SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, March 4.—"Luminosity and Photometry.' By John Berry Haycraft, M.D., University College, Cardiff.

The luminosity of the spectrum was determined by the method of the "minimal effective stimulus," the portions of the spectrum investigated being as a physical quantity reduced in amount until its effect on the visual apparatus was just apparent. The luminosity was also determined by the "flickering" method. A rotating semi-disc periodically cut off the spectral ray, and produced flickering, which flickering disappeared after a certain speed of rotation had been reached: the speed of this rotation was taken as a measure of the luminosity. The curves obtained by these methods agreed with each other and with curves obtained by methods of "inspection" used by Abney and König. The curves obtained with the dark adapted eye—the observer was kept in a dark room during and for an hour before the experiment—gave a maximum in the green in the case of the minimal effective stimulus. With the light adapted eye—the room was whitewashed and lit by gas—the yellow of the spectrum was the most luminous. With the flicker method the curve of a spectrum of low physical luminosity has a maximum in the green, the curve of a spectrum of high luminosity in the yellow. Purkinje's phenomenon was also studied by the above methods, using coloured papers and a graduated gas-burner to vary the luminosity. The full paper will shortly appear in the *Journal of Physiology*.

Physical Society, March 26.—Mr. Shelford Bidwell, President, in the chair. At the invitation of Dr. S. P. Thompson, the meeting was held at the Technical College, Leonard Street, Finsbury. Mr. Rollo Appleyard read a paper on liquid coherers and mobile conductors, and showed the following experiments: (1) A glass tube, containing mercury and paraffin-oil, is shaken up until the mercury divides into small spheroids. The resistance of the chain of spheroids under these conditions is several megohms. Coherence can be brought about by a direct current, a spark, or by a Hertz oscillator. The coherence is visible, the spheroids forming into large globules. At the same time, the resistance falls to a fraction of an ohm. (2) An unstable emulsion is formed by shaking water and paraffin oil together, in a glass tube; called by the author a "rain" tube. The oil may be coloured with alkanet root. By electrification, the water suspended in the oil is suddenly precipitated in a shower through the oil, precisely as rain is precipitated in the air, after thunder. (3) A mixture of paraffin oil and water is poured into a photographic dish, just covering the bottom; and a little mercury is poured in. Any two separate globules of mercury in the dish are then connected by wires to a battery of about 200 volts, through a reversing-key. A momentary tap of the key causes instantaneous deformation of the mercury, especially of the globule connected to the negative pole. If the current is kept on, the negative globule sends forth a long tentacle of mercury across the dish to the positive globule. The tentacle may break into spheroids. Intermediate globules send forth "fingers" towards the positive terminal globule; and, by continued application of the current, the "fingers" link intermediate globules; illustrating the nature of liquid coherence. By using the current-reverser as a telegraphic transmitting-key, the motions, to right or left, of the "finger" of any stray globule may be interpreted to form the letters of the Morse code. By a succession of taps of the key in one direction or the other, a globule can be made to "caterpillar" along the dish. Prof. Ramsay said he had once attempted to facilitate churning by the application of 8 or 9 volts to some milk. He thought the cream came a little faster, but it turned sour very quickly. Prof. Fitzgerald thought that the effects observed in experiment (3) were the result of current, and not of electro-static changes, and he would like to know the value of the actual current used. There was no doubt that the motions were due to variations in capillarity. Mr. Shelford Bidwell asked how the mercury was formed into spheroids in the tube in experiment (1). Mr. Appleyard, in replying to Prof. Fitzgerald, said it was not easy to define the circuit, as the terminal-globules were rather capricious, but he would try and measure the current in some particular case. The mercury-tube in experiment (1) was shaken in a horizontal plane; the operation took about ten minutes. Equal volumes of mercury and oil was a good proportion. One-quarter of the length of the tube should be left as an air-space.