and the magnetic data are made for intervals of less than a year—a month, for example—the lack of exact synchronism and the lack of proportionality between the two sets of changes become especially noticeable. Fortunately, beginning with 1905, we have a new set of figures, the values of the solar constant, determined with high precision at Mount Wilson, California, by Dr. Abbot. Remarkable fluctuations are shown in these values, amounting at times to 10 per cent. of the value. The present paper makes a comparison between the annual changes in the values of the solar constant for the period 1905 to 1914, with the irregularities in the annual changes of the earth's magnetic constant. It is found that the two sets of data, in general, show similar fluctuations. Also, a closer correspondence is found between these two sets of changes than between either set and that of sun-spot frequencies. In brief, the solar-constant values furnish another index of changes in solar activity which may be usefully studied in connection with minor fluctuations in the earth's magnetism.

Dr. W. Patten, "Co-operation as a Factor in Evolution":—

The purpose of this discussion is to show that co-operation, or the summation of power, is the creative and preservative agent in evolution, and that the summation of power depends on co-operation in the conveyance of power. Co-operation in the inner life of the individual is a pre-requisite to co-operation in its external life. The larger physical volume and organic power of the individual are the means by which it finds the larger sources of supplies and the better ways of cosmic and social co-operation. What we call "evil" is that which prevents, or destroys, co-operation. "Good" is that which perpetuates and improves co-operation. The "struggle for existence" is a struggle to find better ways of co-operation, and the "fittest" is the one that co-operates best. The same laws which prevail in the inner and outer life of animals and plants prevail in the social life of man. Man's social progress is measured by the degree to which he has extended the mutually profitable give-and-take of co-operative action beyond himself to the family, tribe, and State, and into the world of life at large. The chief agents of civilisation—language, commerce, science, literature, art, and religion—are the larger and more enduring instruments of conveyance, which better enable the part and the whole to avoid that which is "evil" and to find that which is "good," and which yields a larger surplus for "freedom."

Prof. G. H. Parker, "Types of Neuromuscular Mechanism in Sea-Anemones":—

In the origin of nerve and muscle the sea-anemone has been supposed to represent a step in which a nervous net of very primitive structure could throw into prolonged contraction the general musculature of the animal's body. An examination of the body of the sea-anemone shows that its muscular activities are of a much more diverse kind. They include, first, muscles that act under direct stimulation and without the intervention of nerves; secondly, muscles that are stimulated directly, as well as by nerves; thirdly, muscles that are stimulated only by nerves and exhibit in these circumstances profound tonic contractions; and, finally, muscles that react in the same reflex way that those in the higher animals do. This diversity of muscular response has not been fully appreciated by previous workers.

Prof. E. C. Pickering, "Determination of Stellar Magnitudes by Photography":—

An immense amount of work is being carried on by observatories all over the world in determining the photographic magnitudes of the stars. It is of the utmost importance that all these magnitudes should be reduced to the same scale. Accordingly, in April, 1909, an International Committee was appointed, with members from England, France, Germany, Holland, Russia, and the United States. This committee met in 1910 and 1913, and, after a most amicable discussion, agreed on a system in which all stars were to be referred to a standard sequence of stars near the North Pole. The magnitudes of the latter were determined at Harvard by Miss H. S. Leavitt by six different methods, using eleven different telescopes, having apertures from one-half to sixty inches. All gave accordant results, and were adopted by the committee. A simple method was found for transferring these magnitudes to stars in other parts of the sky, but here extraordinary sources of systematic errors presented themselves. For example, if two equal exposures were made on a plate, the second was found to give fainter images; if, by means of a small prism, exposures were made simultaneously with different apertures, the smaller aperture indicated a brighter magnitude than the larger when the stars were bright, and a fainter magnitude when they were faint. The colour equation was found to vary by different amounts, not only for different instruments, but for different magnitudes.

