	2	1	0·5	0
Mean apparent thickness of black film (measured electrically)	10·6	12·7	24·4	26·5	154

The large value obtained for the apparent thickness in the case of the unsalted hard soap solution is confirmed by experiments on a solution of unsalted soft soap, which gave a mean apparent thickness of $162\mu\mu$.

In different films the measured thicknesses of the black differ widely from each other, the limits being roughly $80\mu\mu$ and $230\mu\mu$. This large variation is due in some cases, at all events, to a real variation in the thickness. Two different shades of black are (in cases where the solution contains little or no salt) frequently seen in a film. They are separated from each other by a line of discontinuity which is irregular in shape. Comparative measurements on the two shades of black have been made, and the results indicate that the electrical thicknesses of the two kinds of black are approximately as 2 : 1.

The results of numerous experiments carried out with the object of determining the *cause of the great increase in electrical conductivity in black films made from unsalted soap solutions* have shown that the increase of specific conductivity in question—

(1) Is independent of moderate changes of temperature.

(2) Is not due to the absorption or evaporation of water by the film.

(3) Is not due to change in the composition of the liquid by electrolytic decomposition produced by the current used to measure the electrical resistance of the film.

(4) Is not affected by a very large change in the quantity of CO_2 in the air around the film.

(5) Is practically unaltered if the films are formed in an atmosphere of oxygen.

The next question to be answered was whether the large changes in specific conductivity affect black films only, or whether similar phenomena can be detected in the case of thicker films.

The conclusions arrived at were (1) that the specific conductivity of a film increases as the thickness decreases, and (2) that this increase is less in the case of a film to which a salt has been added and is *nil* when the proportion of salt is as much as 3 per cent.

The paper concludes with a discussion as to the cause of the increase of electrical conductivity in thin films. The authors point out that it may be attributed either to a modification of the chemical constitution of the film brought about by its tenuity, or to the formation of a pellicle on the surface or to both causes combined.

Physical Society, May 12.—Prof. A. W. Rücker, F.R.S., President, in the chair.—A paper on the drawing of curves by their curvature, by C. V. Boys, F.R.S., was read, and demonstrations of the method employed given. Whilst giving a course of lectures on capillarity, in 1891, the author wished to explain the principles upon which the form of a water drop depended, and finding Lord Kelvin's rule (*Proc. R. Inst.*, Jan. 29, 1886) cumbersome, devised the modification now described. The construction depends on the fact that the total curvature is proportional to the hydrostatic pressure, *i.e.*, proportional to the depth below the plane surface of the liquid. To avoid the trouble of finding reciprocals, a rule was divided so that the distance from what would be the zero of the scale are the reciprocals of the numbers attached to them, and the curvature of an arc, being the reciprocal of its radius, can be read off immediately by the rule. To meet cases where the curvatures of surfaces are, in opposite directions, the zero, or ∞, is put at the middle of the rule and divided both ways. The chief gain depends on the abolition of cumulative errors due to compass settings, which is effected as follows: The rule is made of a thin slip of transparent celluloid with a small hole at the centre or ∞. A small brass tripod with needle feet is placed so that two feet just penetrate the paper and the third rests on the longitudinal straight line of the strip, which passes through the centre hole, thus forming a temporary but rigid centre about which the rule can rotate. A pen or pencil through the hole at ∞ traces out an arc whose curvature is equal to the reading of the scale where the needle point presses. When the rule crosses the axis of rotation of a generating curve, the numbers representing both curvatures are visible, and the position of the needle-point corresponding to a given total curvature can readily be found. A small arc is then drawn. Holding the strip firmly on the paper, the tripod is moved a little so that the sum of the two readings at the needle point and where the rule crosses the axis has the value corresponding to the position of the tracing point, and another arc drawn. Repeating the process, a very perfect and accurate curve results. Details for drawing nodoids, unduloids, catenoids, and other curves are given in the paper, and many beautiful examples, which had been executed by Miss Stevenson, were exhibited at the meeting. The author also pointed out that the locus of points about which the strip successively turns is the evolute of the curve drawn by the tracing point. Prof. Perry considered the method a new departure of great value. When he (Prof. Perry) drew the capillary surfaces of revolution in 1875, he found that cumulative errors produced considerable discrepancies. Prof. Greenhill said one would now be able to secure better diagrams of transcendental and other curves than heretofore, and he