—Prof. Dalby then exhibited five pieces of apparatus: (1) a kinematic slide, (2) an inertia apparatus with trifilar suspension, (3) a Wilberforce spring, (4) an Ewing's reading-telescope, (5) a kinematic Hook-gauge. Models (1), (2), (4), and (5) illustrated the various degrees of freedom of bodies restrained at different numbers of points. It was shown with (3), that in extending a spiral spring there results a certain amount of twisting. If a mass is hung at the lower end of the spiral in such a way that, when suddenly released after extension of the spring, the time of oscillation of the mass in the horizontal plane (rotation) is the same as the time of vertical oscillation, then the tendency to twist results in a change of energy which alternates between the rotary and linear forms. Mr. Boys drew attention to the conditions of restraint, and suggested a criterion for determining whether a piece of mechanism was designed for minimum strain on the structure: a thin wedge slipped under any one point of contact should not disturb the other points of restraint. Prof. Fitzgerald pointed out the effect of symmetry upon the motion of the spring of (5). The spiral happened to be an unsymmetrical form; the change of phase from vertical to rotary oscillation was therefore rapid. In the case of the vibration of a symmetrical stretched cord the change of phase would be very slow.—Dr. Thompson exhibited two kinematic models depending upon the principle that any simple harmonic motion may be considered as the resultant of two oppositely-directed motions. The first illustrates the synthesis of two opposite circular motions of equal period and amplitude to form a straight-line motion; the second shows the combination of two simple harmonic motions of equal period and amplitude in any difference of phase, to form a circular motion. In each case the motion is communicated to a stylus by a link-gear, operated by two wheels rotating in opposite directions. In the first apparatus, the wheels are pivoted about their centres, and the link-gear is pinned to one point on the flat surface of each wheel, near the circumference; in the second apparatus, the wheels rotate as eccentrics at 180° to one another, and the motion to the link-gear is communicated by thrust-rods, held by springs against the peripheries of the corresponding wheels. Dr. Thompson further exhibited a device for projecting, by lantern, the rotating magnet and copper disc, of Arago. The curious rotations and lateral movements of iron-filings, in a revolving magnetic field, were similarly projected on a screen. He also showed some experiments with a heat-indicating paint, made from a double iodide of copper and mercury, discovered twenty years ago by a German physicist. At ordinary temperatures the paint is red, but at 97° C. it turns black. If paper is covered with this substance, and then warmed at a stove, the change is effected in a few seconds. Various designs can be wrought upon the back of the paper in dead-black or gold, so that when warmed they appear in red or black on the front, according to their respective absorptive powers. Or local cooling by the hand will yield a silhouette. If the paper is allowed to cool, the silhouette vanishes, but it appears again when the paper is reheated. It has thus a kind of thermal "memory." A yellow double iodide of silver and mercury is even more sensitive. It changes from yellow to dark red at 45° C. Lastly, Dr. Thompson exhibited a kinematic model of Hertz-wave transmission. A row of lead bullets is suspended from strings, so that the bullets hang clear of one another by about an inch, in a right line. The strings are meshed, and herein the model differs from the well-known wave-models used in acoustics. If the attempt is made to send an acoustic form of wave through the system, by giving an impulse to the first bullet in the plane of the other pendulums, it fails immediately, owing to the slackening of parts of the meshes. Thus, only *transverse* vibrations can be transmitted. To illustrate the propagation of a Hertz-wave, a heavy pendulum, oscillating in a plane at right-angles to the line of bullets at one end, represents the Hertz "oscillator." A metal ring, mounted horizontally on a trifilar suspension, and properly "tuned," represents, at the distant end, the Hertz "resonator." Waves, formed by the transverse vibrations of successive bullets, are then propagated from end to end. Prof. Fitzgerald said the model was specially interesting as illustrating the difference in velocities of propagation of a given wave, and of the energy corresponding to it. The model did not accurately compare with ether, because in ether the rate at which the energy is propagated is the same as that of the wave. The difference of the two rates, for any medium, depended upon the "dispersion"

