THURSDAY, MAY 25, 1916.

CHEMISTRY FOR STUDENTS AND GENERAL READERS.

(1) *A Text-book of Elementary Chemistry.* By Prof. A. Smith. Pp. x+457. (London: G. Bell and Sons, Ltd., 1915.) Price 5*s.* net.

(2) *A Laboratory Outline of Elementary Chemistry.* By Prof. A. Smith. Pp. 152. (London: G. Bell and Sons, Ltd., 1915.) Price 2*s.* net.

(3) *A Text-book of Inorganic Chemistry.* Edited by Dr. J. Newton Friend. Vol. viii.: The Halogens and their Allies. By Dr. G. Martin and E. A. Dancaster. Pp. xviii+337. (London: C. Griffin and Co., Ltd., 1915.) Price 10*s.* 6*d.* net.

(4) *Modern Chemistry and its Wonders.* By Dr. G. Martin. Pp. xvi+351. (London: Sampson Low, Marston and Co., Ltd., 1915.) Price 7*s.* 6*d.* net.

(1) THOSE who have used, and appreciated the merits of, Prof. Smith's well-known "Introduction to Inorganic Chemistry" will study with interest his new "Text-book of Elementary Chemistry" and the "Laboratory Outline" which has been written as a companion to it. The published work of the author, and the brilliant results that have followed from his experimental researches, are a sufficient guarantee of the authenticity and accuracy of the statements of which the book is composed, and there is no lack of novelty in the range of subjects or in the facts which are quoted as illustrations. A perusal of the book has left in the mind of the reviewer some feeling of disappointment that the author has consented to be bound by the narrow restrictions involved in the compilation of one of the smaller elementary text-books. So many fascinating subjects are dealt with that one cannot help regretting again and again that a few lines in the text have had to carry a load which might well have been distributed over a page or a chapter. Thus the allotropy of sulphur, the constitution of water, the chemistry of petroleum, starch and sugars, enzymes and fermentation, the fixation of nitrogen, radioactivity and the inert gases of the atmosphere, pottery and cement, colloids and adsorption, fats and soaps, explosives and artificial silk, are all touched upon very briefly as illustrating the fundamental laws of chemistry or its applications to everyday life. Facts and observations such as these are amongst the most valuable assets of the lecturer, who can use them at his own discretion to cover with flesh the bony skeleton on which his subject is built up; some teachers at least will feel disappointed when they have to compete with a text-book in which the dry bones are already so amply covered with flesh. The attention of English teachers may be directed to the brief description given on pages 207 and 208 of the Frasch process of mining sulphur at the new township of Sulphur, Louisiana, where a quarter of a million tons of sulphur are pumped up every year in a molten state from beneath a quicksand with the help of superheated steam.

The book is illustrated by means of a series of simple, but very effective, line-drawings; there are also full-page portraits of Lomonossoff (the great Russian chemist, 1711–1765, whose forgotten work has been rediscovered to modern chemists by the aid of Prof. Smith himself), Mayow, Ramsay, Perrin (a charming and lifelike portrait), and Becquerel; a full-page illustration is also given of C. T. R. Wilson's photographs of fog-tracks from radium. The British edition contains two additional chapters, on the laws of chemical combination and the periodic classification of the elements, which have been added at the suggestion of Mr. H. A. Wootton, the senior science master at Westminster School.

(2) The "Laboratory Outline" calls for little comment, as it has been arranged to harmonise with and to illustrate the subject-matter of the "Text-book." Those who adopt the text-book will be glad to base their course of laboratory work on the "Laboratory Outline," and will find there an ample selection of suitable experiments and suggestions.

(3) Dr. Friend's new "Text-book of Inorganic Chemistry" promises to be a very valuable addition to chemical literature. Vol. viii. is the second, out of nine volumes, to reach the stage of publication, and as it is the first volume to deal systematically with an important group of elements, it may be regarded as establishing the kind of treatment that will be adopted throughout the series. The general result is extremely satisfactory, and will provide for English readers an even more useful guide to the literature of inorganic chemistry than they will find in the familiar Continental works of Moissan and Abegg. The chief features of the book, which arrest attention immediately, are the references given at the foot of almost every page to show the authority for the statements made in the text, and the generous treatment given to the physical properties of the various elements and compounds; manufacturing processes, such as the preparation of gaseous and of liquid chlorine, are also described in sufficient detail for an intelligent appreciation of the various operations which are involved. A wholly unnecessary prejudice is created in the introductory pages by numerous quotations from earlier publications of one of the authors, including in one instance an actual claim for priority; but this feature disappears as soon as the chapter on fluorine has been passed, and has no influence on the real utility of the book. Now that the supply of books and journals from the Continent has been so largely curtailed, it may be hoped that English chemists will take the opportunity of adding to their libraries the volumes of this most useful and creditable English text-book.

