

in French universities with a view to obtain the licence or doctorate in law, the licence in science or in letters, or the doctorate of the university in medicine must produce (in the original) diplomas or certificates awarded to them by the universities or other institutions where they have pursued their studies and passed their examinations. These documents, which must be accompanied by a translation by a certified translator (*traducteur juré*), will be viséd and certified either by the Consul-General of France in the student's native country or by one of the representatives of that country accredited to France.

THE following lectures will be delivered at the Lister Institute of Preventive Medicine on various dates from February 4 to March 18:—"The Early Bacteriological Work of Lord Lister," Prof. C. J. Martin, F.R.S.; "Various Products of the Tubercle Bacillus used in Diagnosis and Treatment and Current Views upon their Mode of Action," Dr. G. H. K. Macalister; "Some Recent Work on the Agglutination of Bacteria with Special Reference to Agglutination with Acids," Dr. J. A. Arkwright; (1) "Recent Work on Hæmolysis," (2) "Serum-fast Bacteria," Dr. J. Henderson Smith; "Lipoids," Dr. H. Maclean; "The Laws Governing Disinfection by Various Agencies," Dr. H. Chick; "The Chemical Action of Bacteria," Prof. A. Harden, F.R.S. The lectures are addressed to advanced students and others interested in the subjects discussed. Students of the University are admitted free, and others can obtain a card of admission on application to the secretary of the institute.

IN the issue of *Science* for December 27 last, Prof. Rudolf Tombo, jun., examines the registration returns for November 1, 1912, of twenty-nine of the leading universities in the United States. Five universities show a decrease in the total enrolment, namely Cornell, Illinois, Iowa, Johns Hopkins, and Pennsylvania, while four institutions showed a loss in the total enrolment in the previous year. The largest gains were registered by Columbia (1069), California (733), Minnesota (515), New York University (488), Texas (475), Nebraska (391), and Harvard (303). In the previous year there were four institutions that showed a gain of more than three hundred students, namely California, Columbia, Cornell, and Ohio State. For 1912 ten institutions exhibited an increase of more than two hundred students in the autumn attendance, as against four in 1911. Of these institutions four are in the east, five in the west, and one is in the south. Of the universities dealt with the six with the highest total attendance are as follows:—Columbia, 9007; California, 6457; Chicago, 6351; Harvard, 5729; Michigan, 5620; and Cornell, 5412. As regards the number of students in pure science, Cornell continues to maintain its lead in this branch, enrolling 1419 students, as against Michigan's 1284, Yale's 1139, and Illinois's 965.

MR. JAMES GRAHAM, secretary for education in Leeds, delivered on January 17, at the University of Leeds, a lecture on methods of preparation for the future life of our industrial army. In elementary education in this country, he said, we are not at present getting full value for the money spent, and this is to be attributed to the early age of leaving school and to local by-laws which allow the brightest pupils to leave before they have obtained full benefit from the education provided. The Government should, he said, take steps to raise the school-leaving age to fourteen years for urban districts throughout the country. This would make it possible to organise at the top of the elementary schools a special course of work, thoroughly practical in character, and likely to help in the production of the intelligent and adapt-