of the medium. By slight alteration of the pendulum-suspensions this dispersion might be made different at different parts of the model, and would then correspond to certain known cases of "anomalous dispersion." Or, again, it might be made to illustrate the theory of Helmholtz with regard to the vibrations of the molecules of glass; according to which, the vibration of the molecules alters the vibrations of the waves, so that dispersion occurs, and the energy is not propagated at the same rate as the waves themselves. It was shown by Michaelson that it was possible to have a medium in which the energy is propagated in one direction, and the wave in another. This was attained, in a magnetic model, by Ewing. The mesh apparatus indicated how a model could be made which should give out "harmonics" and "over-tones" very different from one another; where different wave-lengths would be propagated with different velocities, and the over-tones would correspond to the differences. Further, it indicated a mechanism for producing any desired spectrum; such, for instance, as that of hydrogen. A somewhat similar model had been designed by Glazebrook for illustrating the absorption-bands of a medium when the rate of vibration was the same as the free period of the vibrations of each of the molecules, which is the theory of Helmholtz, but it was not such a simple model. The experiment of red paper changing to black was interesting as illustrating a red spectrum varying with temperature.—Mr. Shelford Bidwell proposed votes of thanks to all the exhibitors, and the Society adjourned until April 9.

Chemical Society, March 18.—Mr. A. G. Vernon Harcourt, President, in the chair.—The following papers were read:—On the atomic weight of carbon, by A. Scott. The author calls attention to the unsatisfactory nature of the experimental evidence on which the determinations of the atomic weight of carbon rest; erroneous determinations of the expansion produced by the absorption of carbon dioxide by potash solutions have been employed. When this and other sources of error have been allowed for, the recalculated values of the atomic weight of carbon are 12·008 from the combustion of carbon and 12·050 from the conversion of the monoxide into the dioxide.—On a new series of mixed sulphates of the vitriol group, by A. Scott. The author obtains members of a new series of mixed sulphates of the composition $(MN)''SO_4,H_2O$ by adding sulphuric acid to solutions of the mixed sulphates; the ferrous cupric salt $Cu_2Fe_5(SO_4)_7, 7H_2O$ is reddish-brown in colour.—A synthesis of camphoronic acid, by W. H. Perkin, jun., and J. F. Thorpe. Ethylic β-hydroxy-$\alpha\alpha\beta$-trimethylglutarate is converted by the usual methods into ethylic β-cyano-$\alpha\alpha\beta$-trimethylglutarate, $COOEt.CMe_2.CMe(CN).CH_2.COOEt$; this on hydrolysis yields $\alpha\alpha\beta$-trimethyltricarballylic acid, $COOH.CH_2.C(COOH)Me.CMe_2.COOH$, which is found to be identical with camphoronic acid.—Note on a method of determining melting points, by E. H. Cook.—Velocity of urea formation in aqueous alcohol, by J. Walker and S. A. Kay. The addition of ethylic alcohol to an aqueous solution of ammonium cyanate undergoing conversion into urea accelerates the reaction; if the reverse action and the degree of dissociation at the various stages of the process are taken into consideration, it is found that the law of mass-action is strictly obeyed. The authors calculate that the conversion of ammonium and cyanate ions into urea is accompanied by a heat evolution of about 5000 cals. per gram-molecule.—Action of alkyl haloids on aldoximes and ketoximes, by W. R. Dunstan and E. Goulding. When formaldoxime, acetaldoxime, and acetoxime are heated with an alkyl iodide or bromide in alcoholic solution, compounds of the types $R'CHN(R')O$ and $R'_2CNCH(R')O$ are obtained.

Entomological Society, March 17.—Mr. Roland Trimen, F.R.S., President, in the chair.—Mr. Butterfield, present as a visitor, exhibited a series of thirty-three male and six female *Phigalia pedaria*, taken near Bradford, Yorkshire, on February 14–17, 1897. Twenty-one males were typical in having a greater or less development of the four transverse bars. The remaining twelve were without bands, and varied in colour from black to smoky olive; they were decidedly less in point of size, ranging from $1\frac{5}{12}$ in. to $1\frac{7}{12}$ in., as against $1\frac{7}{12}$ in. to $1\frac{11}{12}$ in. in the banded forms, and were also poorer in scales and slightly deformed. He had only met with this variety once before in the last twenty years, and suggested that the eruption of small, black, and depauperised forms might have been produced by dryness and want of food in the larval conditions, the trees having been extensively defoliated in the preceding year.—Mr. Kirkaldy exhibited an example of the rare macropterous form of *Velia currens*, Fabr., taken at East Grinstead, and one of *Cicadetta montana*, Scop., from Brockenhurst.—Mr. Burr exhibited a series of grasshoppers with red and blue hind wings, of the family Œdipodidæ, to show the remarkable variation in colour seen in this group. Red, blue, and yellow forms are found alike in the same species, the blue being due to the failure of the red pigment, and therefore an incipient albinism, the yellow being a further form of albinism.—Mr. Champion communicated a paper on the Elateridæ and Rhipidoceridæ collected by Mr. H. H. Smith at St. Vincent, Grenada, and the Grenadines, and exhibited the specimens.—Dr. Forel also communicated a paper on the Formicidæ collected by Mr. Smith in the same islands.