(4) It is difficult for a professional worker in any subject to review accurately a popular exposition of the "wonders" which form the familiar material of his "daily round and common task." The best criticism of such a work is obviously that of the general reader, for whom it is in-

tended; but the author's colleagues can at least bear witness to the fact that the wonders are described correctly, without exaggeration and without any undue appeal "to the gallery." Dr. Martin has probably been wise to assume that his readers are familiar with chemical formulæ, or that, even if they are not, they will still like to see these mystic symbols occupying a place in the text, as evidence that the book is a real contribution to chemistry, and not merely a misleading, if popular, exposition. The subjects dealt with include nitrates, explosives, petroleum, coal-tar, alcohol, sugar, and salt, whilst on the more theoretical side are chapters on radium, on modern alchemy, and on the "mystery of the periodic law." Only in the case of these last-mentioned chapters does any doubt arise as to the ability of the general reader to appreciate the author's exposition; but that is a question that may soon be solved when the book has circulated as widely as its merits demand. Here and there the burning questions of the day are touched upon—the underpayment of chemical workers generally, and especially of those who are willing to undertake the burden of original research; the discouragement of research by the undue prolongation of examination tests at the universities; the loss of the coal-tar industries; and the risk that freedom of thought may be hampered by the creation of "immensely rich and immensely powerful international scientific societies." These questions, discussed in a popular book on the wonders of modern chemistry, may perhaps drive home a lesson which has not yet been fully learned by a public unversed in the literature of presidential addresses to technical and scientific societies. The book contains thirty-six excellent plates and twenty-nine drawings in the text.

T. M. L.

WIRELESS TRANSMISSION OF PHOTOGRAPHS.

Review

Wireless Transmission of Photographs. By M. J. Martin. Pp. xi+117. (London: Wireless Press, Ltd., 1916.) Price 2s. 6d. net.

THE problem of transmitting pictures by wireless is not one of actual performance, but of speed of transmission. It is obvious that a "process" picture, one inch square, consisting of some 2000 dots of, say, six different sizes, could be transmitted and set up as "letterpress" in the time it takes to transmit and set up half a column of NATURE. The task which Mr. Martin faces is, therefore, the task of bringing the speed of transmission within commercially manageable limits. He does this by means of an apparatus which transmits more than 5000 dots a minute.

This transmission is effected by current impulses produced by the contact of a metal point travelling over a metal positive of the picture, consisting of bichromated gelatine on tin- or lead-foil. Wherever the stylus touches the foil it produces a current impulse in the transmitting antenna. At the receiving station these impulses are photographically recorded on a revolving drum synchronised with the drum on which the transmitted metal picture is fixed. The size adopted is 5 by 7 inches, and the time required for transmission is said to be twenty-five minutes. This is short enough for practical purposes, but very considerable skill is required to prepare the metal prints, and the whole "telephograph" consists of an array of different apparatus, each requiring very careful adjustment. The author acknowledges, indeed, that the process is still in the purely experimental stage.

The book is useful as giving a general survey of the present state of the problem and some guide towards future experimentation. It should be remarked, incidentally, that the sensitiveness of the Einthoven galvanometer is greatly understated, 10^{-8} ampere being quite a strong current for the larger quartz-fibre instruments. Selenium and the preparation of the metal prints are dealt with in separate appendices. The only method of preparing Se cells described is Bell and Tainter's method with brass electrodes, which, of course, are quite unsuitable, and are never used nowadays. The definition of sensitiveness as the ratio between resistance in the dark and resistance "when illuminated" is too vague to be useful, and should be replaced by some less ambiguous statement.

The electrolytic receiver described on p. 54 as "the most practical and simple of all photo-telegraphic systems" is remarkably ingenious, though its simplicity is not very obvious. Like the rest of the book, it gives an impression of the great difficulties encountered and the amount of ingenuity already expended on them.

E. E. F.

ELECTRICAL ENGINEERING MANUALS.

(1) *Examples in Magnetism.* Second edition. Pp. 90. Price 1.10 dollars.

(2) *Examples in Alternating Currents.* Vol. I. Second edition, with additions. Pp. 223. Price 2.40 dollars.

