

to the consideration of that modification of sound which constitutes its pitch, and showed that it depends on the frequency of vibration; he also explained the several modes by which this frequency could be estimated. He made experiments with Robison's stop-cock and Cagniard de la Tour's syren, and referred to the standard of pitch proposed by Chladni. He next dealt with the various experiments made with the view of determining the limits of audibility, with respect to the human ear, dealing particularly with those of Wollaston and Savart, and explained the origin and formation of musical scales. He concluded his lecture with an exhibition of Trevelyan's experiments on the vibration of heated plates, and a mode of producing sounds by an electro-magnetic apparatus.

#### One of Faraday's Unsuccessful Researches

At intervals throughout the year 1835, Faraday worked on the preparation of fluorine. He had completed the long series of experiments by which he had laid the foundations of electro-chemistry, and had not yet begun his researches on electrostatics. In the course of his determinations of electro-chemical equivalents, he had found that fused salts as well as aqueous solutions could be electrolysed, in certain cases with the separation of the elements in a free state; and he proposed now to apply the method of electrolysis to fluorides in the hope of devising a method of producing fluorine. Thus on February 19, 1835, the "Diary" records the construction of an electrolytic retort, of platinum, with electrodes of the same metal, in which experiments were begun on the electrolysis of fused lead fluoride. This research was unsuccessful as regards the production of fluorine. It came between two of his great periods of discovery, and was given up at the end of 1835, so that he might begin the electrostatic experiments with the great cube in the Royal Institution lecture theatre. It is of interest as an investigation which is described at some length in the "Diary", but of which no record appears in his published work.

#### The South Magnetic Pole

At a meeting of the Royal Society on February 19, 1835, E. Rudge read a paper "On the Probable Position of the South Magnetic Pole". The recent discovery of the site of the North Magnetic Pole, which had resulted from the experiments of Capt. James Ross, had suggested to the author the inquiry whether any similar indications of an approach to the South Magnetic Pole could be gathered from any observations then on record. With this view he gave a table of the observations made by Tasman in 1642 and 1643, during his voyage of discovery in the Southern Ocean, extracted from his journal. From this it appeared that Tasman on one occasion noticed the continual agitation of the horizontal needle, in south latitude  $42^{\circ} 25'$  and longitude from Paris  $160^{\circ}$ . On the presumption that the South Magnetic Pole, said the author, was at that time near this spot, and that it had since been retrograding towards the east, he conjectured that it would now be found in or about the 43rd parallel of south latitude; and to the south-east of the Island of Madagascar, a situation extremely convenient for ascertaining its exact position, which he considered an object of great theoretical as well as practical importance.

## Societies and Academies

### LONDON

Royal Society, February 7. E. N. DA C. ANDRADE and P. J. HUTCHINGS: Mechanical behaviour of single crystals of mercury. In the mercury crystal the rhombohedral faces are glide planes, and the short diagonal is the glide direction. The crystal twins under strain on a plane through the long diagonals of two opposite faces acting as glide planes. In simple glide, twinning takes place when the twinning plane makes an angle of  $45^{\circ}$  with the axis of the wire. The rhombohedral face and the hexagonal basal plane are equally close-packed, but the former contains a much more closely packed line than does the latter. Double and triple glide can take place. Hardening on one set of glide planes hardens the whole crystal. The critical shear stress at  $-43^{\circ}\text{C}$ . is  $9.3\text{ gm. wt. per sq. mm.}$  E. N. DA C. ANDRADE and J. C. MARTINDALE: Structure and physical properties of thin films of metal on solid surfaces. The films were prepared by cathodic sputtering under carefully controlled conditions, with a water-cooled anode. The films obtained were uniform, and appear to be amorphous with all types of microscopic examination. When they are maintained at a temperature of about  $230^{\circ}$  for silver, and somewhat higher for gold, the first stage of crystallisation takes place, which consists in the formation of birefringent aggregates, of the order of  $1\ \mu$  across, showing the spherulitic figure in polarised light. Prolonged heating at a somewhat higher temperature leads to rapid growth of the particles, which eventually become well-formed cubic crystals, all arranged with the (111) faces parallel to the supporting surface. The first aggregates are formed by the movement of the upper layers of the films, which are about 50 atoms thick, the further growth of the crystals being accompanied by the formation of areas from which the metal has retreated, leaving a thinner film. Crystallisation in such thinner films does not take place until a much higher temperature is reached than that required for the thicker films. M. BORN: On the theory of optical activity. This paper contains a detailed development of the theory of rotatory power given by the author in 1915. The molecule is considered as consisting of a set of isotropic oscillators coupled by Coulomb forces. The interaction is calculated by the perturbation method. The resultant formula is rather complicated but can be simplified very much for special cases. A molecule consisting of two equal pairs of oscillators perpendicular to one another and to their central line is worked out in detail; it gives the angle of rotation of the expected order of magnitude.