Linnean Society, March 18.—Dr. A. Günther, F.R.S., President, in the chair.—Mr. Bernard Arnold exhibited three contiguously-built nests of the chimney swallow, *Hirundo rustica*, having a continuous wall of mud as if built by one pair of birds; but from the evidence of the observer it appeared that there were two pairs of birds, and that one pair had made two of the adjacent nests.—The Right Hon. Sir John Lubbock, Bart., F.R.S., read a paper on stipules, their forms and functions. This embodied observations supplementary to those published in previous papers (*Linn. Soc. Journ., Bot.* xxviii. 217, and xxx. 463). It was shown that while the usual function of stipules is to protect leaves in bud, in some cases they replace them, and in others serve to hold water. Instances were mentioned in which stipules developed into spines, and in other cases became glandular. Where stipules were absent, other arrangements for bud protection were found to exist. Attention was especially directed to the formation of the winter buds of certain common shrubs and trees, and some curious differences were noted even in nearly allied species. In the wayfaring-tree, *Viburnum Lantana*, the author remarked that the young leaves are uncovered, but are protected by a growth of hairs; in the ash and thorn the outer scales of the bud consist of expanded petioles; in the willow the outer scales consist of leaves; in the poplar of stipules. The buds of the oak and beech were also described; and it was shown by the aid of lantern-slides that in the beech the outer scales of the bud consist of two pairs of stipules, that the twelfth pair are the first which have a leaf, and that the subsequent growth is between the leaves, while the portion of the shoot between the stipules scarcely elongates at all. As a consequence the seat of each winter bud is marked by a ring, and thus a series of successive rings which remain visible for many years indicate each year's growth.—Mr. W. C. Worsdell read a paper on the origin of transfusion-tissue in leaves of gymnospermous plants. It was explained that "transfusion-tissue" is a special kind of conducting-tissue found chiefly in the leaves of conifers, in direct connection with the vascular bundles. Evidence was adduced in favour of the conclusion that transfusion-tissue, as universally found in recent coniferous leaves, has originally sprung from the centripetal xylem of the leaf-bundle of the ancestors of these plants.

CAMBRIDGE.

Philosophical Society, March 8.—Mr. F. Darwin, President, in the chair.—On the injection of the intercellular spaces occurring in the leaves of *Elodea* during recovery from plasmolysis, by the President and Miss D. F. M. Pertz. *Elodea* continues to assimilate in salt solutions strong enough to plasmolyse the cells. On replacing the plant in water assimilation ceases, the gas disappears from the intercellular spaces, and the leaf is injected with water. The disappearance takes place partly by the escape of bubbles at the open ends of the intercellular spaces, but chiefly by solution. The first of these phenomena depends on the surface tension of salt solutions being greater than that of water. The solution depends on the fact that air is less soluble in salt solutions than in water.—The phenomena of carbon dioxide production associated with reduced vitality in plants, by Mr. F. F. Blackman. By the aid of an apparatus (which was exhibited), specially adapted for physiological research on very small outputs of carbon dioxide, several new phenomena of this nature have been brought to light in plants. These comprise the liberation of carbon dioxide produced in the following four cases. Firstly, that resulting from the action of temperatures between 40° C. and 50° C. on dry resting seeds: at temperatures below 40° C. no appreciable