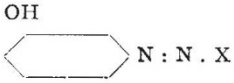
thought Mr. Boys' method would supplant the laborious processes now used to determine the paths of projectiles. Where the resistance varied as the square of the velocity the elevation for maximum range depended on the initial velocity, and for a cube law both elevation and range tend to finite limits as the initial velocity increases. Prof. Minchin inquired whether the catenary could be best drawn by using a scale of equal parts instead of one divided reciprocally. The President greatly appreciated the saving of labour effected by Mr. Boys' method, and thought the apparatus should be shown at the forthcoming exhibition of mathematical instruments in Germany.—Prof. O. J. Lodge, F.R.S., read a paper on the foundation of dynamics, in which he examines the objections raised by Dr. MacGregor (*Phil. Mag.*, Feb. 1893) against the views of Newton's Laws of Motion and the Conservation of Energy, expressed by the author in 1885. The first part of the paper treats of the nature of axioms. An axiom or fundamental law is regarded as a simple statement suggested by familiar or easily ascertained facts, probable in itself, readily grasped, and not disproved or apparently liable to disproof, throughout a long course of experience. On such bases the conservation of energy and of matter rests. Neither can be proved generally, but like other fundamental laws they fit into a coherent and self-consistent scheme, and are therefore worthy of acceptance until they are shown to be wrong. The second part relates to the first and third laws of motion. Dr. MacGregor objects to the first law on the ground that uniform motion is unintelligible unless its direction and velocity are specified with reference to a set of axes, and directly axes are introduced, difficulties occur as to their motion, because there is no satisfactory criterion of rest. Such notions the author deems artificial and unnecessary, except where it is required to define the absolute magnitude and direction of the motion. Reasoning from his own experiments, he believed the ether was at rest, for he had not found it possible to move it by matter. The first law, he said, had been considered unnecessary, as being only a particular case of the second. While admitting the latter fact, he maintained that its separate statement was desirable, on account of its simplicity, and its affording a practical definition of the mode of measuring time. As regards the third law being deducible from the first, he pointed out that if it could be axiomatically asserted that the centre of mass of a rigid system moves uniformly unless an external force acts on the system, then the third law follows. Newton apparently considered it best to state the third law as an axiom, but to many persons it is not obviously axiomatic (some engineers do not accept it), hence its deduction from the other two laws is useful. Part III. of the paper deals with the deduction of the law of conservation of energy from Newton's third law, and universal contact-action. Dr. MacGregor objects to the author's definition of energy as the name given to "work done," and contends that this definition assumes conservation. On this point Dr. Lodge invited criticism, meanwhile pointing out that his definition was analogous to the customary definition of the potential function, and a name for the line integral of a force considered as a quantity that can be stored. On the basis taken, two bodies can only act on one another whilst in contact, hence, if they move, they must move over equal distances; but their action consists of a pair of equal and opposite forces, therefore their activities are equal, and whatever energy one loses the other gains, *i.e.*, energy is transferred from one body to another without change in quantity. In Part IV. the dissipation of energy, the nature of potential energy, and the second law of thermodynamics, are considered. In discussing transference and transformation, "potential energy" is used to indicate the energy of a body under stress, and "kinetic energy," that due to sustained motion. Each corresponds to one of the factors of the product Fv, "activity." So long as one factor is absent no activity can manifest itself, but directly the missing factor is supplied, transference and transformation begin. This was shown to hold in an example of an air-gun with its muzzle plugged, chosen by Prof. MacGregor as an instance of transference of potential energy without transformation. The law of dissipation of energy is stated thus:—"If a body has any portion of energy in such a condition that it is able automatically to leave the body, that portion usually does so sooner or later." Instead of the ordinary form of the second law of thermodynamics the following statement is proposed:—"The portion of energy which a body can automatically part with is alone available for doing work." In discussing this subject the author points out that the common notion that heat engines are much less efficient than water or electric engines is a mistake, arising from the fact that in the one case the efficiency is calculated on the total energy, whilst in the latter cases only the available energy is considered. Two appendices accompany the paper, one the objectivity of energy and the question of gravitation, and the other on more detailed discussion of the transmission of energy in difficult cases.

Chemical Society, May 4.—Dr. Armstrong, President, in the chair.—The following papers were read:—The hydrates of sodium, potassium and lithium hydroxides, by S. U. Pickering. By cooling solutions of sodium hydroxide, the author has succeeded in isolating a number of crystalline hydrates; their formulæ and freezing-points are given in the following table:—

$NaOH, H_2O$	freezes at		64°·3
$NaOH, 2H_2O$	,,	,,	12·5
$NaOH, 3·11H_2O$	,,	,,	2·73
$NaOH, 3·5H_2O$	,,	,,	15·55
$\alpha NaOH, 4H_2O$	,,	,,	7·57
$\beta NaOH, 4H_2O$	,,	,,	− 1·70
$NaOH, 5H_2O$	,,	,,	−12·22
$NaOH, 7H_2O$	,,	,,	−23·51