able type of boy now required in industry. He described an interesting educational experiment which is being made in Leeds in the establishment of day preparatory trades schools. These schools combine a preliminary practical training in trades with a continued general education for boys who have passed through the elementary school. The course covers a period of two years and aims at an all-round development of the boy's faculties in a practical manner. For such schools it is important, Mr. Graham insisted, to secure a teaching staff with practical experience of the workshop. For boys who enter some trade or industry directly they leave the elementary schools, a corresponding course of study is required between the ages of twelve and fourteen. The ultimate success of such a scheme lies to a large extent with the employer, and the Leeds employers are beginning to appreciate the value of the training given in the preparatory trades schools. During the years of youth and adolescence, he continued, supervision and guidance are needed, especially in regard to blind-alley occupations where comparatively high wages are paid for unskilled employment, often leading to the premature development of a spirit of independence in the boy and to the withdrawal of discipline and guidance on the part of the parent.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Meteorological Society, January 15.—Annual general meeting.—Dr. H. N. Dickson, president, in the chair.—Mr. C. J. P. Cave was elected president and Mr. F. Druce treasurer for the ensuing year.—Ordinary meeting.—C. F. Brooks: The snowfall of the United States. The author has collected the data available from more than 2000 stations for the fifteen years 1895-1910, and from the results thus obtained he has prepared a map showing the annual snowfall. The effects of topography, prevailing winds, storm frequency, and the location of the great lakes and oceans in and about the United States on snowfall are very apparent. In the first place, the western coast ranges, the Sierra Nevadas and Cascade ranges, lying in the path of the prevailing westerlies blowing from the Pacific Ocean, bring excessive snowfall (in many places exceeding 400 in. per year) on their western flanks. The dry interior basin just to leeward of these mountains has very little snowfall, except where mountains rise above the general level. The great Rocky Mountain chain again brings copious snowfall (exceeding 100 in. per year in a great many places, from Idaho and Montana south to northern New Mexico, and in some places in Colorado as high as 400 in. a year, and 300 in. per year in southern Wyoming). Again, in the lee of these mountains, the dry western prairies suffer deficient snowfall. On nearing the Great Lakes, snowfall increases, and on the south-east shores of each of the lakes, 80 to more than 100 in. of snow falls annually. The Appalachian Mountain chain brings the lines of equal snowfall far south, there being 50-100 in. in the mountains from Maryland to Maine. In northern New England frequent storms in winter cause a snowfall of more than 100 in. annually. In south-eastern United States snowfall occurs practically everywhere, except in extreme southern and eastern Florida and southern Texas. The Gulf Stream shows its influence as far as Cape Hatteras by bending the lines of equal snowfall far to the north.

Institution of Mining and Metallurgy, January 16.—Mr. Edward Hooper, president, in the chair.—L. H.

Cooke: (1) Some considerations on the specification of theodolites for mines. (2) Specification for a precision-theodolite. Having found in the course of a long experience that the greater number of theodolites catalogued by British makers, while not unsuitable for the purposes of the civil engineer and surface surveying in general, are not well adapted for underground work, more particularly in inclined deposits, the author has attempted to draw up a specification for a precision-theodolite specially suited for the requirements of the mining engineer. The outcome of successive endeavours in that direction was embodied in the two papers presented to the institution, the intention being to provoke discussion from mining men with a view to the ultimate drafting of a specification which should standardise the vital features and quality of a mine-theodolite suitable for working on lodes of no great thickness or inclination. As a preliminary, Mr. Cooke has formulated a series of twenty-four conditions which he regards as more or less essential to the production of a really useful instrument for the purpose required, his chief points being portability and readiness for immediate use, protection of the vernier plates and other vital parts from dust and dirt, absolute accuracy in reading, and all possible simplicity of construction and operation.—**S. C. Bullock**: Description of a modern lead concentrating mill, Broken Hill Junction North Mine, New South Wales. While not desiring to hold up the plant described in his paper as a model, the author showed how by pursuing a series of experiments, it was possible to improve a mill's output to a marked degree. The mill feed, which was originally treated as one class of ore, was divided into two sections, rhodonite and quartz, to undergo separate treatment in accordance with their respective physical characteristics, after the preliminary crushing and sorting. This system was devised as the outcome of exhaustive tests in sizing, screening, and concentrating, and the result of the new working has been a considerable increase in recovery. A further development alluded to in an addendum to the paper is the installation of a minerals-separation plant, which is intended to treat the crude zinc-lead ore after the jig lead has been extracted. **J. H. Levings**: The blast-roasting of sulphide ores. This paper related the practical experience of a working metallurgist in Tasmania, when the first smelter at which the Huntington-Heberlein process was used outside Europe was installed, in 1900, the Carmichael-Bradford process following a year later. A chief point of interest in the paper deals with the shape of the pots or roasting vessels, various experiments ultimately deciding the form which gave the most uniformly satisfactory results.