formation of carbon dioxide takes place, and at continued higher temperatures the amount, which is at first large, does not remain so but steadily falls off, indicating the decomposition of a definite limited quantity of some substance. Secondly, the large amount of carbon dioxide produced in the first few hours after wetting coarsely-ground dry seeds. This cannot be attributed to the action of micro-organisms, and is hindered by the action of chloroform and other poisons. Thirdly, the varying production of carbon dioxide by the action of volatile poisons and of fatal temperatures on living leaves. Finally, the post-mortem production of carbon dioxide brought about by subjecting recently-killed leaves to the action of a temperature of 100° C. This amount was shown to vary with the method of killing adopted, and evidence was forthcoming to show that in this, as in the other cases, those substances which easily oxidise with liberation of carbon dioxide are in some way to be associated with normal respiratory processes.—On the leaves of *Bennettites*, by A. C. Seward. In this paper the author described some specimens of *Williamsonia gigas* Carr. and *Zamites gigas* L. and H., from the Jurassic rocks of the Yorkshire coast, and now in the Natural History Museum, Paris. In recent years it has been customary to discredit or entirely deny the correctness of the earlier views as to the generic identity of *Zamites gigas* and *Williamsonia*. A recent examination of the specimens in the Paris Museum convinced the author that *Williamsonia* is the inflorescence of *Zamites gigas*. The conclusions now arrived at enable a Bennettitean inflorescence to be connected with a definite form of fronds.

PARIS.

Academy of Sciences, March 22.—M. A. Chatin in the chair.—The President announced to the Academy the loss it had sustained by the death of M. Antoine d'Abbadie, Member of the Section of Geography and Navigation.—On the Phanerogams without seeds, forming the division of the Inseminеæ, by M. Ph. van Tieghem. An outline of a new classification of the Phanerogams.—On the mechanical work performed by muscles, by M. A. Chauveau. An extension of a preceding paper, giving details of experiments with isolated fresh muscles from frogs. The muscle was weighted with different loads, stimulated with a rapidly alternating current, and the heating effects produced measured with a thermo-electric couple.—On an angular multi-divider, by M. Guillerminet.—On an electric commutator capable of being adjusted from a distance, by M. C. Gros.—On the perihelia of the planets, by M. Delauney.—On autoradioscopy, by M. Foveau de Courmelle.—On the geometry of the triangle, by M. Labergère.—On the successive differentials of a function of several variables, by M. Moutard.—On the determination of the group of transformations of a linear differential equation, by M. F. Marotte.—On the latent heats of evaporation and the law of Van der Waals, by M. Georges Darzens. The author has shown in a preceding note that the Van der Waals equation $M\lambda/T_c = f(T/T_c)$ (where M is the molecular weight, λ the latent heat of vaporisation at the absolute temperature T, and T_c the absolute critical temperature) may be put in the form $M\lambda/T = F(T/T_c)$, where the first term is independent of the critical temperature. The exactness of the law of corresponding states may be indirectly verified by plotting on squared paper the values of $M\lambda/T$ as ordinates against T/T_c as abscissæ, and seeing if the resulting points, either for one substance at different temperatures, or for different substances, lie on a continuous curve. It was found necessary to divide the substances taken into groups in order to get the points to lie on a curve. Thus benzene, chloroform, carbon tetrachloride, sulphur dioxide, nitrous oxide, and carbon dioxide form one group; water, acetone, and ether form another.—Stereoscopy of precision applied to radiography, by MM. T. Marie and H. Ribaut. The theoretical development of the subject is first given, and then measurements from a series of experiments bearing out the results of the preceding analysis.—The action of nickel upon ethylene, by MM. Paul Sabatier and J. B. Senderens. The nickel used in these experiments was reduced by hydrogen from the oxide at as low a temperature as possible; as it was found that this metal gave the most rapid reaction. The property of acting upon ethylene, however, is not lost even if the nickel oxide is reduced at a red heat. The reaction between the nickel and the ethylene takes place at about 300°; and the main reaction appears to be according to the equation $C_2H_4 = C + CH_4$, although hydrogen is also produced by what is apparently a secondary reaction, the amount increasing with the temperature of the nickel. No such phenomenon occurs when the nickel is replaced by copper, cobalt, iron, or by platinum or palladium black.—Researches on the monazite sands, by MM. G. Urbain and E. Budischovsky. The hydrated earths were treated with acetylacetone, and the resulting acetylacetonates fractionally recrystallised from alcohol and benzene. The lowest atomic weight obtained from the fractions was 95, the highest 112.—A reaction of carbon monoxide, by M. A. Mermet. A solution of potassium permanganate, acidified with nitric acid, and containing silver nitrate, is decolorised by carbon monoxide. With air containing ·002 to ·0002 of its volume of carbon monoxide, the decolorisation was complete in from one to twenty-four hours. Upon this reaction is based the determination of small quantities of CO in rooms.—On isolauronolic acid, by M. G. Blanc. Isolauronyl chloride, treated with zinc methyl in ethereal solution, yields an isomer of camphor, of which the oxime, semicarbazone, hydrazone, and reduction products are described.—On a new method of storing acetylene, by MM. Georges Claude and Albert Hess. It has been found that acetone is a good solvent for acetylene, one kilogram of acetone dissolving 300 litres of acetylene under a pressure of 12 atmospheres.—On the mineralogical constitution of the island of Polycandros, by M. A. Lacroix. The south-eastern portion of the island consists of white or greyish-white limestone deposits, the remainder consisting of mica and chlorite schists.—On the part played by phenomena of superficial alteration in metalliferous strata, by M. L. de Launay.—On the gradual loss of lime in basic eruptive rocks of the region of the Pelvoux, by M. P. Termier.—Work carried out by the Geographical Service of the Expeditionary Corps of Madagascar, during the campaign of 1895, by M. R. Bourgeois.—The movement of lunar rotation, by M. D. A. Casalonga.—On an apparatus called a kineometer, by M. Aug. Coret.—The problem of aviation, by M. Th. Colombier.