The hydrate containing $3\frac{1}{2}$ molecules of water is the only one of the eight which has been previously described. In the case of potassium hydroxide two new hydrates have been isolated; these have the formulæ KOH,H_2O and $KOH,4H_2O$, and freeze at 143° and −32·7° respectively. The previously known dihydrate freezes at 35·5°. Lithium hydroxide monohydrate, which was already known, was the only hydrate of this hydroxide isolated.—Detection of arsenic in alkaline solution, by J. Clark. Arsenic acid is not reduced to hydrogen arsenide by zinc dust and caustic potash, or even by sodium amalgam in alkaline solution. No trace of arsenic volatilises on heating sodium arsenate with a large excess of aluminium and caustic soda. The statement of H. Fresenius, that Gatehouse's modification of Fleitmann's test indicates arsenic acid, is hence erroneous; Fresenius's results are probably due to the use of impure aluminium or of arsenic acid containing arsenious acid. The author concludes that none of the methods hitherto proposed for the generation of hydrogen arsenide from alkaline solutions, are available for the detection of arsenic acid.—Improvements in Reinsch's process, by J. Clark. Although Reinsch's process is sensitive to minute quantities of arsenic, and removes all traces of that element from organic mixtures, there are two objections to its use in medico-legal cases. With small quantities of arsenic, the stain obtained is sometimes not easily identified, as the coated copper when heated is apt to give a sublimate of cupric chloride and organic matter instead of arsenious oxide; the method is also not suitable for quantitative estimations, as the whole of the arsenic cannot be volatilised from the copper by means of heat. The author's improvement on Reinsch's process consists in digesting the coated copper with cold caustic potash and hydrogen peroxide, and distilling with ferrous chloride and hydrochloric acid. The arsenic is precipitated in the distillate and weighed as sulphide, whilst any antimony present may be detected in the residual liquor.—The action of light in preventing putrefactive decomposition and in inducing the formation of hydrogen peroxide in organic liquids, by A. Richardson. Several observers have noted that the development of putrefactive organisms is checked by the combined action of sunlight and oxygen; this sterilising influence of light in presence of oxygen has apparently always been regarded as the outcome of an action exerted by the organism. The author has made a number of experiments with urine, in order to ascertain whether, when sterilisation has been effected by light, any oxidising agent, such as hydrogen peroxide, is formed, and whether such substance may not be the sterilising agent. No hydrogen peroxide is produced by the action of oxygen on sterilised urine in the dark, but an appreciable amount of the peroxide is formed on exposing such urine to light; the production of the peroxide is hence independent of the presence of organisms. Substances, such as manganese dioxide, which destroy hydrogen peroxide, greatly facilitate organic growth; the addition of hydrogen peroxide to fresh urine renders the liquid much less liable to change under the influence of organisms, whilst if added to urine in which fermentation has already set in, the peroxide is rapidly decomposed.—The supposed saponification of linseed oil by Dutch white lead, by J. B. Hannay and A. E. Leighton. The author shows that the state-

ment made by several technical writers to the effect that white lead acts on the oil with which it is ground, is erroneous.—Notes on capillary separation of substances in solution, by L. Reed. The author has made experiments on the separation of salts in solution by selective absorption in bibulous paper, using a method differing somewhat from those employed by previous workers. If a drop of a fairly dilute aqueous salt solution is allowed to spread on bibulous paper, a pure water margin is obtained surrounding a sharply defined interior space containing stronger salt solution. The width of the exterior zone is apparently dependent on the nature and concentration of the solution employed; some solutions, such as those of chrome and ammonia alums, give no pure water zone.—Note on a meta-azo-compound, by R. Meldola and F. B. Burls. A comparison of meta-azo-compounds of the formula