Miss A. J. Cannon, "A New Catalogue of Variable Stars":—

So great has been the increase in the number of variable stars that a new catalogue now being compiled contains 4641 stars, of which 3397, or nearly three-quarters of the whole, have been found at Harvard, and 1244 elsewhere, by astronomers in nearly all portions of the civilised world. The variable stars are divided into five classes, dependent upon the character of their variation in light. The periods vary from three hours to 698 days. Determination of the periods and light curves of these stars constitutes a large piece of work. Much has been done at Harvard in this field, and many observations have been furnished by other astronomers for such determinations. No more suitable place could be found for the preparation of this catalogue than the Harvard Observatory, for the rich library of a quarter of a million stellar photographs furnishes the only complete material in the world for the study of these stars during the last twenty-five years. By examining the past history of a star on these photographs, the investigator may far more readily find an answer to such perplexing questions as to whether a star is variable or constant, what is the length of the period, is the period changeable, what is the colour or the spectrum of the star, than by waiting months or years to accumulate additional observations.

During the morning of April 15 the following foreign members were elected:—Dr. F. D. Adams, F.R.S., of Montreal; Dr. W. L. Johannsen, of Copenhagen; and Dr. J. D. van der Waals, of Amsterdam.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

THE sum of 3000*l.* has been bequeathed to the Yale University School of Medicine by Mr. Norman B. Bayley.

PROF. J. J. VAN LOGHEM has been appointed to the newly founded chair of tropical hygiene in the University of Amsterdam.

DR. R. ARMSTRONG-JONES has resigned, as from September next, after twenty-three years' service, the medical superintendency of Claybury Asylum.

THE Gladstone Memorial prize at the London School of Economics and Political Science has been awarded to Mr. Ramchandra Mahadev Joshi, of Bombay.

THE sum of 10,000*l.* in Consols has been given by Mrs. Streatfeild, to be held in trust jointly by the Royal College of Physicians of London and the Royal College of Surgeons of England, for the promotion of research.

THE programme for the session 1916–17 of the Department of Technology of the City and Guilds of London Institute has now been published by Mr. John Murray at the price of 9*d.* net. It contains the regulations for the registration, conduct, and inspection of classes, the examination of candidates in technological subjects, and for the award of teachers' certificates in manual training and domestic subjects. The syllabuses in the following subjects have been revised:—Gasfitting, silversmiths' work, goldsmiths' work, and jewelry, painters' and decorators' work, and heating and ventilating engineering. Other syllabuses have been redrafted, and these include:—Electrical installation work, typography, carpentry and joinery, brickwork, masonry, and plasterers' work.

WORK has been begun upon the building of the Museum of the American Indian, at 155th Street and Broadway, New York, which is to house the ethnological collection made by Mr. George G. Heye during the last twenty-five years. It will be in charge of a group of trustees, of which Mr. Heye himself is chairman. The ground was given by Mr. Archer M. Huntington, and the cost of the building, amounting to 50,000*l.*, has been subscribed by other friends of Mr. Heye. The collection will be supplemented by the working library of archæology which has been brought together by Prof. Marshall H. Saville, of Columbia University. In addition to Prof. Saville, Mr. George H. Pepper, who has spent much time among the Navajo and Hopi Indians, will be a member of the staff of the museum.

AT the conference of presidents and other representatives of Canadian universities held at McGill University, Montreal, in May last, the following resolution was unanimously adopted:—"This conference is strongly of the opinion that, to strengthen the unity of the Empire, the universities of Great Britain should be urged to modify and increase their graduate facilities to meet the needs especially of students of the Dominion; and also, to effect this purpose, that a committee be appointed to correspond with the universities of Great Britain, and that the committee also correspond with the universities of France, with the object of increasing the number of students from Canadian colleges." The members of the committee are President Falconer, of Toronto University; Sir W. Peterson, president of McGill University; Abbé E. Chartier, of Laval University; and Dean Cappen, of Queen's University. The next conference will be held in Ottawa in 1917.

A COPY of the prospectus of the university courses in the Manchester Municipal School of Technology for the session 1916–17 has been received. The school offers systematic training in the principles of science and art as applied to mechanical, electrical, and municipal and sanitary engineering; architecture and the building trades; the chemical industries; the textile industries; and photography and the printing crafts. It possesses extensive laboratories and workshops equipped with full-sized modern machinery, tools, and apparatus, including not only machines of the types now in general use, but also machines especially constructed for demonstration, experiment, and original research. Its work includes advanced study and research in science and technology; university courses in the faculty of technology, leading to degrees in applied science; and part-time day and evening courses for a great variety of workers. The present prospectus forms the first part of the calendar of the school, the other activities of which are to be described and explained in later parts of the calendar.