### DUBLIN

Royal Dublin Society, December 12. KENNETH C. BAILEY: Thermal decomposition of hydrogen peroxide in presence of glass wool and copper sulphate. Hydrogen peroxide decomposes very slowly in the absence of suitable solid surfaces, even in markedly alkaline solution. In presence of glass wool, the decomposition is probably complex, and approximately correct results are obtained by using the equation  $v = 15[\text{H}_2\text{O}_2][\text{OH}'] + 7 \times 10^{-5}[\text{H}_2\text{O}_2]$ , the amount of glass wool present having very little influence on the velocity, although the stopping of the reaction in absence of solid surfaces suggests that both first and second order reactions are probably

heterogeneous. In presence of glass wool on the surface of which copper has been adsorbed, the reaction is of zero order, and probably takes place in two stages, a peroxide of copper acting as intermediate compound. It seems certain that this reaction follows an entirely different course from that on the surface of glass wool alone, copper ions in solution having little or no effect. J. LYONS: The influence of physical and mechanical treatment on the firmness of butter. When the cream is cooled to a low temperature immediately after pasteurisation, it gives butter which is considerably firmer than cream which is not so cooled. Pasteurising cream at unnecessarily high temperatures reduces the firmness. The fat content of the cream used for churning and the moisture content of the butter and size of the fat globules in the cream appear to have little influence on the firmness. The firmness of butter does not appear to be improved by holding it at a low temperature over a long period.

## PARIS

Academy of Sciences, January 2 (*C.R.*, 200, pp. 1-100). JULES DRACH: The logical integration of equations of dynamics with two variables. Conservative forces. Cubical integrals. Movements in the plane. LOUIS BLARINGHEM: The acclimatisation and degenerescence of varieties of brewing barley, *Hordeum distichum*. Discussion of the conditions necessary for the maintenance of the stability of hybrid barley. MAURICE GIGNOUX and LÉON MORET: The tectonic of the external border of the zone of the Flysch of Embrunais, between the Brae and the Durance (Piolit and Autanes massifs, Haute-Alpes). S. JANCZEWSKI: The complex equations of Fredholm with uniform nuclei. C. POPOVIĆ: The kinematic equilibrium. ANDRÉ WEIL: Almost periodic functions. A. DINGHAS: Remarks on two theorems of the theory of functions. JULIUS WOLFF: The conservation of the angles in the conformal representation of a domain in the neighbourhood of a boundary point. FERNAND HOLWECK: Improvements in the elastic pendulum. Recent gravimetric linkages between the reference station of the French network and that of neighbouring countries. F. PRUNIER: An experiment of Sagnac with a flux of electrons. P. LANGEVIN: Remarks on the preceding communication. ALBERT ARNULF: The resolving power of optical instruments as a function of the acuteness of vision. N. THON: The capacity of polarised mercury at very low frequencies. After studying and eliminating certain sources of error, the author finds, contrary to the experiments of Erdey-Gruz and Kromey, that there is complete agreement between the capacities calculated starting with the cathode and anode polarisation. CHARLES HAENNY: The variations of the magnetic double refraction of cerous salts in solution. RAYMOND LAUTIDÉ: Latent heat of vaporisation and characteristic temperature. ARNALDO PERES DE CARVALHO: Contribution to the study of phototropy. Three new phototropic bodies. MARCEL CHÂTELET: Some reactions of cobalt sulphate dissolved in glycerol. MAURICE DODÉ: The study of the decomposition products of ammonium perchlorate. At temperatures less than 300° C., chlorine, oxygen, water and nitrous oxide are the main products of decomposition: at higher temperatures the reaction becomes explosive and nitric oxide appears in the place of nitrous oxide. JEAN CALVET: The annealing of pure aluminium and its possible utilisation as a criterion of the

