

it is hoped will be as useful and interesting to manufacturers as to men of science. Sixteen lectures of a popular nature dealing with various aspects of recent researches on the structure of matter and on the origin and characteristics of radiation will be delivered by Prof. J. C. McLennan, who will deal chiefly with the results of the experimental investigations which have been made in numerous branches of the subject, concluding with an account of the production and uses of helium. The conference will be opened on Wednesday, January 5, by Sir Robert Falconer, president of the University of Toronto.

Societies and Academies.

LONDON.

Royal Society, December 9.—Prof. C. S. Sherrington, president, in the chair.—Lord **Rayleigh**: Double refraction and crystalline structure of silica glass. Although glasses in general have no double refraction, except that due to bad annealing, yet silica glass is found to have a doubly refracting structure which cannot be so accounted for, and must rather be regarded as crystalline. The double refraction is very weak, of the order of $1/60$ that of crystalline quartz. In a mass of silica which has been melted, but not drawn or blown, the structure consists of doubly refracting grains with dimensions of about $\frac{1}{2}$ mm., oriented at random. If the grained material is drawn out while soft, the grains are elongated into crystalline fibres or ribbons. Fused silica sometimes contains isolated, small inclusions of quartz with angular outlines which have escaped vitrification. These are conspicuous in the polariscope by the strain effects they produce in the surrounding glass.—Prof. J. W. **Nicholson** and Prof. T. R. **Merton**: The effect of asymmetry on wave-length determinations. (1) The apparent displacement of an unsymmetrical spectrum line caused by the finite resolving power of the spectroscope can be calculated on certain simple assumptions. (2) The displacement is independent of the actual widths of the lines. (3) It is considered that the general practice of measuring spectrum lines to a degree of accuracy far transcending the resolving power is not justified.—Prof. T. R. **Merton**: The effect of concentration on the spectra of luminous gases. Certain spectroscopic phenomena appear to be associated with the concentration of the radiating atoms in the source. An increase in concentration may result in a broadening of the lines, a change in the structure of the lines, and changes in the relative intensities. Sources containing lithium exhibit these three phenomena, and the broadening is familiar in sodium flames. A study has been made of the behaviour of sources containing sodium and lithium. The results seem to exclude a temporary association of atoms as the cause of the changes, for the addition of large quantities of sodium to a source containing a trace of lithium produces no change in the lithium spectra. Mixtures of hydrogen and helium have also been investigated. The broadened lines of both these elements from vacuum tubes excited by condensed discharges are accounted for completely by the electrical resolution of the lines by the electric fields of neighbouring charged particles.—Prof. E. **Wilson**: The measurement of low magnetic susceptibility by an instrument of new type. The paper deals with the design, construction, and working of an instrument for the measurement of susceptibility (of low order) over a wide range of magnetic force, and thus avoids the difficulty met with in the Curie balance, the defections of which follow the square law, and, in fact, limit the measurement of susceptibility of a given specimen to a very narrow range of magnetic force. The force due to torsion in

a suspending fibre is replaced by an electromagnetic system in which the mechanical force is due to two components—one proportional to the magnetic force impressed upon the specimen and the other variable if the susceptibility varies. The expression for the susceptibility is that of the reciprocal of a resistance multiplied by a constant, and thus the instrument lends itself to great accuracy in the detection of variations in susceptibility.—Prof. W. T. **David**: The internal energy of inflammable mixtures of coal-gas and air after explosion. In the first part of this paper an empirical law of cooling of exploded mixtures of coal-gas and air contained in a closed vessel has been formulated. This is based upon measurements of the heat loss by conduction and by radiation made during the explosion and later cooling of the inflammable mixtures. In the second part the heat-loss measurements have been applied to the estimation of the internal energy of the gaseous mixtures at the moment of maximum temperature and at various stages during cooling.—Prof. A. **McAulay**: Multenions and differential invariants. The paper is a summary of the properties of a linear associative algebra suitable for electromagnetic relations, differential invariants, and relativity. There are n fundamental units, otherwise it is the same algebra as that considered in a paper by W. J. Johnson and read to the Royal Society on November 20, 1919.