IN his opening address to the vacation course of the Oxford School of Geography on August 3, Dr. J. Scott Keltie reviewed the progress of geography during the last half-century. This included, first, the additions to our knowledge by means of exploration; secondly, progress in the methods of dealing with such results; and thirdly, improvements in geographical education. No period, said Dr. Keltie, had been so prolific in exploration since the half-century following the discovery of America by Columbus. The two poles have been reached, and large additions made to our knowledge of polar regions. The unknown two-thirds of Africa have been provisionally mapped. Great areas of North America have been surveyed and occupied, and much of South America has been explored. The map of Asia has been largely reconstructed, the interior of Australia traversed in all directions, and much of Europe re-surveyed. Lastly, the science of oceanography has been created. Geographical research is now conducted on scientific lines, and the explorer of the future must be differently equipped from the pioneer of the past. Geographical education has made strides in universities and schools, but there is still a dearth of adequately trained teachers to do the subject justice.

THE future of the British chemical industries is so closely bound up with the education of the technical chemist that it is not surprising to find this constantly discussed in the technical and daily Press. In the July Engineering Supplement of the *Times* Prof. F. G. Donnan deals with the relation of the engineer and the chemist from the point of view that it is necessary to bridge the gap which exists between our present chemical and engineering laboratories by "interlinking" laboratories of chemical engineering. He pictures the young chemists and engineers who intend to enter the field of applied chemistry meeting here and learning to work together to the great benefit of the industries. Unfortunately, this development is hindered, if not prevented, by the British examination degree system, which, as Prof. Donnan truly observes, is even more powerful at the newer and supposedly modern universities than at Oxford and Cambridge. The only apparent remedy is for manufacturers to recruit their staff by taking men on the personal recommendation of the university professor, a course which the more enlightened firms have been following for some time. This involves, however, that the professor should have an accurate knowledge of the requirements of industry, so that he may not recommend the wrong type of man. Prof. Donnan lays great stress on the superiority of a training in physical chemistry as the only road to real applied chemistry, and condemns what he terms the molecule-juggling type of chemist usually turned out from the chemical laboratories of the universities and higher technical schools. The training in physical chemistry as sketched by Prof. Donnan appears to be open to the criticism of being too general and not yielding a product of sufficiently high calibre to act in any other capacity than as departmental under-manager in the works. It must not be forgotten that the industry needs also men with a real knowledge of chemistry, above all of organic chemistry, and, though the demand for such men is less than that for under-managers, they alone can act to recreate the industry.

It is within experience also that the plant constructed by the so-called chemical engineer, meaning the chemist with a knowledge of engineering, is likely to result in heavy repair costs. As Prof. Donnan truly indicates, what the industry wants is the association of specialists in both sciences, each understanding enough of the other's profession to enable them to work together with the greatest efficiency.

SOCIETIES AND ACADEMIES.

PARIS.

