

the scale at a metre's distance was obtainable with a current of 0'000,000,0005 of an ampere. At present, under such circumstances, a similar deflection would be obtained with 0'000,000,000,0012 ampere, that is to say, the apparatus is about 400 times as sensitive as it was when first described.

At present the bolometric apparatus, under the conditions already cited, will indicate a change of temperature in its strips of, at any rate, much less than one-ten-millionth of one degree Centigrade.
S. P. LANGLEY.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

MRS. PHEBE HEARST has offered to erect for the University of California a new building for the School of Mines.

DRAUGHTSMEN and engineering students familiar with the principles of the science of steam, are given opportunity of advancing their knowledge by a special class in steam-engine trials which will commence at the South-Western Polytechnic, Chelsea, on May 17, and terminate on June 28. The class will be conducted by Mr. W. W. F. Pullen and Mr. H. A. Clark.

THE trustees of Cornell University have just established a Medical Department and a State College of Forestry. The medical department will be situated in New York City, and its faculty will be made up principally of those surgeons and physicians who have heretofore been connected with the medical department of New York University; including all but three of the instructors of that department. The endowment of the new medical school is by a donor whose name is not disclosed. The College of Forestry established by Cornell University will be situated at Ithaca, and called the State College of Forestry, having been authorised and endowed by the State with a grant of 10,000 dollars by the legislature which adjourned a few days ago. Prof. Bernard E. Fernow, director of the United States Division of Forestry, has been made director of this department.

ONE of the most important educational problems at the present time refers to the coordination of the work of the University and Technical Colleges with that of other educational institutions in the neighbourhood. It is unfortunate that in several cities the educational institutions are competing with one another instead of working together as an organic whole, in which each part has a definite function to perform. Efforts are, however, being made in the large provincial centres to prevent the undesirable overlapping which at present exists, in order to make the various educational institutions complement each other's work without competition. Summaries of what has been done in this regard at Birmingham, Manchester, Plymouth, and Sheffield appear in the current number of the *Record of Technical and Secondary Education*. In Birmingham, though no formal machinery exists for the coordination of educational work, the various institutions have adapted their organisation to the circumstances of their environment, supplying any need that was felt, and avoiding duplication of function. An educational ladder has, in fact, been constructed, up which a boy may climb from the Board School to the highest University honours without exciting the jealousy of other schools than those which he attended. This event actually occurred last year, when Mr. W. H. Austin, who began his education at a Birmingham Board School, came out Senior Wrangler at Cambridge. In Manchester the provisions for coordination take the form of an agreement between the Technical Instruction Committee of the City Council and the School Board, and between the authorities of Owens College and the Manchester and Salford Technical Schools. As between Owens College and the Technical Schools it is arranged that the latter shall aim at demonstrating how the general principles of science and art may be applied to the advancement of trade and industry, whilst the college will eschew these obviously bread-and-butter subjects, and address itself to the higher walks of pure science. In Plymouth, also, a scheme has been arranged which correlates and connects the whole of the science and art teaching of the town, from the infant school upwards. In Sheffield a scheme which secures the effective coordination and economical management of the Board Schools, the Technical School, and the School of Art, has been at work since last September, and appears to give entire satisfaction to all concerned; and Bradford has just taken steps to grade its various educational forces. Through all the schemes one main principle runs—that, namely, of making the common schools, Primary and Secondary, the kindergarten and nursery of science and art, and of making the Technical Schools true to

their name as the places where is taught the application of science and art to the purposes of industry and commerce, while to the University Colleges are allocated the higher scientific studies. These examples should encourage other county boroughs to consider and adopt educational schemes which will prevent waste of effort and do away with conflicting interests.

SOCIETIES AND ACADEMIES.

LONDON.