where X is an *unsubstituted* hydrocarbon radicle, with the corresponding ortho- and para-series, would be of interest as throwing light on the question of the constitution of organic colouring matters, the "quinonoid" bonds not being present in the meta-compounds according to the present method of formulation. The authors have hence prepared metaphenolazo-α-naphthylamine with the intention of converting it into naphthaleneazometaphenol; they have not yet isolated the latter substance and are therefore extending the investigation to other compounds of the same series.—The influence of moisture in promoting chemical action. Preliminary note, by H. B. Baker. The author has continued his investigations on the influence of moisture on chemical action. Ammonia was dried as completely as possible by freshly ignited lime; on then subjecting it to the action of phosphoric anhydride very little of the gas was absorbed. Hydrogen chloride was dried first by sulphuric acid and finally by a week's contact with phosphoric anhydride. On mixing ammonia and hydrogen chloride, dried in this way, *no ammonium chloride fumes were produced* and no contraction was indicated by the mercury gauge attached to the apparatus: it may therefore be concluded that ammonia and hydrogen chloride do not combine when dry. Union at once occurs, however, on introducing a small quantity of moist air. In like manner sulphur trioxide was found not to unite either with lime, barium monoxide, or copper oxide. Furthermore, no brown fumes were produced on mixing dry nitric oxide with dry oxygen.—The genesis of new derivatives of camphor containing halogens by the action of heat on sulphonic chlorides, by F. S. Kipping and W. J. Pope. When the sulphonic chlorides derived from camphor recently described by the authors, are heated at temperatures not very far above their melting points, decomposition occurs and sulphur dioxide is evolved whilst haloid derivatives of camphor remain. In the case of camphorsulphonic chloride, a chlorocamphor melting at 137–138°, is thus obtained. From chlorocamphorsulphonic chloride, a well-crystalline dichlorocamphor melting at 118–119° is formed, whilst bromocamphorsulphonic chloride yields a compound which crystallises in long prisms and melts at 142–143°. These three derivatives of camphor appear to be different from any known compounds and their further study will, it is hoped, throw light on the complex question of isomerism in the camphor series.

May 5, Extra Meeting.—Dr. Armstrong, President, in the chair.—This being the anniversary of the death of Prof. A. W. von Hofmann, the President, after opening the proceedings with a short speech, called upon Lord Playfair, Sir F. Abel and Dr. Perkin to deliver addresses commemorative of Hofmann and his work.

Anthropological Institute, May 9.—Prof. A. Macalister, President, in the chair.—Mr. C. Dudley Cooper exhibited and described the skull of an aboriginal Australian.—A paper by Mr. Charles Hose on Borneo was read. The Baram District, with which the author was most intimately acquainted, is situated in the Northern portion of Sarawak, and the races inhabiting it may divided into four sections:—(1) The low country people and the inhabitants of the coast; (2) the Kayans and Kenniahs, inhabiting the head waters of the Baram River and its tributaries; (3) the Kalabits, living inland; and (4) the Punans, no nomadic tribes, found at the head waters of all the great rivers in Central Borneo. Each of these four divisions comprises a number of sub-divisions speaking different dialects, which can, however, be traced to the same origin. All the various races, except the Punans, employ dogs in hunting. The houses usually stand about twenty feet above the ground supported by huge posts of hard wood; they are some four hundred yards in length, and often hold more than a hundred families. In times gone by the first post put into the ground was passed through the living body of a slave—usually a young girl—but wild animals are now used instead of human beings for this purpose. Mr. Hose exhibited and described a large collection of native implements, weapons, and other objects, and the paper was further illustrated by a number of photographic views shown by the limelight.—Prof. Macalister exhibited a skull from North Borneo.—Mr. F. W Rudler exhibited a wooden fire syringe from the Malay Peninsula, with a bean tinder box.—Mr. R. G. Leefe contributed a paper on the nivates of Tonga.