Academy of Sciences, July 24.—M. Ed. Perrier in the chair.—The president announced the death of Sir William Ramsay, foreign associate.—G. **Bigourdan**: The propagation of sound to a great distance. The distance at which the sound of firing at the front can be heard, given in a recent note as 250 kilometres, must be extended to 300 kilometres.—C. **Richet**: The time minimum in the psycho-physiological reaction to visual and aural stimulations. Remarking on a note by MM. J. Camus and Nepper (see below), the author agrees that the figures put forward by M. Lahy appear to be too low, and are probably affected by a systematic error.—M. **Petrovitch**: The relations of inequality between arithmetical and geometrical means.—M. **Mesnager**: The displacement of the points of a rectangular plate.—M. de **Broglie**: The K absorption band of the elements for the X-rays, from bromine to bismuth, and the emission of a Coolidge tube for very short wave-lengths. Measurements of the absorption band of elements—that is, indirectly the shortest line of the K group of their spectra—are given for twenty-four elements, ranging in atomic weight from bromine to thorium. A tungsten antikathode was used and the wave-lengths measured, decreasing regularly with the increase in the atomic weight, the only exception being the relative positions of iodine and tellurium.—Mlle. P. **Collet**: The working of galena employed as detectors in wireless telegraphy.—MM. **Massol** and **Faucon**: The absorption of ultra-violet radiations by the bromo-derivatives of methane. Experiments were made on bromine, carbon tetrabromide, tribromomethane, and dibromomethane. The characteristic band of bromine in solution was not found in any of the bromo-derivatives of methane. These compounds increase in transparency for ultra-violet light as the proportion of bromine they contain diminishes, and each bromine derivative is less transparent than the corresponding chlorine derivative, examined under the same conditions of concentration and thickness.—E. **Moles**: The density of hydrogen bromide. Contribution to the revision of the atomic weight of bromine. The mean of thirty-two determinations of the density of hydrobromic acid is 3·64442 grams per normal litre. This leads to the value 79·926 for the atomic weight of bromine.—J. **Eriksson**: The reappearance of mildew (*Phytophtora infestans*) in the potato.—M. **Repelin**: The age of the Oligocene deposits of the basins of Aix and Marseilles, and, in particular, of the clays of Milles and the lignites of Saint-Zacharie.—Mmes. M. **Lapicque** and C. **Veil**: Muscular velocities measured by chronaxy in the different cavities of the heart.—J. **Camus** and M. **Nepper**: The reaction times of the candidates for aviation. A criticism of a recent communication by M. Lahy. The authors find it difficult to explain the reaction times measured by M. Lahy, which appear to be much too small.—L. **Vialleton**: Ontogenic development and the analogous organs.—H. **Bierry**: The detection of tuberculous bacilli in sputa. Details of a method based on the liquefaction and subsequent centrifugation of the sputa, which has given good results in practice.

BOOKS RECEIVED.

Fossil Vertebrates in the American Museum of Natural History. Department of Vertebrate Palæontology. Vol. v., Articles collected from the American Museum Bulletin for the Years 1913–14. (New York.)

Scientific Method in Schools: A Suggestion. By W. H. S. Jones. Pp. 36. (Cambridge: At the University Press.) 1*s.* net.

Papers from the Geological Department, Glasgow University. Vol. ii., 1915. (Glasgow: J. Maclehose and Sons.)

The Genus Phoradendron: a Monographic Revision. By Prof. W. Trelease. Pp. 224+plates 245. (Urbana, Ill., U.S.A.: The University.)

Concentrating Ores by Flotation. By T. J. Hoover. Third edition. Pp. vi+320. (London: The *Mining Magazine*.)

The Nation of the Future. By L. Haden Guest. Pp. 115. (London: G. Bell and Sons, Ltd.) 2*s.* net.

An Emperor's Madness or National Aberration? By Prof. E. Lugaro. Translated by Dr. W. N. Robinson. Pp. v+135. (London: G. Routledge and Sons, Ltd.) 2*s.* 6*d.* net.

Department of Statistics, India. Agricultural Statistics of India, 1913–14. Vol. ii. Pp. v+116. (Calcutta: Superintendent Government Printing, India.) 1 rupee.

Preliminary Geometry. By F. Rosenberg. Pp. vi+220. (London: W. B. Clive.) 2*s.*

Commercial Arithmetic and Accounts. By A. R. Palmer and J. Stephenson. Part i., pp. xiv+292+lvi. Part ii., pp. xi+293–514+lvii–cliv. (London: G. Bell and Sons, Ltd.) Each 2*s.* 6*d.* net.

Return. British Museum. May, 1916. Pp. 110. (London: H.M.S.O.; Wyman and Sons, Ltd.) 5½*d.*

CONTENTS.

Editorial and Publishing Offices:
MACMILLAN & CO., LTD.,
ST. MARTIN'S STREET, LONDON, W.C

Advertisements and business letters to be addressed to the Publishers.

Editorial Communications to the Editor.
Telegraphic Address: PHUSIS, LONDON.
Telephone Number: GERRARD 8830.