Aristotelian Society, December 6.—Prof. T. P. Nunn in the chair.—Prof. W. P. **Montague**: Variation, heredity, and consciousness: a mechanist answer to the vitalist challenge. It was attempted to show that it is possible to point out a solution of the problems of phylogeny, ontogeny, and consciousness, statable in mechanistic terms, which provides full satisfaction to the demand of the vitalist that the purposive and psychic characters of life shall not be reduced to an epiphenomenal status of dependence upon blind processes. The occurrence of useful variations in the germ-plasm in greater frequency than is explicable on recognisable mechanistic principles may be explained by the conception of biological vectors, according to which the unpurposed, yet purposeful, products of telogenesis in the germ-plasm and in the brain, when occupied with creative imagination, are results of a system of protoplasmic stresses. The problem of the many hereditary determinants in the minute germ-cell may be met by conceiving the germ as a system of superforces or superimposed stresses which are the embodiments of a manifold of invisible intensive determinants equal in richness to the serial events of the germ's ancestral past, and capable of reproducing its pattern by induction during embryonic growth. The problem of explaining mind in physical terms was met by suggesting that the structure of conscious life is analogous to the structure of life in general, except that the system of cerebral superforces in which the past is stored up in the present is composed of traces of potential energy acquired by the brain through the transformation of the kinetic energies of sensory nerve-currents. A new category, "anergy," was proposed as a measure of the form of durational being produced whenever the energy of motion is transformed into the invisible or potential phase.

Linnean Society, December 9.—Dr. A. Smith Woodward, president, in the chair.—Prof. E. S. **Goodrich**: Hymenopterous parasites of grain-infesting insects.—L. V. **Lester-Garland**: Plants from Darfur collected by Capt. Lynes, R.N., with remarks on their geographical distribution.—Dr. B. Daydon **Jackson**: The Norsemen in Canada in A.D. 1000; with the plants they reported. The course followed by the Norsemen was narrated, from their colonies in Greenland, across

Davis Strait, to the north-east coast of Labrador, southward through Belle Isle Strait to the valley of the St. Lawrence and the tract of country on its right bank, where vines were found growing, unsown corn, and a tree called "Masur," these being regarded as *Vitis labrusca*, L., *Zizania aquatica*, L., and an Acer. The reasons why these voyages were not continued were explained as due to the weak colonies at that time in Greenland, the actual starting-point, and the opposition of the natives, termed "Skrællings," who prevented any attempts at settlements in "Vinland"—the Wineland of the sagas of Erik the Red and of Thorfinn Karlsefni—the northern part of New Brunswick.

Royal Meteorological Society, December 15.—Mr. R. H. Hooker, president, in the chair.—C. K. M. Douglas: Temperature variations in the lowest 4 km. The chief object of this paper is to emphasise the importance of the source of the air-supply in causing variations of the upper-air temperature, and to discuss the relationship of these variations to the weather changes, with special reference to the theories of Prof. V. Bjerknes, which the observations strongly support. The view put forward is certainly not disproved by statistical results, though the evidence for it is derived chiefly from the study of a large number of observations of temperature and humidity in the upper air, in conjunction with synoptic charts. Among the associated points mentioned in the paper the following may be emphasised: (1) Both troughs of low pressure and wedges of high pressure normally lie farther west in the upper air than at the surface. (2) The pressure in the upper air may be regarded as being partly a consequence, and not purely a cause, of the temperature of the underlying column. (3) Very powerful wind-currents are observed at great heights between the polar and the equatorial air at those levels.—A. P. Wainwright: A sunshine recorder (mechanical type). The new type of sunshine recorder is in the form of two mercury thermometers similar to one another and of fairly large capacity. The bulb of one thermometer, which is contained in a vacuum, is exposed to the direct rays of the sun, while the other is contained in the shade of a Stevenson screen. The difference in expansion of the mercury in each bulb is recorded mechanically by means of a pointer on a clockwork drum, and denotes the varying intensity of the sun's radiant heat at any hour of the day. The object of this instrument is to obtain a more detailed record of sunshine, and in particular to show the total intensity of the sun's rays for the day as apart from the number of hours during which the sun has actually put in an appearance.—Lt.-Col. J. E. E. Craster: An investigation of river-flow, rainfall, and evaporation records. Measurements of the flow of the Shannon show a fluctuation due to variations in the amount of rainfall and evaporation in the Shannon basin. Rainfall records for the Shannon basin are few, and there are no evaporation records, so that it is not possible at present to determine the amount of rainfall and evaporation by direct methods. But the monthly variations of the rainfall and evaporation, expressed as fractions of the total annual rainfall and evaporation, are constant over large areas. Records of evaporation from the soil have been kept at Rothamsted for many years, and in the absence of any Irish records it has been necessary to employ these. By using the monthly variations of rainfall and evaporation as described above it is possible to determine the minimum annual rainfall and evaporation in the Shannon basin, which will account for the fluctuations in the river flow. The minimum annual rainfall has been found to be 45.71 in., and the minimum annual evaporation from the soil 16.88 in.

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MANCHESTER.