Physical Society, April 22.—Mr. Shelford Bidwell, F.R.S., President, in the chair.—A paper by Prof. T. C. Porter, on a method of viewing Newton's rings, was read by Prof. S. P. Thompson. If a parallel beam of light from a rectangular slit falls at oblique incidence upon a plane plate of glass, the first two reflections occur at the upper and lower surfaces of the glass, respectively, and give two corresponding images that may be formed on a screen. If now a second glass plate is added below the first, and parallel to it, at a short distance, four images of the slit appear on the screen. But when the lower plate is brought into contact with the upper one, the reflection from the lower surface of the upper plate follows the same path as that from the upper surface of the lower plate, so that only three images are now to be distinguished. For the two glass plates the author substitutes a "Newton's rings" apparatus, and by the above device for eliminating a set of reflections he is able to restrict the illumination to the light that comes from the two interior surfaces. As thus observed, the colours of the rings are very brilliant. When the plates are very clean, the darkest area of the "black" spot has a sharply-defined edge, similar to that of the black film of a soap-bubble. By using monochromatic light, the various sets of rings may be photographed; they appear as several systems of concentric circles, the systems intersecting one another. This method of illumination by a slit, enables Newton's rings to be viewed free from all light except that due to reflections at the bounding surfaces of the air-space between the plates. It reveals to the eye the subordinate interference-systems that coexist with the primary rings, and it demonstrates which of these reflections must be taken into account in the theory of the phenomenon. Moreover, it supplies a means for analysing these systems, and it indicates that the interference of monochromatic light is never complete under these circumstances. Prof. Herschel said it was rather difficult to follow the arguments of the author without witnessing the phenomena. Much complication was introduced by the successive reflections; it was not clear what became of them. There was no doubt as to the advantage of a narrow slit for the illumination. He thought some of the secondary reflections might be got rid of by using plates that were slightly prismatic. Prof. Thompson had, in his own laboratory, verified the advantages of the author's method of illumination. The result was a very sharply-defined first system of rings. Curves of subordinate interference were easily to be observed by this arrangement. Prof. Boys noticed in the photograph of the ring-systems that the independent systems of bands were distorted at the points of intersection. The intersecting curves formed a sort of honey-comb, or hexagonal system, instead of a system of curvilinear quadrilaterals. This distortion reminded him of similar effects observed in the photographs of "ripples." Mr. Edser said he had often noticed similar distortions, but he had always been able satisfactorily to explain them as being the result of imperfect focussing. The author had referred to the fact that a thin film when viewed by reflected light appears black. A phase-change of half a wave-length takes place either on reflection at a rarer, or at a denser medium; but there is no information from which to decide between these two alternatives. The truth of the assumption that the phase-change occurs at the denser medium seems to depend, so far as experimental evidence is concerned, upon the observation that in Lloyd's bands the central one is black. To produce the Lloyd's bands only one mirror is used; the bands produced by Fresnel required three mirrors. Wernicke performed an interesting series of experiments in which white-light reflected for various angles of incidence from a thin sheet of glass was examined spectroscopically. The spectrum was crossed by numerous black bands, and from the position of these bands in the spectrum the thickness of the glass was calculated. The calculated thickness when the angle of incidence was great, differed from that obtained with small angles of incidence; the conclusion was that when light is internally reflected, even at an angle of incidence less than the angle of

total reflection, a phase-change is produced. If the space between the two plates in Prof. Porter's experiment were filled with a substance of higher refractive index than glass, a confirmation, or otherwise, of this result might be obtained.—Dr. S. P. Thompson then exhibited a model apparatus made by the Helios Company to illustrate the three-phase method of transmitting power. It consists of a small generator, driven by hand, and a small motor. The generator may be separately excited by a secondary battery; it has three independent coils. The six ends of the coils are connected to six commutator rings. The motor has three corresponding pairs of opposite coils; these can be grouped in various ways for connection to the brushes of the generator. The six coils are on a hinged frame, so that, if necessary, they can be laid down flat, for other rotation experiments. Two armatures are provided, either of which may be used. The first is an iron wheel with peripheral copper bars arranged like a squirrel-cage; the other is a simple iron disc without added conductors.—The President proposed votes of thanks, and the meeting was adjourned until May 13.