purity of the metal. The samples studied ranged between 99.96 and 99.9986 per cent of aluminium, and the differences between the velocities of annealing are so large that a study of annealing after rolling into sheets forms a very sensitive test of the purity of the metal. JULES GARRIDO: The crystalline structure of manganite. STOYAN PAVLOVITCH: The action of heat on some natural oxides of manganese. A. KAZMITCHEFF: The tectonic structure of the Cannes-Antibes region (Alpes Maritimes). PAUL FALLOT and LOUIS DONCIEUX: The age of the Flysch of the periphery of the limestone chain of the Rif. F. LINK: The density of the upper atmosphere calculated from twilight phenomena. The theory of meteors of Lindemann and Dobson led to higher densities for the upper atmosphere than those generally accepted. The author, using a totally different method, confirms these results. JOSEPH DEVAUX: Study of the albedo of snow in the infrared spectrum. Starting with the band due to the water vapour in the air, melting coarse grained snow absorbs practically the whole of the solar radiation. R. BUREAU: The foci of atmospheric and their localisation. MILLE. COLETTE GAUTHIER: Singular reaction of a bean (*Phaseolus Mungo*) to a lesion of the seed. EMILE MIÈGE: The variations of the characters of seeds of elementary species of *Hordeum distichum*. RENÉ HAZARD: The action of sparteine on the inversion of the hypertensive effects of adrenaline by three phenoxyethylamines. PAUL WINTREBERT: The irregular mitoses of the vitelline merocytes in the course of embryogenesis of selacians (*Scylliorhinus canicula*). MAURICE PIETTRE, AUGUSTIN BOUTARIC and MME. MADELEINE ROY: The study of some proteins in aqueous solution. GEORGES CRUT: The comparative study of the action of hydrogen ions and of thrombase on the coagulation of fibrinogen. J. VELLARD and M. MIGUELOTE-VIANNA: Blood modification in cancer subjects treated with snake poison. Study of the effects produced by small repeated doses of snake poison. The necessity of extreme caution is emphasised.

## BRUSSELS

Royal Academy (*Bull. Classe Sci.*, No. 11). TH. DE DONDER: The system adjoint to a linear system of partial derivatives of several unknown functions (2). CL. SERVAIS: Geometry of the tetrahedron (12). LUCIEN GODEAUX: Second order involutions of space. A second order involution produced by a birational transformation of the seventh order, having a single fundamental curve of the first kind of order eight and genus five, first investigated by Montesano, is considered. TH. DE DONDER: Vortical gravific. A gravific theory is developed in which the potentials  $g_{\alpha\beta}^a$  are antisymmetrical. This vortical gravific completes the classical gravific constructed from symmetrical potentials,  $g_{\alpha\beta}$ , and furnishes a unitary theory of the electromagnetic field. MARCEL WINANTS: Solution of a problem in limits concerning the equation  $\frac{\delta^2 z}{\delta x^2} = \frac{\delta z}{\delta y}$ . M. KOURENSKY: Integration of systems of partial differential equations of the first order containing two unknown functions of three independent variables. YVONNE DUPONT: Electromagnetic couples and angular momenta in the gravific of Th. De Donder. (2) The antisymmetrical electromagnetic tensor is expressed in terms of the polarisation tensor and of the two electromagnetic potentials generalised by J. Géhéniau. GEORGETTE

**SCHOULES:** Application of generalised statistical mechanics to the calculation of the entropy of gases with rigid molecules. De Donder's generalised statistical mechanics is used to calculate the entropy of a gas of rigid molecules. With the classical statistics the formulæ of Ehrenfest and Trkal are obtained. The Bose-Einstein and Fermi-Dirac statistics are also employed and a general formula for the entropy in terms of the energy is deduced. **M. BERTRAND:** Mechanism of pulmonary ventilation in the turtles. The triphasicism of the respiratory movements is caused by the occlusion of the glottis. The expiration which precedes the central pause is purely passive. **Z. M. BACQ:** Physiological observations on the heart, the muscles and the nervous system of an ascidian (*Ciona intestinalis*). The chronotropism of the heart of *Ciona intestinalis* is not modified by non-toxic doses of adrenaline, acetylcholine or the ions of potassium, calcium and barium.