Literary and Philosophical Society, November 16.—Sir Henry A. Miers, president, in the chair.—A. E. Heath: The disinterested character of science in view of certain of its working maxims. The object of this paper was to show that Mach's "principle of economy" and Occam's "principle of parsimony" are not—as would appear on the surface—contradictory. It was contended that the sciences are synthetic, and consist in the setting up of conceptual constructions for the complete description of the fields of primary fact in each science. When alternative conceptual constructions are possible Mach's principle is used to decide between the alternatives. But the constant reference back to the field of primary fact removes from its use any menace to the disinterested character of science. Occam's principle, however, is a maxim applicable only to a process opposite in direction to the synthetic advance of the sciences, namely, the analysis of the field of primary fact itself. It is, therefore, not contradictory, but complementary, to the principle of economy.

Literary and Philosophical Society (Chemical Section), October 29.—Mr. J. H. Lester (chairman) in the chair.—J. H. Lester: Address on "The Textile Chemist." The value of a thorough training in physics was emphasised, and the importance of a post-graduate training in a technical college considered. The chemist in a dye-making works is only a textile chemist when he deals with the textile process of dyeing.

November 29.—Mr. J. H. Lester (chairman) in the chair.—H. E. Potts: How can the results of chemical research be best protected by patents? If the patent agent studied the subject sufficiently to criticise freely and intelligently the research programme, the requirements of the law could be met and the research at one and the same time assisted.

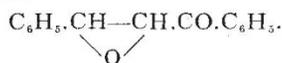
EDINBURGH.

Royal Society, December 6.—Prof. F. O. Bower, president, in the chair.—Miss A. Mann: Observations on the behaviour of the endodermis in the secondarily thickened root of *Dracaena fruticosa*, Koch. The paper demonstrated the effect of cambial activity in disintegrating the endodermis and establishing channels for direct ventilation between the cortex and the pith, which are otherwise isolated by the continuous endodermal sheath. Frequently where such a disintegration takes place the endodermis is not so easily recognised. Here it is a strongly indurated layer of cells, so that the detail of the disintegration can be accurately followed. The physiological result is that the large roots where secondary thickening occurs have a common ventilating system; but small roots, where the point is less vital, have the cortex strictly delimited by the endodermis from the central pith.—L. F. Spath: Cretaceous Ammonoidea from Angola collected by Prof. J. W. Gregory (with notes by the late G. C. Crick). These Ammonites formed part of a collection that included the Brachiopoda and Mollusca dealt with by R. B. Newton in a paper already published (Trans. R.S.E., vol. li.). The fauna was there described as belonging to the Vraconian stage of the Cretaceous series, which includes the zone of *Schloenbachia inflata*. Since there is great confusion about this more or less universal "zone" and about the Ammonites found in it, an attempt had to be made to trace the interrelations of the numerous keeled Ammonites of the Gault and their ranges in time. Some new genera are proposed in addition to a classification of the Hoplitids in general, and a subdivision of the various horizons of

the Upper Albian is offered. The specific descriptions deal with sixty different forms belonging to twelve genera. Some of these represent new, indeterminate, or doubtful species; but the genus to which *A. inflatus* itself belongs includes 50 per cent. of the total number of specimens. An analysis shows that half the number represent local types, some also occurring in the Albian of North Africa; but all the types common with Madagascar and India also occur in the European Gault—that is to say, what intermixture of Indian or American elements there is must have taken place *via* Thetys. The Ammonites do not include a single Cenomanian form. Some new facts of importance obtained from the study of various unworked collections in the British Museum from Angola, Nigeria, South and East Africa, and other localities are incorporated in this paper.

PARIS.

Academy of Sciences, November 29.—M. Henri Deslandres in the chair.—H. Le Chatelier: The phase rule. Some recent criticisms of the phase rule are based on misconceptions. A summary of Gibb's demonstration is given and some particular cases are examined in detail.—C. E. Guillaume: Cause of the instability of nickel-steels: its elimination (see p. 545).—C. Sauvageau: New observations on *Ectocarpus padinae*. The megaspores of this parasite on *Padina pavonia* can live and reproduce outside the plant acting as host; an alternation of generations between a summer parasitic plant and a winter plant of independent life is not improbable, although as yet unproved.—M. J. L. Breton was elected a free Academician in succession to the late M. Ad. Carnot.—R. Birkeland: The solution of the general equation of the fifth degree.—B. Gambier: The imaginary application of two real or imaginary surfaces. The corresponding real cyclic systems or triply orthogonal systems.—G. Reboul: A new property of substances feebly conducting electricity. If a photographic plate is covered with a sheet of black paper and placed in a dark box, and if two insulated electrodes with a potential difference of 1000 volts are brought into contact with the paper for a period of twenty-four to forty-eight hours, on developing the plate the fibres of the paper are found to be reproduced, and the equipotential lines also appear. If the paper is divided, or replaced by a sheet of metal or of mica, the effect is *nil* or confined to the electrodes. The effect can be modified by altering the conductivity of the sheet of paper.—S. Procopiu: The electrical dichroism of smoke and the dichroism of diffraction gratings.—S. Posternak: The constitution of the paramolybdates.—R. Cornubert: The spectrochemical study of the α -allyl and α -allyl-methylcyclohexanones. The results are in agreement with the theory of Auwers on the influence of the double groups on the value of the molecular refraction.—C. Dufraisse: Remarks on the so-called dibenzoylmethane of J. Wislicenus. The author considers that the substance regarded by J. Wislicenus as dibenzoylmethane is, in reality, an ethylene oxide of the constitution