(3) *How to Make Low-pressure Transformers.* Second edition, with additions. Pp. 17. Price 40 cents. All by Prof. F. E. Austin. (Hanover, N.H.: Published by the author, 1915-1916.)

(1) OUR opinion of this book is distinctly unfavourable. The substance is poor in quality, and its quantity is much less than many better books at half the price. In his very first numerical examples the author shows that he has no sound grasp of the real use of numbers in connection with measurements; and he further displays his deficiency by stating that "1 foot-pound *exerts a force* (our italics) of 13,549,213·44 ergs," in spite of the satisfactory definition of "force" appearing on the next page. Although he starts with four-figure data (30·48 cm. = 1 ft., 453·6 grams = 1 lb., g = 980 cm. per second per second), he has worked this out to no fewer than ten significant figures! Such a procedure is unpardonable in one who proposes to "give

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guidance" to others. We have noted quite a number of points like this, but it would be a waste of time and space to refer to them in detail.

(2) "It is the design of this book to furnish guidance" to the "college student" and to "those who are pursuing a correspondence course" "in the solution of engineering problems." The first forty pages or so contain a *résumé* of the mathematical and trigonometrical formulæ likely to be required. This is certainly useful, but much of it should not be necessary to students whose mathematical attainments are sufficient to follow the methods employed in the book, which make free use of the calculus, and seem to prefer pure trigonometrical solutions to those obtained with the help of vectors. Then follow a number of definitions concerning alternating quantities and elementary electrical matters. The uninitiated reader should be warned that some of these give quite a different meaning to certain terms from that current in this country, and others, if strictly interpreted, do not express quite what the author presumably intended. The book, however, is not intended as a text-book, but as a book of examples, and if the student conscientiously works through all the examples and problems given, he can scarcely fail to gain a fair insight into alternate current theory.

(3) The amateur or student who wishes to make a small transformer for himself will find the construction of the little one described in this book well within his powers. The type chosen is the Faraday ring type, which is an efficient type for its size, and is suitable for making with somewhat limited resources as to tools. The type does not, however, lend itself to cheap factory construction, and the book is not intended for electrical engineers.

D. R.

AN AMERICAN GARDENING BOOK.

My Growing Garden. By J. H. McFarland. Pp. xiii+216. (New York: The Macmillan Co.; London: Macmillan and Co., Ltd., 1915.) Price 8*s*. 6*d*. net.

IT is the better sort of intellectual morality which has inspired the writer of "My Growing Garden." As its title suggests, it begins *ab initio,* almost *in principio,* and the whole book bubbles over with the enthusiasm of the genuine gardener who creates, aspires, and sometimes has to stoop to conquer. The shrewd common sense that underlies some of the passages, which a meticulous critic might perhaps describe as otherwise florid, has a pleasant American character, and gives the book a quality of its own.

It is quite possible that the English garden-lover may not be able to extract many special "wrinkles" from Mr. McFarland's book, but he will most surely derive a good deal of pleasure from an acquaintance with the American garden as it has developed under the care of an American enthusiast. The chapter on weeds is especially a pleasant one, and, indeed, the whole book is well worth the reading.

One of the oddly deep-rooted tendencies that Adam has transmitted to his descendants is a love of the garden. Like other tendencies, it may be latent in some, but is continually cropping up after the fashion of other primal instincts. Now and again it bursts into widespread activity, which is perhaps more than genuine; for imitation, a pre-Adamite simian character, plays no small part in the ostensible development, mental, moral, and otherwise, of gregarious folk. One of the accompanying features of the present epoch, symptomatic, perhaps, of the proselytising spirit of aggressive humanity, is apparent in the multitude of books on gardens which have, for the last decade or so, been rolling so tumultuously from the printing press. The future student of our times might do worse than give his attention to this oddly mixed literature. It has been written by and for all sorts and conditions of men—and women—and it reflects, as the serious, fictitious, or mercenary pursuit of a widely cultivated hobby can do so well, a wide range of human aspiration—a curious mixture of noble metal and worthless clay.

J. B. F.

OUR BOOKSHELF.

Elements of Mineralogy. By F. Rutley. Revised by H. H. Read. Nineteenth edition. Pp. xxii+394. (London: T. Murby and Co., 1916.) Price 3*s*. 6*d*. net.

IN this nineteenth and extensively revised edition of Rutley's "Mineralogy" the general arrangement of the original has been largely retained, but such changes have been made as the reviser has thought necessary "to bring the book into line with modern tendencies in economic mineralogy, and to make it an introduction to the scientific prospecting and determination of mineral deposits."