### Forthcoming Events

[Meetings marked with an asterisk are open to the public.]

Sunday, February 17

BRITISH MUSEUM (NATURAL HISTORY), at 3 and 4.30.—  
Dr. Isabella Gordon: "Deep-sea Crustacea".\*

Monday, February 18

BRITISH MUSEUM (NATURAL HISTORY), at 11.30.—A. C. Townsend: "The Linnæus Collection in the Library".\*

CHADWICK PUBLIC LECTURE, at 5.15—(at the Royal Society of Tropical Medicine and Hygiene, Mansion House, 26 Portland Place, W.1).—Dr. William A. Robson: "A Hundred Years of Public Health Administration".\*

UNIVERSITY OF LEEDS, at 5.15.—Prof. B. Melville Jones: "The Stalling of Aeroplanes".\*

ROYAL GEOGRAPHICAL SOCIETY, at 8.30.—Major R. E. Cheesman: "The Islands of Lake Tana".

Tuesday, February 19

ROYAL HORTICULTURAL SOCIETY, at 3.—Annual Meeting.  
Lord Aberconway: Presidential Address.

Wednesday, February 20

ROYAL SOCIETY OF ARTS.—Lieut.-Col. J. D. Restler: "Water Supplies from Underground Sources".

INSTITUTE OF PHYSICS, at 8—(at the Science Museum, South Kensington). Informal discussion on "Modern Magnetic Materials and their Application".

Thursday, February 21

ROYAL SOCIETY, at 4.30.—Dr. F. W. Aston: "The Isotopic Constitution and Atomic Weights of Hafnium, Thorium, Radium, Titanium, Zirconium, Calcium, Gallium, Silver, Carbon, Nickel, Cadmium, Iron and Indium". J. M. Stagg: "The Diurnal Variation of Magnetic Disturbances in High Latitudes".

Friday, February 22

INSTITUTION OF CHEMICAL ENGINEERS, at 11—(at the Hotel Victoria, Northumberland Avenue, London, W.C.2).—Thirteenth Annual Corporate Meeting.  
W. Macnab: "Chemical Engineering in Explosives Manufacture" (Presidential Address).

INSTITUTION OF MECHANICAL ENGINEERS, at 5.30.—Annual General Meeting.

Dr. H. E. Merritt: "Worm Gear Performance".

INSTITUTION OF PROFESSIONAL CIVIL SERVANTS, at 5.30—(at the Royal Society of Arts).—R. A. Watson Watt: "The Cathode Ray Oscillograph".\*

ROYAL INSTITUTION, at 9.—Prof. A. O. Rankine: "Some Experiments in Gravitation and Magnetism".

### Official Publications Received

#### GREAT BRITAIN AND IRELAND

Department of Scientific and Industrial Research. Report for the Year 1933-34. (Cmd. 4787.) Pp. iv+192. (London: H.M. Stationery Office.) 3s. net.

Department of Scientific and Industrial Research. Report of Test by the Director of Fuel Research on the Plant of the British Coal Distillation Company, Ltd., at Newbold, Leicestershire, Test carried out 11th to 25th March 1933. Pp. iv+29. (London: H.M. Stationery Office.) 9d. net.

Report on the Third Mycological Conference, 1934. Pp. 32. (Kew: Imperial Mycological Institute.) 2s. net.

#### OTHER COUNTRIES

Denkschriften des Schweizerischen Naturforschenden Gesellschaft. Band 69, Abh. 2: Die Mittlere Kreide in den helvetischen Alpen von Rheinal und Vorarlberg und das Problem der Kondensation. Von Arnold Heim und Otto Seitz, unter Mitarbeit im Felde von Siegfried Fussenegger. Pp. xi+185-310+3 plates. (Zürich: Gebrüder Fretz A.G.)

Publications of the Dominion Observatory, Ottawa. Vol. 12: Bibliography of Seismology. No. 3: July, August, September, 1934. By Ernest A. Hodgson. Pp. 47-64. (Ottawa: King's Printer.) 25 cents.

Mysore Geological Department. Bulletin No. 15: Cunninghamite in the Limestones of Kudurekanave (Mysore State). By B. Rama Rao. Pp. iv+36+7 plates. (Bangalore: Government Press.) 1 rupee.