Zoological Society, April 5.—Lieut.-Colonel H. H. Godwin-Austen, F.R.S., Vice-President, in the chair.—Prof. Sydney J. Hickson, F.R.S., read a paper on the species of corals of the genus *Millepora*. The author stated that thirty-nine species of the genus *Millepora* had been described. A prolonged investigation of the characters hitherto used for the determination of the species had proved them to be all unsatisfactory. An examination of the soft parts of a great many specimens of several forms of growth and from widely distant coasts had revealed no features that could be used for separating species. In the author's opinion, therefore, there was only one species of this genus now living, and that the individuals of this species were capable of assuming a great variety of form, according to the conditions in which they lived.—A communication was read by Mr. J. Stanley Gardiner containing an account of the perforate corals collected by him in the South Pacific. Fifty-one species were treated of, of which fifteen were described as new.—Mr. Oldfield Thomas read the description of a new Dik-dik allied to *Madoqua kirrkii*, but much larger, which had been obtained by Mr. H. S. H. Cavendish in the region of Lake Rudolf, and was proposed to be called *Madoqua cavendishii*.—Mr. R. Lydekker, F.R.S., made some remarks on the geographical races of the Banting (*Bos sondaicus*), and suggested that the Burmese and Manipur forms of this animal should be given subspecific rank, for which he proposed the respective names of *Bos sondaicus birmanicus* and *B. s. woodi*.

Entomological Society, April 6.—Mr. R. McLachlan, F.R.S., Vice-President and Treasurer, in the chair.—On behalf of Mr. Greenshields, Mr. Jacoby exhibited specimens of the longicorn beetle, *Micropsalis durnfordi*, Burm., from Patagonia. Mr. Greenshields, who was present, stated that this species, remarkable for the great development of the palpi, was originally taken by Darwin; his own examples were taken hiding in thorny bushes in a dry watercourse.—Mr. Champion exhibited European examples of *Harpalus fröhlichi*, a newly-discovered British species.—Mr. B. O. Bower showed living larvæ of *Caradrina ambigua*, an insect which had recently occurred in England in countless numbers. They were bred from ova laid by a female taken on the South Devon coast, and fed indiscriminately on low plants.—Mr. M. Burr read a paper supplementary to Mr. Green's previous communication on *Dyscritina*, and definitely referred the imago to the genus *Diplatys*, *D. longisetosa*, Westw., being a good species, and Mr. Green's new form proving to be *D. nigriceps*, Kirby.—Dr. Chapman read a paper on the larva of *Erioccephala allionella*, which he stated to be essentially similar to that of *E. calthella*, previously described by him.

Linnean Society, April 7.—Dr. A. Günther, F.R.S., President, in the chair.—Mr. J. E. Harting exhibited specimens of the Asiatic partridge, *Pardix daurica*, of which a large consignment had been lately received in London. Mr. W. E. de Winton, who brought another specimen of this bird for exhibition, made some remarks on the geographical distribution of the species, and expressed the opinion that it had been improperly described by certain writers as Manchurian, its true habitat lying to the west of the Khinghan Mountains in Mongolia.—Mr. J. E. Harting also exhibited the skin and skull of a wild cat, *Felis catus*, recently obtained near Speanbridge, in Inverness-shire. He pointed out the present restricted range of the animal, which had not only disappeared entirely from England and Wales, but was no longer to be found in Scotland south of a

line drawn from Oban to Ben Lui, along the southern and eastern boundary of Perthshire, and thence northward to Nairn. He explained the cause of reversion in the colour of emancipated house-cats to the wild type of *Felis catus*; and referred to the skulls of cats which had been exhumed on the site of the Roman city of Silchester, which he thought disproved the view of the late Prof. Rolleston (*Journ. Anat. and Physiol.*) to the effect that the domestic cat was not known to the Romans.—Dr. G. Elliot Smith read a paper, entitled "A contribution towards a more exact knowledge of the anatomy of the brain in Edentata." A full account of the brain of *Orycteropus* was first given, and comparisons were instituted with that of a dozen species representative of the leading Edentate families, including *Manis* and *Chlamydomorphus*.—A paper was read by Mr. H. Farquhar, of Wellington, N.Z., on some New Zealand *Actiniaria*, in which he described a new genus, *Halcampactis*, and species *Halcampactis mirabilis*, together with the following new species: *Edwardia elegans* and *neo-zelandica*; *Corynactis Haddoni*, *mollis*, and *gracilis*; and *Actinia tenebrosa*. *Halcampactis mirabilis* he regarded as of special interest, since it appeared to form a link between the *Sagartidae* and *Halcampidae*, which had hitherto been widely separated by systematists.