Occurrence and origin are treated more fully than in former editions, also the uses of the industrial minerals, and the geographical location of important deposits. An interesting introduction has been contributed by Mr. G. T. Holloway, and a series of excellent paragraphs prefatory to the several useful and precious metals by Mr. W. G. Wagner. A serviceable glossary of terms used in economic geology has been added by the reviser.

Typographical errors are few, but errors of matter numerous. The composition of anorthite is given as $CaO.Al_2O_3.6SiO_2$ (p. 191); it is stated of orthorhombic crystals (p. 111) that "all sections give straight extinction"; ægerine and wollastonite are classed with the aluminous pyroxenes (p. 198), and riebeckite with the aluminous amphiboles (p. 206). Style, and precision of language, too, are often defective. The tetragonal system is characterised by "two equal lateral axes, one unequal vertical axis" (p. 71); the optic axes of biaxial crystals are described as directions "along which light can travel with equal velocity" (p. 99); the Mond process is said to produce "nickel in a great state of purity" (p. 338); we are told (p. 116) that "iron carbonate ($FeCO_3$) is the mineral chalybite," and (p. 376) that platinum is used "in the manufacture of chemicals by the contact process in dentistry and in jewellery."

Mr. Read was ordered abroad for active service while the volume was being set up. Had he seen all proofs, no doubt imperfections, of which the foregoing are random examples, would have been eliminated.

The book is a useful epitome of mineralogical principles and methods, and a convenient small work of reference to the more important rock-forming and economic minerals. C. G. C.

British Sea Fish: An Illustrated Handbook of the Edible Sea Fishes of the British Isles. By Harold Swithinbank and G. E. Bullen. Pp. xi + 35. (London: Simpkin, Marshall, Hamilton, Kent and Co., Ltd.) Price 2s. net.

THIS is a pamphlet of which six pages are devoted to an account of the British sea fisheries, and thirty-five pages to descriptions of some thirty-four species of marketable fishes. The illustrations are very small half-tone reproductions of mediocre photographs. The descriptions consist each of about six to ten lines of print summarising the characters of the species; two or three lines of print giving the range of occurrence; and of "remarks" dealing mainly with the quality, flavour, and methods of cooking of the fishes considered. We learn from the preface that the work "is to be regarded as in no way scientific," and that it is intended to popularise the cheaper and coarser kinds of sea-fish which at present suffer from prejudice. Considering these limitations and the relatively high price of the pamphlet, we find it difficult to think of the particular public to which it is intended to appeal at the present time; for it is far too small to be of much use to anyone really interested in marine biology, and too expensive to be used in a propaganda.

J. J.

LETTERS TO THE EDITOR.

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of* NATURE. *No notice is taken of anonymous communications.*]

"Summer Time" and Meteorology.

RECENTLY I have had occasionally to rise at 3 a.m. and to be out between 3 a.m. and 5 a.m. I found the weather misty and relatively very cold, with temperature about 45° F. Later in the day temperature rose to 75° F. Clothing suitable for the early morning was quite unsuitable for the day, and (what I specially noticed) *vice versâ*; it occurred to me that civilised people had unconsciously adopted a day which centred a little later than the time of maximum temperature, thereby securing the nearest possible approach to a uniform temperature in the daily period of their "away from home" existence. In this way they save themselves unnecessary trouble in putting on and taking off clothing; and, further, they save themselves unnecessary risk of chills and colds. The change from a temperature of 45° F. to one of 75° F. is equivalent to changing from a cool day of January to a warm day of July. The change may stimulate and energise the labourer in the fields; I doubt if its effect on the worker in a city office is good or pleasant.

The average increase of temperature from 8 a.m. to 9 a.m. in the summer months is nearly 40 per cent. of the increase from 9 a.m. to the maximum about 2 p.m.; and the decrease in humidity (or dampness of the air) from 8 a.m. to 9 a.m. is nearly 50 per cent. of the decrease from 9 a.m. to the minimum humidity in the afternoon (and the rate of change from 7 a.m. to 8 a.m. is equally fast).

Moving the hands of the clock will neither warm nor dry the air. People are therefore being plunged into cooler, damper air through their ignorance (1) of the fact that custom is usually based on the teachings of experience; (2) of the facts of observation which indicate directly what has been the indirect teaching of experience in this case.

The argument that it is as cold in April at 9 a.m. as it is in May at 8 a.m. is ineffective, because people in England adapt the amount and character of their clothing to the season of the year, and what they feel most is not absolute cold, but relative cold; and *relatively to the middle of the day* it is twice as cold at 8 a.m. in May as at 9 a.m. in January.