MANCHESTER.

Literary and Philosophical Society, January 7.—Mr. Francis Jones, vice-president, in the chair.—**Dr. G. Hickling**: A remarkable band-like cloud, observed on the night of December 24, 1912. It was suggested that the object observed was possibly due to cloud formation on the trail of dust in the track of a meteorite.—**Dr. H. F. Coward** and **F. Brinsley**: Vortex rings of flame in a hydrogen-air mixture.—**R. F. Gwyther**: The specification of the elements of stress. Part ii., simplification of the specifications already given (*vide* Manchester Memoirs, vol. lvi., No. 10); and part iii., an essay towards the reconstruction of the fundamental equations. Part ii. dealt with a general mode of reducing the number of arbitrary functions or the general stresses within a body from six to three. Part iii. dealt with the physical basis of the fundamental equations, and proposed a scheme differing from that generally accepted.

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PARIS.

Academy of Sciences, January 6.—**M. F. Guyon** in the chair.—The president announced the death of **M. Teisserenc de Bort** and of **M. Cailletet**.—**L. E. Bertin**: Calculation of the increase of load or of speed obtained by increasing the dimensions of a steamer.—**E. Bouty**: The dielectric polarisation of the wall and measurements of dielectric cohesion; the retardation of the silent discharge.—**L. Maquenne** and **E. Demoussy**: The influence of the preceding conditions on the value of the respiratory coefficient in green leaves. The theory developed by the authors regards two stages as essential in normal plant respiration, introducing a new factor, the solubility of carbon dioxide in the cell juices.—**A. Calmette** and **C. Guérin**: A new contribution to the pathogeny of tuberculous infection. Healthy and tuberculous cattle were kept in the same shed for a period of eleven months, under conditions preventing infection by the lungs. All the healthy animals became tuberculous, and responded to the tuberculin test, although only half of them showed definite tuberculous lesions.—**P. Stroobant**: The distribution of spectroscopic double stars on the celestial sphere. Spectroscopic double stars are relatively much more numerous in the galactic zone than in the whole of the stars of the same magnitude, and this is due to the high proportion of helium stars among the binaries.—**A. Demoulin**: A general property of lines traced on a surface.—**A. Rosenblatt**: Irregular surfaces satisfying the inequality $\rho_a \geq 2(\rho_a + 2)$.—**Ch. Müntz**: The direct solution of the secular equation and some analogous transcendental problems.—**Georges Giraud**: A class of transcendentals having a theorem of multiplication.—**M. Nörlund**: Linear equations of finite differences.—**G. Königs**: The construction of the centres of curvature and principal planes of the envelope of a surface of a cylinder which rolls without slipping on another.—**Jules Andrade**: Experimental researches on the double cylindrical spiral.—**Henri Villat**: The flow of heavy fluids.—**J. de Boissoudy**: The equilibrium of a gas in a state of binary dissociation.—**A. Leduc**: Guldberg's law and the law of corresponding states.—**O. Dony-Henault**: The use of resistances of granulated metallic chromium for electrical heating. Powdered chromium, compressed between carbon plates, can be conveniently used as a resistance furnace, and permits of the use of low voltages. Temperatures above the melting point of quartz can be maintained.—**Daniel Berthelot** and **Henri Gaudechon**: The commencement of photolysis of ethyl alcohol, acetaldehyde, and acetic acid.—**H. Copaux**: The basicity of the tungsto-acids.—**P. J. Tarbouriech**: 2,2-Dimethylcycloheptanone.—**A. Fernbach**: The acidification of musts by yeast in the course of the alcoholic fermentation.—**Marcel Baudouin**: The lumbar vertebral canal in the anthropoid apes and in prehistoric man.—**Pierre Teissier**, **Pierre Gastinel**, and **P. L. Marie**: The passive vaccine immunity conferred by intravenous injections of variolic serum.—**F. Bordas**: The use of low temperatures in cryotherapy. A freezing mixture of solid carbon dioxide in alcohol or acetone is recommended for therapeutic work instead of pencils of solid carbon dioxide.—**A. Magnan**: The relations between feeding and the dimensions of the cæcum in ducks.—**Pierre Kennel**: Contribution to the study of the functions of the large tentacles in *Arion rufus*.—**Jacques Liouville**: The polymorphism of *Delphinus Cruciger*.—**M. Desgrez** and **M. Dorléans**: The influence of the constitution of the purin bodies on their action towards arterial pressure.—**A. Railliet**, **G. Moussu**, and **A. Henry**: Experimental researches on the development of *Fasciola hepatica*.—**Ch.**