Royal Meteorological Society, April 20.—Mr. F. C. Bayard, President, in the chair.—Major H. E. Rawson, R.E., read a paper on anticyclonic systems and their movements. Cyclones and anticyclones have long been recognised as powerful weather controls, and their movements studied, but up to the present very little has been written in this country upon the progressive movements of the cores of the permanent high-pressure areas which are found to be associated with certain localities at different times of the year. The author referred to previous investigations by Abercromby, Scott, Loomis, H. C. Russell, and Buchan, and then proceeded to give the results of an examination which he had made of all the available synoptic weather charts for the eleven years 1881 to 1891. During this period there were 212 cases in which the centre or core of an anticyclonic system was over the British Isles, and of these 130 were due to the Atlantic system, 41 to the Scandinavian, and 17 to the Greenland, 22 to the Atlantic and Scandinavian systems extending and merging together, and 2 to the same thing occurring in the case of the Atlantic and Greenland systems. It is thus evident that we owe the greatest number of our anticyclones to the Atlantic system. They occur in all months, but more especially in January, June and October, and are least frequent in April and November. When such anticyclones move away from our area the direction is very much influenced by the season of the year, by far the largest number drift off in some direction between north-east, through east to south, and take the more southerly course in December, January and February. Some few between April and July move west or south-west, and still fewer north or north-west.—The Hon. F. A. Rollo Russell described the results of observations which he had made on haze and transparency during 1897. He found that the greatest clearness occurred with winds from the westward, and the least clearness with winds from the eastward. The highest mean visibility was 24 miles with the west winds, and the lowest mean visibility was 10.6 miles with north-east winds.

PARIS.

Academy of Sciences, April 18.—M. Wolf in the chair.—Expression of tidal coefficients by means of a sum of periodic terms, by M. Hatt.—On the reduction of double integrals of algebraic functions, by M. Émile Picard.—On some derivatives of tetra-methyl-diamido-benzophenone, by M. E. Grimaux. The dinitro- and dibromo-derivatives are described, and colouring matters produced from them.—Sugar and fat from the point of view of their respective nutritive value, by M. A. Chauveau. In these cases the subjects under experiment were kept at rest; the results were similar to those obtained in the previous experiments, the sugar diet being always superior to the thermally corresponding fat diet.—The committees were nominated for awarding in 1898 the prizes bearing the names of Wilde, Vaillant, Desmazières, Montagne, La Fons-Melicocq, Thore, Savigny, Montyon (medicine and surgery), Bréant, and Godard.—On the ellipsoid of Jacobi, by M. P. S. Krüger.—On the motion of a heavy body of revolution; suspended from a point on its axis, by M. E. Jahnke.—On the potential functions of the theory of elasticity, by MM. Eugène and François Cosserat.—On the transport of luminous