There is an element of romance about early rising if the experiment is not too often repeated. Perhaps one summer will suffice. E. GOLD.

IN accordance with the provisions of the Summer Time Act, Greenwich Mean Time will continue to be used for all meteorological observations and publications, so that no discontinuity will be caused during the period when Summer Time is in force. But besides the observations which are made by regular observers, many meteorological phenomena of various kinds are from time to time recorded or reported, and it is highly desirable that there should be no ambiguity in these reports, which are often of much interest and importance. The council of the Royal Meteorological Society desires to direct attention to the necessity of stating precisely the time of occurrence in all such cases, and whether the times quoted refer to Greenwich Mean Time or to Summer Time, since the omission of this information may render the record of the phenomenon useless for meteorological purposes.

Such occasional observations form a valuable addition to those which are made at the permanent observing stations and supplement them usefully; it is therefore essential that they should be recorded with precision. H. G. LYONS, President.

Royal Meteorological Society, May 19.

Geologists and Special Constables.

A RECENT experience of Canon E. Hill and myself may be useful to geologists. On May 3 we went by train from Lincoln to East Barkwith Station, on the line to Louth, and walked by a rather roundabout route to South Willingham Station, looking at the structure of the country and for sections of drift. While waiting for our train outside the latter station, a man, in dress and aspect rather above a farm labourer, accompanied by another with a badge of some sort on his coat, came up to us, and in none too civil a tone began to catechise us as to what we were doing, where we were and had been staying, our homes, professions, ages, heights, and the like, about which we gave him full information. Apparently he did not know that there was such a science as geology, but after he had received a large amount of biographical information he acknowledged it by saying, in the tone of one rebuking two peccant villagers, that as educated men we ought to have known we had no business to be going about the country. This was rather too strong, so I retorted, "That is nonsense; we have a right to take a walk along the roads to see the country." To cut a long story short, he departed, before our train arrived, with the remark that, if we had been photographing or sketching, he should have taken us into custody.

We were at nearest about seventeen miles from the sea. Neither at Louth (where we had spent a week) nor at Lincoln was any notice posted up in the hotel (or elsewhere, so far as we had seen) supporting his view, and we had not left the high road, except to enter two pits. It is therefore obvious that any village Dogberry may employ the "brief authority" with which he imagines himself clad to prevent all study of English geology or natural history.

T. G. BONNEY.

National Food Supply and Nutritional Value.

ONE of the remarks made in the article in NATURE of May 11 on my survey of the "Food Value of Great Britain's Food Supply" is certainly justified, namely, "the value for protein seems low." It is too low. This has arisen from taking an analysis for wheat flour in which the protein was 7·9 per cent., whereas it should be, more correctly, something like 10·7 per cent. Making an allowance for this difference increases the daily protein ration per man by 10·4 grams and brings it to 112·1 grams instead of 101·7. For a similar reason the carbohydrate should be reduced from 587·12 grams per man per day to 580·7 grams. Whether the fat should be reduced depends on the analysis adopted for the different kinds of meat. A recalculation, however, adopting different analyses, and perhaps, on the whole, more accurate ones, makes no material difference in the daily ration "as purchased." It certainly affords no ground for reduction; on the contrary, it shows an increase of 1·9 grams per man per day.

In conclusion, perhaps I may be permitted to express my grateful appreciation of the very fair and sympathetic way in which your article, as a whole, is written and for the opportunity it affords of making these corrections, which I hope to publish later in detail.

W. H. THOMPSON.

Trinity College, Dublin, May 15.

I AM glad to find that Prof. Thompson has discovered a reason for giving us a more reassuring figure concerning the national supply of protein. It is now clear that we have a larger margin upon which to draw in case retrenchment should prove necessary. Readers of NATURE should be grateful to Prof. Thompson for making the correction, and I have myself to thank him for the courtesy of his letter.

THE WRITER OF THE ARTICLE.

May 19.

The Lower Greensand Flora.

IN the kind review of my work on the Lower Greensand Flora in NATURE of May 4 your reviewer states that I have overlooked a memoir by Buckland. This is the Bridgewater treatise. May I point out (1) that I was dealing with Lower Greensand and not Portland Oolite plants, and therefore not professing to give a complete account of the latter, but merely referred to Buckland's *original* memoir, in which the name of the genus was founded, for purposes of nomenclature; (2) that, even though in the later work (the Bridgewater treatise) Buckland figures a specimen with the "lateral buds," which are probably cones, it remains the fact, as I stated, that no cones are figured in the original *type*; (3) that the Bridgewater treatise example can only be accepted as being the same species as the original type by an assumption that they were, in fact, identical, because, as I stated, the original type specimen is lost; (4) that, consequently, it is not carelessness, but a perhaps over-meticulous scrupulousness in nomenclature which made me, and still makes me, hesitate to accept as a certainty the identity of the so-called *Cycadites microphyllus* of the Bridgewater treatise with the lost original vegetative type of *Cycadeoidea microphyllus,* in spite of the top part of the drawing.