Geological Society, May 10.—W. H. Hudleston, F.R.S., President, in the chair.—The following communications were read:—The felsites and conglomerates between Bethesda and Llanllyfni, N. Wales, by Prof. J. F. Blake. The author brought forward fresh evidence in support of the views he had previously expressed as to the Cambrian age of these felsites, and as to the unconformity of the conglomerates on the purple slates. A new tunnel-section at Penrhyn Quarry was described, in which felsite was followed by St. Ann's Grit with a conglomerate-band, and there lying in the midst of the Cambrian series. After a word or two on the conglomerate on Moel Rhiw-wen, the sections on either side of Llyn Padarn were discussed in detail, and it was shown that the distribution of the rocks on the surface of the country could only be explained by the unconformable position of the conglomerates and grits, which, moreover, lie nearly horizontal. After a discussion of the conglomerates of Bettws-Garmon, a detailed section of the adit at Moel Tryfaen was given, in which it was shown that there was only a 3 ft. 6 in. band of conglomerate next the purple slates, followed by 1350 feet of banded slates and laminated grits with four distinct intercalated bands of felsite; and it was argued that the conglomerate on the summit, 55 yards across, could scarcely be represented by this thin band. Finally, the distribution of rocks on Mynydd-y Celgwyn was shown to be satisfactorily explained by unconformity. Incidentally it was mentioned that a band of rock in the felsite at Llyn Padarn, which had been considered to be a deposited slate, was in reality an intrusive igneous rock. The conglomerates described were considered to be an overlap of the Bronllwyd Grit. The reading of this paper was followed by a discussion, in which the President, Prof. Hughes, Mr. Rutley, Mr. Marr, and the author took part.—The Llandovery and associated rocks of the neighbourhood of Corwen, by Philip Lake and Theo. T. Groom. The area described forms a part of the northern slope of the Berwyn Hills, and stretches along the southern bank of the Dee from Corwen to Pen-y-glog. The beds of the Berwyns are here thrown into a series of folds which run nearly E.-W.; and the northerly limbs of these folds are long and low, while the southerly limbs are short and steep. The folds are cut through by a number of faults which run nearly E.-W., generally along the crests of the anticlinals, and these invariably throw down towards the north. The southern bank of the Dee Valley is here formed by these faults. A second series of faults running about 20° W. of N. to 20° E. of S. is of later date. One of these, near Corwen, presents some peculiar features, since its downthrow in some places is on the east and in others on the west. The lowest beds present are bluish slates, with numerous Bala fossils. These are succeeded immediately by the Corwen Grit of Prof. Hughes. No fossils have been found in this at Corwen; but in a grit occupying a similar position at Glyn Ceiriog numerous fossils have been discovered. The Corwen Grit is succeeded by grey slates with grit-bands; and in Nant Cawrddu, near Corwen, and Nant Llechog, near Pen-y-glog, these slates are followed by banded black shales containing numerous graptolites of the *Monograptus gregarius*-zone. Above these are pale bluish slates; and nothing further is exposed till we reach the Tarannons. The Corwen Grit clearly forms the base of the Llandovery in this area, as suggested by Prof. Hughes. Some remarks were made on this paper by the President, Prof. Hughes, Mr. Groom, and Prof. Lapworth. Mr. Lake briefly replied.

Zoological Society, May 16.—Osbert Salvin, F.R.S., Vice-President, in the Chair.—Extracts were read from a letter

addressed to Prof. Newton, F.R.S., by Prof. E. C. Stirling, of Adelaide, respecting the recent discovery of a large series of remains of *Diprotodon*, *Phascolomys*, and other Mammals at Lake Mulligan, in South Australia, about 600 miles north of Adelaide. It was anticipated that when these remains were received and examined very important additions to our knowledge of the extinct Mammal-fauna of Australia would follow.—Mr. Beddard, F.R.S., read a paper upon the structures termed "atrium" and "prostate" in the Oligochætous worms, in which reasons were given for believing that all these structures were reducible to one common plan.—Mr. G. B. Sowerby read the descriptions of fifteen new species of shells of the family Pleurotomidæ from different localites.—A communication was read from Mr. A. H Everett, containing a revised list of the Mammals inhabiting the Bornean group of Islands, that is, Borneo, and Palawan, which, as Mr. Everett had shown in a previous paper, belongs zoologically to Borneo.—Mr. O. Thomas read a paper containing an account of a second collection of Mammals sent by Mr. H. H. Johnston, from Nyasaland. The present series (collected, like the former, by Mr. Alexander Whyte), consisted of about 75 specimens, referable to 30 species, of which a large proportion were additional to the fauna of Nyasaland.—Dr. P. Sonsino, of Pisa, read some notes on specimens of parasitic worms of the genus *Distomum*, of which he had lately examined specimens.

Royal Meteorological Society, May 17.—Dr. C. Theodore Williams, President, in the chair.—The following papers were read:—Mean daily maximum and minimum temperature at the Royal Observatory, Greenwich, on the average of the fifty years from 1841 to 1890, by Mr. W. Ellis. The author gives tables of the mean maximum and mean mimimum temperature of the air on each day of the year, and also tables showing the daily range of temperature and the mean of the daily maximum and minimum values.—Suggestions, from a practical point of view, for a new classification of cloud forms, by Mr. F. Gaster. The forms assumed by clouds at different levels and under various conditions have recently received considerable attention from meteorologists. The author, however, does not approve of the nomenclatures and classifications which have been proposed, as, in his opinion, they appear to be little, if any, better than the older ones they were intended to replace. He now proposes a somewhat different classification, arranging the clouds according to altitude under the following headings:—(1) Surface clouds, or those which appear commonly between the earth's surface and a level of about 2000 feet; (2) Lower medium clouds, including all varieties which usually float at an elevation ranging from 2000 to about 10,000 feet; (3) Higher medium clouds, or those commonly found at altitudes varying from 10,000 to about 22,000 feet; (4) Highest (or cirriform) level clouds, or those at elevations exceeding 22,000 feet. The author gives the names of each variety of cloud included in the classification, together with an account of the principal characteristics of each as far as appearance goes.—Notes on winter, by Mr. A. B. MacDowall. In this paper the author discusses the question of periodicity in winter at Greenwich and Paris, and the relation of summers to winters.