variations by means of a wire conducting electricity, by M. Dussaud. An application of the selenium cell.—On the influence of self-induction in the explosion by the electric spark of mixtures of marsh gas with air, by MM. H. Couriot and J. Meunier.—Influence of temperature upon chemical reactions, by M. Albert Colson. An experimental study of the effect of temperature upon the velocity of absorption of hydrogen sulphide by orthophosphate and pyrophosphate of silver, zinc phosphate, and copper phosphate.—On the ammoniacal bromides of silver, by M. Jarry. By the action of liquid ammonia upon silver bromide the two compounds $2\text{AgBr} \cdot 3\text{NH}_3$ and $\text{AgBr} \cdot 3\text{NH}_3$ are formed, the dissociation pressures of which were measured.—On the phosphoric ethers, by M. J. Cavalier. Monomethyl- and monoallyl-phosphoric ethers were prepared and their behaviour towards indicators examined. The results were analogous to those given by the corresponding ethyl ether. A table is given showing the heats of neutralisation of the three ethers by various bases.—On the alkaline sulphantimonites, by M. Pouget. The sodium sulphantimonites are formed under conditions analogous to the potassium compounds; they differ from the latter, however, by the facility with which they undergo oxidation to sulphantimonates.—General reaction of ethylenic hydrocarbons; corresponding mercuric combinations, by M. G. Denigès. By treatment with acid mercuric sulphate, all ethylenic compounds (except ethylene itself) give yellow compounds of the formula $(\text{HgSO}_4 \cdot \text{HgO})_n \text{R}''$, where R'' represents the hydrocarbon. Compounds of propylene, butylene, and amylene are described.—Heat of formation of some quinones of high molecular weight, by M. Amand Valeur. The quinones used were: α -naphthoquinone, β -naphthoquinone, anthraquinone, phenanthrenequinone, and retenequinone; the results are compared with α - and β -naphthols, new data for which are given.—Heats of neutralisation of ethylphosphoric acid, by M. G. Belugou.—New synthesis of 3,3-di-methyl-1,5-pentanedioic acid, by M. F. E. Blaise.—Spectrum analysis of non-conducting substances by fused salts, by M. A. de Gramont. The finely-powdered mineral is fused with either lithium carbonate, boric acid, or potassium bisulphate, the first for preference, and the sparks passed through the molten mass.—On the functions of cerebral hypophysis, by M. E. de Cyon. The slightest pressure upon the hypophysis is immediately followed by a sudden variation in the blood pressure, and by a marked decrease in the number of heart beats per minute.—Effects upon man and mice of the inoculation of a pyogenous Tricophyte, by MM. Sabrazès and Brengues.—The parasites of cancer and of sarcoma. Coloration, structure, cycles of reproduction, and dimorphism, by M. F. G. Bosc.—Contribution to the study of direct cellular division; its anomalies and functional value, by M. Joannes Chatin.—On the Annelids collected by the expeditions of the *Travailleur* and *Talisman*, by M. Louis Roule.—On a cavity in the integument serving in the *Myrmicine* to spread out a secretion product in contact with air, by M. Charles Janet.—Variations, in four phases, of the pressure and of the two mean components of the wind on the meridian of the sun and its orthogonal, by M. A. Poincaré.—Influence of the movements of the moon on the oscillations of the atmosphere, by M. P. Garrigou-Lagrange.

DIARY OF SOCIETIES.

THURSDAY, APRIL 28.

ROYAL SOCIETY, at 4.30.—On the Meteorological Observatories of the Azores: H. S. H. the Prince of Monaco.—A Compensated Interference Dilatometer: A. E. Tutton.—Observations on the Action of Anesthetics on Vegetable and Animal Protoplasm: Dr. Waller, F.R.S., and Prof. Farmer.—A Calorimeter for the Human Body: Dr. Marcet, F.R.S.—An Experimental Inquiry into the Heat given out by the Human Body: Dr. Marcet, F.R.S., and R. B. Floris.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.

FRIDAY, APRIL 29.

ROYAL INSTITUTION, at 9.—Magneto-Optic Rotation and its Explanation by a Gyrostatic Medium (with Experimental Illustrations): Prof. A. Gray, F.R.S.

INSTITUTION OF MECHANICAL ENGINEERS, at 7.30.—Steam Laundry Machinery: Sidney Tebbutt.

MONDAY, MAY 2.

SOCIETY OF ARTS, at 8.—The Electric Locomotive: Prof. Carus Wilson.

SOCIETY OF CHEMICAL INDUSTRY, at 8.—Self-intensive Refrigeration of Gases, Liquid Air and Oxygen: Dr. W. Hampson.

VICTORIA INSTITUTE, at 4.30.—British Submerged River Valleys: Prof. Hull, F.R.S.

TUESDAY, MAY 3.

SOCIETY OF ARTS, at 8.—Senefelder and the Centenary of Lithography, 1798-1898: Joseph Pennell.

ZOOLOGICAL SOCIETY, at 8.30.

NO. 1487, VOL. 57]

WEDNESDAY, MAY 4.

SOCIETY OF ARTS, at 8.—The Revival of Hand-loom Weaving: Miss Clive-Bayley.

GEOLOGICAL SOCIETY, at 8.—The Carboniferous Limestone of the Country around Llandudno: G. H. Morton.—On the Graptolite-Fauna of the Skiddaw Slates: Miss G. L. Elles.

ENTOMOLOGICAL SOCIETY, at 8.

THURSDAY, MAY 5.

ROYAL SOCIETY, at 4.30.

LINNEAN SOCIETY, at 8.—On some Spitsbergen Collembola: Sir John Lubbock, Bart., M.P., F.R.S.—On the Structure and Development of *Soranthera*: Miss Ethel Barton.—The Species, the Sex, and the Individual: J. T. Cunningham.