Pussenot: The lower Stephanian (Cevennes zone) in the axial Alpine zone. An attempt at the coordination of the various levels of the coal strata in the western Alps.—De Montessus de **Ballore**: Earthquakes and the phases of the moon. These appear to be unrelated.

January 13.—M. F. Guyon in the chair.—G. **Bigourdan**: Description of an apparatus for sending time signals automatically. A diagram is given of the time signal agreed upon by the recent International Conference, and form of commutator described by means of which such a signal may be sent automatically with high accuracy.—Lord **Rayleigh**: The resistance of spheres in air in motion. Referring to some experimental results published in a recent number of the *Comptes rendus* (December 30) by M. Eiffel, it is pointed out that the law of dynamical similitude as developed by Stokes and Reynolds for viscous liquids is applicable, at least as a first approximation.—R. **Lépine** and M. **Boulud**: Feebly combined sugar in the blood.—Jules **Baillaud**: An integrating opacimeter for stellar photographs. The Hartmann microphotometer is based on the assumption of a homogeneous photographic plate; a new form of photometer is described which is independent of this condition.—P. E. **Gau**: The most general transformations of partial differential equations of the second order.—Maurice **Janet**: The characteristics of systems of partial differential equations.—M. **Schwartz** and M. **Villatte**: The application of an optical method of coincidences to the transmission of time. The apparatus used consists of two optical telegraphs of the military type using acetylene, a Leroy electromagnetic pendulum with variable contact, and chronometers beating half-seconds. Two methods have been devised, one optical, the other partly optical and partly auditory. Results are given for distances between 6 and 45 kilometres, with an accuracy of 0.05 second.—Marcel **Brillouin**: The theory of black radiation.—M. **Costanzo**: The occlusion of the products of radium. Palladium occludes the products of the disintegration of radium. These phenomena can be applied to the estimation of radium.—Adrien **Guebhard**: The theoretical possibility of a reversible arrangement for the automatic reconstitution of the natural colours by projection.—E. **Mathias**, H. **Kamerlingh Onnes**, and C. A. **Crommelin**: The rectilinear diameter of argon. The densities of the liquid and saturated vapour at the same temperature of argon are given for eight temperatures ranging from -125.17° to -183.15° . Argon follows the law of the rectilinear diameter approximately, but the deviations, although small, are too systematic to be assigned to experimental error.—A. **Perot**: The movement of the luminous centres in hydrogen tubes.—Ch. **Boulanger** and G. **Urbain**: Theory of the efflorescence of saline hydrates. The influence of temperature.—Marcel **Boll**: The relation between the velocity of a photochemical reaction and the incident radiant energy. The velocity coefficient of a photochemical reaction is proportional to the incident radiant energy, even if the reaction is bimolecular.—Nicolas **Czako**: The alloys of aluminium with vanadium alloys were prepared, containing from 1 to 80 per cent. of vanadium, and these were studied by the metallographic method. Crystals of AlV and AlV_2 were identified, and indications of the existence of AlV_3 were obtained.—Jacques **Duclaux**: The elements of energy.—P. **Lebeau** and A. **Damiens**: A method of analysis of mixtures of hydrogen and gaseous saturated hydrocarbons, hydrogen, methane, ethane and propane. The method is based on the fractional distillation of the liquefied gases. Hydrogen and methane cannot be separated in this way, but a good separation of hydrogen from