PARIS.

Academy of Sciences, May 23.—M. Lœwy in the chair.—The Permanent Secretary announced the death, at Berlin, of Herr Kummer, Foreign Associate, and M. Hermite gave a review of the work of the celebrated geometrician. Herr G. Wiedemann was elected correspondent for the section of physics, in the place of Herr W. Weber, deceased.—On the kinetic theory of gases, by M. H. Poincaré. A correction of Maxwell's proof of the law of adiabatic expansion.—Note by M. Berthelot, accompanying the presentation of his work, "On the Chemistry of the Middle Ages."—On some rare or new natural phosphates; brushite, minervite, by M. Armand Gautier. A new lime and alumina phosphate was found among the concretionary phosphates of the *Grotte de Minerve*. Microcrystalline like most of these substances, soluble in dilute mineral acids, in weak potash lie, and in alkaline ammonium citrate, except a slight clayey residue, it has a different composition from the other natural aluminium phosphates, and has been called Minervite to recall its place of discovery.—Determination of the water contained in soil carrying various crops after a period of great drought, by M. Reiset.—Observation of the total solar eclipse of April 16, 1893, made at Joal (Senegal), at the observatory of the expedition of the Bureau des Longitudes, by M. G. Bigourdan.—On the investigation of the solar corona apart from total eclipses, by M. H. Deslandres.—On a highly sensitive manometric apparatus, by M. Villard.—The heat spectrum of fluorspar, by M. E. Carvallo.—Dynamical phenomena due to the residual electrification of dielectrics, by M. Charles Borel.—On chloroborate of iron and on a method of preparing chloroborates isomorphous with boracites, by MM. G. Rousseau and H. Allaire. The method consists in letting a volatilised metallic chloride act at a red heat upon natural calcium borate or upon borosodiocalcite. In the case of iron, the product obtained corresponds sensibly to that of a boracite in which the magnesium has been replaced by iron, according to the formula $6FeO.8B_2O_3.FeCl_2$. The chloroborate of iron crystallises in transparent cubes of a greyish colour, which act upon polarised light. This optical property shows that these crystals, like those of natural boracite, present a pseudo-cubic symmetry. They dissolve slowly in nitric acid and are rapidly disintegrated by fused alkaline carbonates.—On the heat developed in the combination of bromine with some unsaturated substances of the fatty series, by MM. W. Louguinine and Irv. Kablukov. Calorimetric determinations carried out in the cases of trimethylethylene, hexylene, diallyl, allyl alcohol, and allyl bromide led to the following conclusions: The heat developed by their combination with bromine increases as one proceeds upwards in the homologous series. The presence of an atom of Br replacing H in the unsaturated hydrocarbons mentioned, considerably reduces the rapidity of the addition reaction of the bromine. In presence of the OH group the addition reaction ceases to be sharply defined and is accompanied by a substitution reaction.—On licarhodol derived from licareol, by M. Ch. Barbier.—Action of sodium sulphite upon the amidophenol salts; new method of obtaining amidophenols from their salts, by MM. Aug. Lumière and A. Seyewetz.—Ptomaïn extracted from urines in eczema, by M. A. B. Griffiths.—On δ-achroglobine, a respiratory globuline contained in the blood of certain Mollusca, by M. A. B. Griffiths. In addition to the α-achroglobine extracted from the blood of Patella, the β variety from the Chitons, and the γ variety from the Tunicata, a fourth variety, δ-achroglobine, has been discovered in the blood of certain species of Doris. 100 grammes of this substance absorb 125 cc. of oxygen at 0° and 760 mm. Its empirical formula is $C_{659}H_{792}N_{165}SO_{153}$.—On the Plankton of the northern lagoon of Jan Mayen, by M. G. Pouchet. The island of Jan Mayen possesses two lagoons formed by fresh water due to the melting of the glaciers, and separated from the sea by narrow dykes of sand and shingle. The southern lagoon is of recent date. At the time of discovery it was an open bay. The northern lagoon was explored by the steamer *La Manche* in July 1892. By means of a fine net the central portion was tested for any surface life (Plankton) that might have escaped the Austrian expedition, which had failed to discover any. As the result of prolonged work a few species were found, including a Conferva, Infusoria allied to Paramecium and Actinophrys, a Tardigrade, a Copepod, and numerous Rotifers.—Dimorphism in the development of hemosporidia, by M. Alphonse Labbé.—On the scented mists observed on the coasts of the Channel, by M. S. Jourdain. These mists occur in spring under a north-east wind, and usually in the morning. The appearance is that of a bluish-grey vapour, and the smell that of lime-kilns. The air is very dry while they last. The author thinks that they are cosmic, not local phenomena.