MARIE C. STOPES.

OVERLOOKING a reference is at least to some of us too common an occurrence to need an elaborate defence. My point is that Buckland's later description of one of his species, *Cycadeoidea microphylla,* is fatal to an important argument used by Dr. Stopes. Buckland expressed no doubt as to the specific identity of the specimen figured in the Bridgewater treatise with that on which the original account was based, and, whether or not the stems belong to the same species, there are no adequate grounds for doubting their generic identity. The natural course to pursue in endeavouring to solve a problem is to consider such evidence as is available, and, as regards the question at issue, I maintain that the evidence overlooked by Dr. Stopes furnishes a serious—in my opinion a fatal—objection to her conclusions.

A. C. S.

Meteorological Conditions of a Blizzard.

THE word "blizzard," signifying originally a type of snowstorm most common and most severe in the Rocky Mountain States of the Union, although occasionally occurring elsewhere, is now loosely used to mean any heavy snowstorm. This is unfortunate, for a term is needed for the type of storm referred to above. Three things must co-exist in a blizzard—large quantities of very fine snow; very low temperature, generally below zero Fahrenheit; and a high wind of great velocity.

Apparently the loose use of the word is becoming common in Great Britain, for you refer in NATURE of April 6 (p. 129) to "a blizzard of unusual severity." The context shows that neither the snow nor the temperature condition could have been fulfilled, for you say that the gale "was accompanied by *rain* and snow."

I doubt very much whether the British Isles could produce the requisite conditions for a real blizzard.

ARTHUR E. BOSTWICK.

St. Louis, Mo., April 24.

THE ROUTLEDGE EXPEDITION TO EASTER ISLAND.

NOW that members of Mr. Scoresby Routledge's expedition to Easter Island have returned to this country, it is possible to give some idea in broad outline of the objects of the expedition and of its chief results. The expedition, which was aided by grants from the British Association and the Royal Society, was exceptionally well equipped. It also had the advantage of being independent of the infrequent opportunities of communication with Easter Island, as Mr. Routledge had built and fitted at his own expense the schooner *Mana,* of 126 tons, with auxiliary motor power, in which the expedition sailed from

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Southampton to Chile *viâ* the Straits of Magellan, and thence to its destination. The party consisted of Mr. and Mrs. Routledge, Lieutenant R. D. Ritchie (seconded by the Admiralty for navigation and survey work), and Mr. F. Lowry Corry, geologist. The last-mentioned gentleman had unfortunately to be left behind in South America owing to a severe attack of typhoid fever which necessitated his subsequent return to England. The expedition arrived at the island on March 29, 1914, and did not leave until August, 1915, making a stay of sixteen and a half months.

Easter Island, or Rapa Nui, the most easterly island of the Polynesian group, lying about 11 miles south-east of Pitcairn, was discovered in 1721 by a Dutch captain named Roggewein. It was visited on several occasions subsequently by navigators, notably by H.M.S. *Topaze* in 1868. Our knowledge of the history and antiquities of the island is based largely on the results of a visit of twelve days' duration made by the *Mohican*, of the United States Navy, in 1886.

The islanders speak a dialect of Polynesian, and in physical character they conform to the Polynesian type. At the present day their numbers are small, owing to the fact that in 1862 or 1863 about half of the population was carried off by Chilian slave raiders, and a large number of the remainder were transferred to Tahiti, Eimeo, and Gambier by various agencies. Considerable modification in their customs would appear to have taken place after the Chilian raid; the chiefs upon whom their social organisation was based disappeared, and many of their ancient customs fell into desuetude, though the tradition was preserved among the older members of the community. From this tradition and from the references in the accounts of the older voyagers, it would appear that in religion, culture, and social organisation the Easter Islanders were broadly Polynesian. During their stay on the island the members of the Routledge expedition were able to get into intimate relation with those islanders who still have some knowledge of the older tradition. The result has been a fund of information of quite unhoped-for interest and importance, especially in its relation to the archæological remains of the island, which have always been something of a puzzle.