CHEMICAL SOCIETY, at 8.—The Reactions of the Carbohydrates with Hydrogen Peroxide: C. F. Cross, E. J. Bevan, and Claud Smith.—The Properties and Relationships of Dihydroxytartaric Acid, Part II.: H. J. H. Fenton.—The Affinity Constants of certain Hydroxy-acids: S. Skinner.—Molecular Weights in Solution of Permanganates, Perchlorates, and Periodates: J. Murray Crofts.

FRIDAY, MAY 6.

ROYAL INSTITUTION, at 9.—Living Crystals: Edward A. Minchin.

GEOLOGISTS' ASSOCIATION, at 8.—Notes on Skye: Horace B. Woodward, F.R.S.—Observations in Lapland: Aubrey Strahan.

SATURDAY, MAY 7.

GEOLOGISTS' ASSOCIATION.—Excursion to Hillmorton and Rugby. Director: Beeby Thompson.

BOOKS, PAMPHLET, and SERIALS RECEIVED.

BOOKS.—Domestic Science Readers: V. T. Murché, Book vii. (Macmillan).—Flower Favourites: L. Deas (Allen).—A Century of Vaccination Dr. W. S. Tebb (Sonnenschein).—Maryland Geological Survey, Vol. 1 (Baltimore).—Iowa Geological Survey, Vol. vi. (Des Moines).—Magnetismo e Ipnatismo: Dr. G. Belfiore (Milano, Hoepli).—Museums Association, Report of Proceedings &c., at the Eighth Annual Meeting held in Oxford, July 6 to 9, 1897: edited by J. Paton (Dulau).—Handbook of Jamaica, 1898 (Stanford).

PAMPHLET.—Das Physikalisches-Chemische Institut der Universität Leipzig und die Feier seiner Eröffnung am 3. Januar 1898: Prof. Dr. W. Ostwald (Leipzig, Engelmann).

SERIALS.—Journal of Anatomy and Physiology, April (Griffin).—Journal of the Chemical Society, April (Gurney).—Quarterly Review, April (Murray).—Home University, April 15 (West).—American Journal of Mathematics, Vol. xx. No. 2 (Baltimore).—Journal of the Marine Biological Association of the United Kingdom, April (Dulau).—Himmel und Erde, April (Berlin, Paetel).—Bulletin de l'Académie Royale des Sciences, &c., de Belgique, 1898, No. 3 (Bruxelles).—Wide World Magazine, April (Newnes).

CONTENTS.

	PAGE
Bacteriolysis of Sewage. By G. S. W.	601
Science and Art of Building	602
A German Popular Astronomy. By W. E. P.	604
Our Book Shelf:—	
Préaubert: "La Vie: Mode de Mouvement."—	
F. A. D.	605
Cordeiro: "The Barometrical Determination of	
Heights"	605
Randolph: "Laboratory Directions in General	
Biology"	606
Jones: "The Freezing-Point, Boiling-Point, and	
Conductivity Methods"	606
Wright: "Philip's Artistic Fruit Studies"	606
Dixon: "Philip's Artistic Animal Studies"	606
Letter to the Editor:—	
"The Story of Gloucester."—Alex. Wheeler	606
Röntgen Rays and Ordinary Light. By Lord	
Rayleigh, F.R.S.	607
The Bakerian Lecture. By Dr. W. J. Russell,	
V.P.R.S.	607
Andrée's Balloon Expedition. (Illustrated.) By	
Dr. Hugh Robert Mill	609
The Beneke Prizes	610
Notes.	611
Our Astronomical Column:—	
Astronomical Occurrences in May	617
Double and Multiple Southern Stars	617
Comet Perrine	617
The Manora Observatory	617
The Harvard College Observatory	617
The Nature and Habits of Pliny's Solpuga. (Illustrated.)	
By R. I. Pocock	618
The Laboulbeniaceæ: a New Field of Study	
among Fungi. By R. W. P.	620
The Bolometer. By Prof. S. P. Langley	620
University and Educational Intelligence	622
Scientific and Academies	622
Diary of	624
Books, Pamphlets, and Serials Received	624