BERLIN.

Physiological Society, May 5.—Prof. du Bois Reymond, President, in the chair.—Dr. Schmidt spoke on the colour-reactions of the excreta, whereby the mucin exhibits certain very characteristic and distinctive differences, as compared with proteids.—Prof. Fritsch exhibited a number of lantern slides of the electric organs of Torpedo, Malapterurus, and Gymnotus, by which he had determined the structure of the giant ganglia, the axis cylinders which arise from these and are distributed to the electric organ and the protoplasmic prolongations, which either form a means of connection between neighbouring ganglia, or else resolve themselves into an anastomosing network.—Dr. Benda also exhibited projections of micro-photographs, in linear magnification of 2000 to 3000 diameters, of the testis of Salamanders in illustration of the formation and fate of the karyokinetic nuclear rods.

Meteorological Society, May 9.—Dr. Vettin, President, in the chair.—Prof. Hellmann presented the two first numbers of reprints of important papers on meteorology and terrestrial magnetism, which he is publishing with the support of the German Meteorological Society and the branch society in Berlin. No. 1 is a *fac-simile* of the earliest German work on meteorology: Weather-book by Rynmann, dated 1510. No. 2 is also a *fac-simile* of Bl. Pascal's celebrated research by which the existence of atmospheric pressure was first determined.—Prof. Börnstein spoke on the most recent theories as to thunderstorms, of which none supply a definite solution of the problems involved, and explained a simple form of apparatus by Elster and Geitel, in Wolfenbüttel, by means of which anybody can make observations on atmospheric electricity, and invited the co-operation of the members.—Dr. Kremser gave some notes on the dryness of last April. Whereas the average fall in Prussia for April is 30 to 50 mm., the fall for last month was only 10 mm. in the extreme east, falling to 1 mm. in the central region, and to 0 mm. in the west and south-west. In Berlin a measurable amount of rain fell on only one day, the 17th, amounting to 0·5 mm., so that this month was the driest recorded since observations were first made in Berlin. Up to the present time the driest month had been October, 1865, with a fall of 1 mm. The period of drought began as early as March 21 or 22, and in many parts of Prussia had lasted for forty days, being accompanied by absence of clouds and marked temperature amplitudes of 10° to 18°.—Dr. Less gave an account of the barometric conditions over Europe during the drought. They may be divided into three periods. In the first, at the end of March and beginning of April, the highest pressure lay over France and Germany, the lowest over Russia as far as the Ural Mountains. In the second period, the middle of April, the area of high pressure had moved over towards England, while the lowest pressure had extended to the centre of Germany. In the third period a flat area of lowest pressure situated over the Atlantic had driven the area of highest pressure once more towards central Europe.—Prof. Börnstein exhibited samples of the material used in the construction of the recently-destroyed balloon "Humboldt." This balloon had become ignited, accompanied by a violent explosion, while being emptied, without any definitely ascertainable cause. The speaker demonstrated how readily the outer surface of the material could be electrified by friction, and suggested that electricity had thus been generated, and had, as a spark-discharge, ignited the gas as it escaped. This source of danger could probably be removed by placing a few long metallic wires round the valve.

DIARY OF SOCIETIES.

LONDON.

THURSDAY, JUNE 1.

ROYAL SOCIETY, at 4.30.—On the Colour of Sky-light, Sun-light, Cloud-light, and Candle-light: Captain Abney, F.R.S.—Flame Spectra at High Temperatures; Part I., Oxyhydrogen Blowpipe Spectra: Prof. Hartley, F.R.S.—Note on the Flow in Electric Circuits of Measurable Inductance and Capacity; and in the Dissipation of Energy in such Circuits: A. W. Porter.—On the Metallurgy of Lead: J. B. Hannay.—On the Motion under Gravity of Fluid Bubbles through Vertical Columns of Liquid of a Different Density: F. T. Trouton.

LINNEAN SOCIETY, at 8.—On Polynesian Plants collected by J. J. Lister: W. B. Hemsley, F.R.S.—On the Anatomy of a New Plant—Melastomaceæ or Gentianaceæ, Genus Novum: Miss A. Lorrain Smith.—Observations on the Temperature of Trees made in Boulder, Colorado: Dr. Baur.

CHEMICAL SOCIETY, at 8.—Azo-Compounds of the Ortho Series: Prof. Meldola, F.R.S., E. M. Hawkins, and F. B. Burls.—The Fluoresceïne of Camphoric Anhydride: Dr. Collie.—The Action of Phosphoric Chloride on Camphene: J. E. Marsh and J. A. Gardner.—The Composition of Jute produced in England: A. Pears, jun.