The Coconut Research Scheme (Ceylon). Bulletin No. 1: Report on the Soap Industry in Ceylon. By Dr. R. Child. Pp. iv+45. (Lunuwila: Coconut Research Scheme.)

League of Nations: Health Organisation: Permanent Commission on Biological Standardisation. Report of the Second International Conference on Vitamin Standardisation (London, June 12th to 14th, 1934). Pp. 13. (Geneva: League of Nations.)

A Study of the Life History and Food Habits of Mule Deer in California: a Contribution from the Wildlife Division, United States National Park Service. By Joseph S. Dixon. (Reprint from California Fish and Game, Vol. 20, Nos. 3 and 4.) Pp. 146. (Sacramento: California State Printing Office.) 25 cents.

Baltische Geodätische Kommission. Sonderveröffentlichung No. 3: Bestimmung der Längenunterschiede der Landeszentralen im Jahre 1929, 2: Die Berechnung der Längendifferenzen der Landeszentralen, von F. Pavel; Die Berechnung der Längendifferenzen der Landeszentralen, von Ilmari Bonsdorff. Pp. 49+91. (Helsinki.)

Proceedings of the American Academy of Arts and Sciences. Vol. 69, No. 11: New Bands of the Ionized Nitrogen Molecule. By F. H. Crawford and P. M. Tsai. Pp. 407-437. 60 cents. Vol. 69, No. 12: The Relation of the Eyes to Chromatophoral Activities. By G. H. Parker, F. A. Brown, Jr., and J. M. Odiorne. Pp. 439-462+1 plate. 60 cents. (Boston, Mass.)

U.S. Department of the Interior: Office of Education. Pamphlet No. 57: Aids in Book Selection for Secondary School Libraries. By Edith A. Lathrop. Pp. iii+28. 5 cents. Pamphlet No. 58: The Economic Outlook in Higher Education for 1934-35. By Henry G. Badger. Pp. 49. 5 cents. Bulletin, 1934, No. 3: Economics through the Elimination of Very Small Schools. By W. H. Gaumnitz. Pp. v+54. 10 cents. (Washington, D.C.: Government Printing Office.)

U.S. Department of the Interior: Geological Survey. Bulletin 857-E: Core Drilling for Coal in the Moose Creek Area, Alaska. By Gerald A. Waring. (Mineral Resources of Alaska, 1932.) Pp. ii+155-173+plates 6-9. 10 cents. Bulletin 864-A: Mineral Industry of Alaska in 1933. By Philip S. Smith. (Mineral Resources of Alaska, 1933.) Pp. ii+94. 10 cents. Professional Paper 185-A: Studies on the Alkalinity of some Silicate Minerals. By R. E. Stevens. (Shorter Contributions to General Geology, 1934-35.) Pp. ii+13. 5 cents. Professional Paper 185-F: A Lower Lance Florule from Harding County, South Dakota. By Edward Wilber Berry. (Shorter Contributions to General Geology, 1934-35.) Pp. ii+127-133+plates 25-27. 5 cents. Professional Paper 185-G: Halloysite and Allophane. By Clarence S. Ross and Paul F. Kerr. (Shorter Contributions to General Geology, 1934-35.) Pp. ii+135-148+plates 28-29. 5 cents. (Washington, D.C.: Government Printing Office.)

University of California Publications in Anatomy. Vol. 1, No. 7: On the Cutaneous Nerve Areas of the Forearm and Hand; their Sizes, Variations and Correlations studied in a Small Sample of Young Adult Males. By I. Maclaren Thompson, Verne T. Inman and Bernard Brownfield. Pp. iii+195-236. (Berkeley, Calif.: University of California Press; London: Cambridge University Press.) 50 cents.

Proceedings of the United States National Museum. Vol. 83, No. 2975: Some Fossil Corals from the West Indies. By John W. Wells. Pp. 71-110+plates 2-5. (Washington, D.C.: Government Printing Office.)

#### CATALOGUES

Watson's Microscope Record. No. 34, January. Pp. 24. (London: W. Watson and Sons, Ltd.)

A Catalogue of Books and Periodicals on Botany, Agriculture, Forestry, Fruit-Culture, Gardens and Gardening, Herbs, Tobacco. (No. 499.) Pp. 94. (London: Bernard Quaritch, Ltd.)

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