The chief interest of Easter Island lies in the fact that it possesses remains which, although not exactly unique, are yet sufficiently remarkable to have given rise to considerable speculation. These consist of stone terraces, or platforms, resembling the Polynesian *marais*; colossal monolithic statues, stone carvings, and stone-built houses. Further, Easter Island is the only part of Polynesia in which anything approaching a script was developed. About fifteen inscribed wooden tablets from the island are known to exist, one being in the British Museum.[1]

The stone terraces or platforms have been carefully examined and measured by the Routledge expedition, and the number known to exist has now been considerably increased. These platforms are remarkable both for their size—one of them is 150 feet long, or with the wings which run from the upper level to the ground, 560 feet long—and for the method of their structure. They were built by filling in with stone rubble the space between parallel walls of squared uncemented stone. On the top of the platforms stood the stone statues. These statues, of which there are two examples in the British Museum, are of enormous size, weighing from 10 to 40 tons. Many of them lie where they were made in the crater, and a large number still stand on the slopes of Rana Roraku, one of the volcanic craters which form the chief physical features of the island. Dr. Rivers has recently directed attention to the fact that Moerenhout in 1837 pointed out that similar, though smaller, statues existed in Pitcairn and Laivaivai, while he himself suggests a connection with the cults and secret societies of Melanesia.[2] None of the statues on the platforms are now standing, and their manufacture appears to have ceased abruptly. One explanation of the cessation which has been offered is that it was due to a volcanic disturbance, while a native legend states that the statues were thrown down in an intertribal quarrel. The Routledge expedition made a number of excavations around the statues in the hope that light might be obtained on this point, and the methods of manufacture were carefully investigated. Particular attention was given to the question of orientation, but no uniformity was observed. On the coast the statues on the platforms faced inland, while the platforms themselves faced in all directions. Those erected on the mountain followed the nature of the ground. Inside the crater they faced north and east; on the outer slope south-west. The stone-built houses were also subjected to a close examination, and much new information obtained as to them. It could scarcely be expected that at this late date, especially having in view the results of earlier inquiries, an interpretation of the tablets could be obtained; but a certain amount of information of value has been acquired.

The expedition, on leaving Easter Island, visited Pitcairn Island (where a stay of four days was made), Tahiti, and the Sandwich Islands, in all of which material valuable for comparative purposes was obtained.

It would be premature and unfair, while the data of the expedition are still under examination, to do more than indicate in the briefest manner the points to which attention has been directed. Enough has been stated, however, to suggest the value of the expedition's work, which it may safely be said will not only add considerably to our knowledge of the island itself, but will have important bearing upon more general questions relating to the culture of the Pacific. It is hoped that it will be possible for a full account of the expedition to be given at the forthcoming meeting of the British Association at Newcastle.

E. N. FALLAIZE.

[1] The tablets are described and the attempts at their interpretation summarised and discussed by Mr. O. M. Dalton. "On an inscribed wooden tablet from Easter Island (Rapa Nui) in the British Museum." *Man*. London, 1904. No. 1.

[2] W. H. R. Rivers, "Sun Cult and Megaliths in Oceania." *American Anthropologist*, New Series, 17, 1915. 442 fol.

THE BRITISH SCIENCE GUILD.

THE tenth annual meeting of the British Science Guild was held at the rooms of the Royal Society of Medicine on May 17, when the Rt. Hon. Sir William Mather (president of the Guild) presided over a large attendance, including many well-known men of science.

In moving the adoption of the annual report the president referred to the past work of the British Science Guild in encouraging the practical applications of science—a matter the importance of which had been acutely realised since the outbreak of war. Many instances are furnished in the report. It will be recalled that public interest in this question was aroused by an address delivered by Sir William Ramsay on the organisation of science at the annual meeting in 1915. This subject has since received constant attention by the executive committee, and useful work has also been done by the various special committees of the Guild. A journal is now being issued periodically summarising the work of such committees and other matters of general interest to members of the Guild.

It is remarked that the need for the proposed National School of Technical Optics has been strikingly illustrated by the difficulty, since the outbreak of war, in securing adequate supplies of binoculars, prismatic compasses, gun-sights, periscopes, range-finders, and other "optical munitions." A resolution urging the national importance of such a school was passed by the executive committee of the Guild on December 7, 1915, and forwarded to the Ministry of Munitions, but notwithstanding the assurance of the Minister that "the object in view appears to be undoubtedly of the greatest importance," the necessary funds for this purpose are not yet forthcoming. Committees are also engaged in studying the manufacture of British microscopes for pathological, chemical, and metallurgical work; and a special committee has outlined a programme of policy of State relationship to industry, science, and education. This memorandum will be issued in due course.