ROYAL INSTITUTION, at 3.—The Geographical Distribution of Birds: Dr. R. Bowdler Sharpe.

FRIDAY, JUNE 2.

GEOLOGISTS' ASSOCIATION, at 8.—Consideration of the Principal Phenomena connected with Volcanoes: Dr. J. W. L. Thudichum.

ROYAL INSTITUTION, at 9.—Study of Fluid Motion by Means of Coloured Bands: Prof. Osborne Reynolds, F.R.S.

SATURDAY, JUNE 3.

ROYAL INSTITUTION, at 3.—Falstaff—a Lyric Comedy by Boito and Verdi (with Musical Illustrations): Dr. A. C. Mackenzie.

INSTITUTE OF ACTUARIES, at 3.—Annual Meeting.—Report of the Council for the Past Year and Election of Officers and Members of Council.

MONDAY, JUNE 5.

SOCIETY OF CHEMICAL INDUSTRY, at 8.—The Movement of Air as applied to Chemical Industries: H. G. Watel.—New Cellulose Derivatives and their Industrial Applications: C. F. Cross and E. J. Bevan.

ROYAL INSTITUTION, at 5.—General Monthly Meeting.

TUESDAY, JUNE 6.

ZOOLOGICAL SOCIETY, at 8.30.—Notes on the Anatomy and Classification of the Parrots: F. E. Beddard, and F. G. Parsons.—On Two Horns of an African Rhinoceros: Mr. Sclater.—On some Bird-Bones from Miocene Deposits in the Department of Isère, France: R. Lydekker.—On the Osteology of the Mesozoic Ganoid Fish, Lepidotus: A. Smith Woodward.

ROYAL INSTITUTION, at 3.—The Waterloo Campaign: E. L. S. Horsburgh.

WEDNESDAY, JUNE 7.

GEOLOGICAL SOCIETY, at 8.—The Bajocian of the Sherborne District; its Relations to Subjacent and Superjacent Strata: S. S. Buckman.—On Raised Beaches and Rolled Stones at High Levels in Jersey: Dr. Andrew Dunlop.

THURSDAY, JUNE 8.

ROYAL SOCIETY, at 4.30.

MATHEMATICAL SOCIETY, at 8.—Complex Integers derived from $\theta^3-2=0$: Prof. G. B. Mathews.—Pseudo-Elliptic Integrals: Prof. Greenhill, F.R.S.

ROYAL INSTITUTION, at 3.—The Geographical Distribution of Birds: Dr. R. Bowdler Sharpe.

FRIDAY, JUNE 9.

PHYSICAL SOCIETY, at 5.—A New Photometer: A. P. Trotter.—Notes on Photometry: Prof. S. P. Thompson, F.R.S.—The Magnetic Field near a Wire: Prof. G. M. Minchin.

ROYAL ASTRONOMICAL SOCIETY, at 8.

ROYAL INSTITUTION, at 9.—The Recent Solar Eclipse: Prof. T. E. Thorpe, F.R.S.

SATURDAY, JUNE 10.

ROYAL BOTANIC SOCIETY, at 3.45.

ROYAL INSTITUTION, at 3.—Falstaff, a Lyric Comedy by Boito and Verdi (with Musical Illustrations): Dr. A. C. Mackenzie.

BOOKS, PAMPHLETS, and SERIALS RECEIVED.

BOOKS.—Year-Book of the Scientific and Learned Societies of Great Britain and Ireland (Griffin).—Graphic Arithmetic and Statics: J. J. Prince (Murby).—Erdbebenkunde: Dr. P. Hoernes (Leipzig, Veit).—Introduction a L'Electricité Industrielle—Potential, Flux de Force Grandeurs Electriques; Ditto, Circuit Magnétique à Induction Machines: P. Minel (Paris, Gauthier-Villars).—The Theory of Telescopic Vision: E. M. Nelson (Dulau).

PAMPHLETS.—Wetterbüchlein von Wahrer Erkenntniss des Wetters: L. Reynman (Berlin, Asher).—Récit de la Grande Expérience de l'Equilibre des Liqueurs: B. Pascal (Berlin, Asher).—The New Priesthood: Ouida (E. W. Allen).

SERIALS.—Bulletin of the New York Mathematical Society, vol. 2, No. 8 (New York, Macmillan).—Internationales Archiv für Ethnographie, Band 6, Heft 2 (K. Paul).—Bulletins de la Société d'Anthropologie de Paris, tome troisième, iv. série, 4e Fasc.; Ditto, Nos. 2, 3, 4 (Paris, Masson).

CONTENTS.