ethane and propane was obtained.—Ed. **Lasausse**: The fixation of the alkaline bisulphites on the salts and ester salts of the acetylenic acids. One or two molecules of sodium sulphite are fixed, giving mono- or di-sulphonates. The reaction has been studied with phenylpropionic acid, methyl phenylpropionate, and methyl amypropionate.—Paul **Gaubert**: Some compounds of cholesterol giving liquid crystals.—Lucien **Daniel**: New researches on grafting of Brassica.—J. **Stoklasa**: The influence of uranium and lead on vegetation. Minute proportions of nitrates of lead and uranium in the soil cause a distinct increase in plant growth.—M. **Marage**: The action of complex and intermittent sound vibrations on the auditive centres.—J. **Mawas**: The form, direction, and mode of action of the ciliary muscle in some mammals.—R. **Anthony** and I. **Bortnowsky**: A pleuropatagium of peculiar type in *Microcebus minor minor*.—H. **Agulhon** and R. **Sazerac**: The action of uranium salts and of metallic uranium upon the pyocyanic bacillus.—P. **Becquerel**: The influence of uranium salts and of thorium salts on the development of the bacillus of tuberculosis.—Ph. **Lasseur** and G. **Thiry**: Coloured cultures of bacteria considered up to the present as achromogens.—Em. **Bourquelot**, H. **Hérissey**, and M. **Bridel**: The biochemical synthesis of glucosides of alcohols with the aid of a ferment (α -glucosidase) contained in air-dried low yeast. α -Ethylglucoside has been obtained in a pure crystallised state biochemically.—Robert **Douville**: The influence of the mode of life on the sutural line of the Ammonites belonging to the family of the Cosmoceratidae.—Alfred **Angot**: Value of the magnetic elements at the Val Joyeux Observatory on January 1, 1913.

BOOKS RECEIVED.

- An Elementary Course of Magnetism and Electricity. By Dr. C. H. Draper. Pp. vii+86. (London: Blackie and Son, Ltd.) 2s.
- Safety in Coal Mines. By Prof. D. Burns. Pp. 158. (London: Blackie and Son, Ltd.) 2s. 6d. net.
- The Principles of Stock-breeding. By Prof. J. Wilson. Pp. vii+146. (London: Vinton and Co., Ltd.) 5s. net.
- Journal of the Institute of Metals. Vol. viii., No. 2. Edited by G. Shaw Scott. Pp. ix+378+plates 32. (London: Caxton House.)
- Die neuere Entwicklung der Kolloidchemie. By Dr. W. Ostwald. Pp. 23. (Dresden and Leipzig: T. Steinkopff.) 1 mark.
- A New Geometry. Parts i. and ii. By S. Barnard and J. M. Child. Pp. xviii+315. (London: Macmillan and Co., Ltd.) 2s. 6d.
- A Vertebrate Fauna of the Malay Peninsula from the Isthmus of Kra to Singapore, including the Adjacent Islands. Reptilia and Batrachia. By Dr. G. A. Boulenger. Pp. xiii+294. (London: Taylor and Francis.) 15s.
- The Electron Theory. By Prof. T. Mizuno. Pp. 336. In Japanese. (Tokyo: Z. P. Maruya and Co., Ltd.)
- Notions de Mathématiques. By Prof. A. Sainte-Lague. Pp. vii+512. (Paris: A. Hermann et Fils.) 7 francs.
- Explosives. By Dr. H. Brunswig, translated and annotated by Drs. C. E. Munroe and A. L. Kibler. Pp. xv+350. (New York: J. Wiley and Sons; London: Chapman and Hall, Ltd.) 12s. 6d. net.
- Building Stones and Clay-products. By Dr. H. Ries. Pp. xv+415+lix. (New York: J. Wiley and Sons; London: Chapman and Hall, Ltd.) 12s. 6d. net.