—P. Landrien: Researches on the acid and polyacid salts of monobasic acids: the potassium and lithium dibenzoates.—Mlle. Augusta Hure: The Lutecian limestone in the Yonne.—E. Passemard: The persistence of *Rhinoceros Mercki* in an Upper Mousterian deposit in the Basses-Pyrénées.—A. Guilliermond: New researches on the vacuole apparatus in plants. The vacuolar system in the embryonic cells of the higher plants frequently presents forms resembling

mitochondria. These pseudo-mitochondrial forms do not show the histo-chemical characters of mitochondria, and should be definitely separated from the chondriome. The author considers the views of M. Dangeard with regard to the relation between these forms and the chondriome of the animal cell as erroneous.—L. Daniel: Researches on the grafting of Solanum.—L. MacAuliffe and A. Marie: The anthropometric study of 127 Spaniards.—M. Baudouin: The variations in the flattening of the tibia in infants and adults of the Neolithic races.—A. Pézard: Intra-puberal castration in cocks and the generalisation of the parabolic law of regression.—F. Vlès and J. Bathellier: The numerical laws of the pedal waves in the movements of Gasteropods.—P. Wirtrebert: The comparative value and the determinism of the principal signs of aneural myotomic contraction observed in the embryos of *Scylliorhinus canicula*.—G. Truffaut and N. Bezssonoff: The characters common to the β bacterium, symbiotic with *Clostridium pastorianum* and *B. aliphaticum non liquefaciens*. The development of these two bacteria suggests that they belong to similar races, possibly to the same race.—G. Odin: A new method for the diagnosis of syphilis. Serum from the blood of the subject is mixed with physiological serum and a small proportion of sodium fluoride. The serum thus produced when injected into the patient increases all the syphilitic symptoms and makes a certain diagnosis. The method has been applied to more than a hundred cases without a single failure.

Books Received.

- The Backward Peoples and our Relations with Them. By Sir Harry Johnston. (The World of Today.) Pp. 64. (London: Oxford University Press.) 2s. 6d.
- The Life of Horace Benedict de Saussure. By D. W. Freshfield. Pp. xii+479. (London: E. Arnold.) 25s. net.
- Home Mechanics Workshop Companion. By A. Jackson, jun. Pp. 222. (London: H. Frowde and Hodder and Stoughton.) 6s. net.
- Home Soldering and Brazing. By R. F. Yates. Pp. 122. (London: H. Frowde and Hodder and Stoughton.) 4s. 6d. net.
- Home Chemical Laboratory. By R. F. Yates. Pp. 127. (London: H. Frowde and Hodder and Stoughton.) 4s. 6d. net.
- Soaring Flight: A Simple Mechanical Solution of the Problem. By Lt.-Col. R. de Villamil. Pp. 48. (London: C. Spon.) 1s. 6d. net.
- Space and Time in Contemporary Physics. An Introduction to the Theory of Relativity and Gravitation. By Prof. M. Schlick. Translated by H. L. Brose. Pp. xi+89. (New York and London: Oxford University Press.) 6s. 6d. net.
- The Geography of Plants. By Dr. M. E. Hardy. Pp. xii+327. (Oxford: Clarendon Press.) 7s. 6d. net.
- Handbook of Spinning Tests for Cotton Growers. By Dr. W. L. Balls. Pp. 59. (London: Macmillan and Co., Ltd.) 3s. 6d. net.
- Some Investigations in the Theory of Map Projections. By A. E. Young. Pp. viii+76. (London: Royal Geographical Society.) 6s. net.
- Der Entropologische Gottesbeweis. By Dr. J. Schnippenkötter. Pp. 109. (Bonn: A. Marcus and E. Weber.) 15 marks.
- Plane Algebraic Curves. By Prof. H. Hilton. Pp. xvi+388. (Oxford: Clarendon Press.) 28s. net.
- Treatise on General and Industrial Organic