AMSTERDAM.

Royal Academy of Sciences, January 30.—Prof. van de Sande Bakhuyzen in the chair.—Prof. Engelmann, referring to experiments made by Dr. Woltering and himself at Utrecht, treated of the rate at which stimuli of various intensity are propagated through muscular fibres.—Prof. van Bemmelen made a communication concerning the chemical metamorphosis of phosphate in fossil bones.—Prof. van der Waals described an inquiry made by himself, in accordance with the molecular theory of a mixture developed by the author (*Arch. Neerl.*, t. xxiv.), into the extent to which the complexity of the molecules of a solvent may influence the magnitude of the decrease of vapour-tension by dissolved salts. He arrived at the conclusion that the decrease of vapour-tension is determined solely by the magnitude of the molecules of the solvent when in the state of vapour.—Prof. Engelmann presented, on behalf of Mr. E. G. A. ten Siethoff, of Deventer, a paper entitled "An explanation of the optical phenomenon in the eye, discovered by Dr. P. Zeeman." Dr. Zeeman described (Report of the meeting of the Physical Section of the Royal Acad. of Sc., February 25, 1893; NATURE, vol. xlvii., 1893, p. 504; and *Zeitschr. f. Psych. und Phys. d. Sinnesorg*, vol. vi., 1894, p. 233-234) a subjective optical phenomenon, which occurs when a slit, brightly illumined, preferably by monochromatic yellow light, is observed in the dark. Then a bluish-violet line of light is seen, curved like the outline of a pear, whose axis stands perpendicularly upon the middle of the slit. When regarded with the right eye, the point of the light figure is turned to the right (to the left when seen with the left eye), and the rounded side slightly overlaps the illumined slit. The observation of the phenomenon is easiest with yellow or white light; still, Dr. Zeeman succeeded in observing it when using any of the three hydrogen lines. The subjective optical phenomenon observed by Dr. Zeeman ought, in the author's opinion, to be conceived as an entoptical, complementary after-image of the macula lutea and its surroundings, caused by the percipient elements posterior to it being stimulated. This after-image is violet-coloured with any kind of light, because in the place indicated yellow light always prevails, in consequence of the elective absorption of the yellow pigment.—Prof. Kamerlingh Onnes read a letter from Mr. Edm. van Aubel, of Brussels, concerning the experiments of Dr. Zeeman, mentioned at a previous meeting, "On the influence of magnetism on the nature of the light emitted by a substance."