The annual report contains a survey of the various science committees working on war problems, the steps taken by various scientific societies to put their members at the service of the Government for scientific work, and other proposals of interest during the year. Reference is made to the recent meeting following the memorandum on "The Neglect of Science"; the conference called by the Royal Society with the view of establishing a conjoint board of scientific societies; and the work of the advisory council to the committee of the Privy Council for the organisation of scientific and industrial research. In an appendix, compiled by Prof. R. A. Gregory, the work of the advisory council is more fully described and a summary is given of the scheme for the establishment of a Commonwealth Institute of Science and Industry in Australia. This appendix also contains a review of the Civil Service estimates for education and science, and some particulars of benefactions to science and education in the United States. During the period 1871–1914 no less than 116,883,000*l.* was given in private donations for these purposes. In the year 1913–14 six universities benefited to the extent of more than 200,000*l.* each, Cornell University receiving 875,220*l.* The average annual benefactions for educational purposes amount to nearly six million pounds. The report as a whole furnishes an extremely interesting review of progress during the past year—a year which may prove a very important one in the history of British science.

The adoption of the annual report was seconded by Dr. R. Mullineux Walmsley, who gave some instances of our present deficiency in facilities for the manufacture and application of optical glass. He recalled that the scheme for the National School of Technical Optics, originally matured by the governors of the Northampton Institute, was placed before the educational authorities thirteen years ago. Had this school been in existence when the war opened, it could have rendered exceedingly valuable service. In appealing for 40,000*l.* to cover the building and equipment of the school Dr. Walmsley read a letter from Mr. Lloyd George agreeing that a National School of Technical Optics was urgently needed, and commending the scheme to the generous consideration of patriotic citizens.

An address was delivered by the Rt. Hon. Andrew Fisher, High Commissioner for the Commonwealth, on the establishment of a National Institute of Science and Industry in Australia. Since the war Australia had learned to appreciate the value of organised science. The laboratory was the adjunct of the workshop. Science, added Mr. Fisher, should be more adequately represented in the Government of this country, and mere attachment to tradition should not interfere with the realisation of this aim. The scheme for the National Institute of Science and Industry was based on co-operation. The conference called last January had received the combined support of men of science, manufacturers, and representatives of the chief State departments, and in a fortnight had evolved a definite scheme. The institute will be under the supervision of three directors, free from political control, one of whom will be a man of proved ability in business and finance, and the other two men of science of high standing. The institute will encourage and initiate researches in the chief colleges and laboratories throughout the country, establish research fellowships, and create new institutions where necessary. It is also proposed to organise a bureau of information, which will act as a clearing-house for intelligence of scientific and industrial value, will help to avoid overlapping of effort, and will promote the interchange of experience between men of science and manufacturers. Among the subjects to be investigated will be many of great importance to Australia connected with metallurgical, chemical, and agricultural matters and the utilisation of waste products. Important work might also be done in studying the development of districts differing widely in climate and temperature.

A vote of thanks to Mr. Fisher was proposed by Sir Alfred Keogh and seconded by Sir John S. Young. Sir Alfred Keogh expressed the hope that the scheme described by Mr. Fisher would be instrumental in promoting constant interchange of views between men of science in this country and in Australia. As an illustration of the practical applications of science, Sir Alfred referred to the care of the wounded and their treatment during convalescence. A striking instance had been the suppression of typhoid fever. To-day there are only twenty-two cases in the British Army in France, whereas if we had gone on in the old way the number of cases would probably have reached 80,000 or 100,000.

The Lord Mayor and Mr. Andrew Fisher have been elected vice-presidents of the Guild; and the Executive Committee for the year 1916–17 is constituted as follows:—President, Right Hon. Sir William Mather; chairman of committees, Sir Norman Lockyer, K.C.B., F.R.S.; vice-chairmen of committees, Sir Hugh Bell, Bt., Hon. Sir John Cockburn, K.C.M.G.; honorary treasurer, Right Hon. Lord Avebury; honorary assistant treasurer, Lady Lockyer; deputy chairman, Sir Boverton Redwood, Bt.; vice-presidents, Sir William Phipson Beale, Bt., K.C., M.P., Surgeon-General Sir Alfred Keogh, K.C.B., Major O'Meara, R.E., C.M.G., Right Hon. Lord Sydenham, G.C.M.G., G.C.S.I., F.R.S.; hon. secretaries, Sir Alexander Pedler, C.I.E., F.R.S., Dr. F. Mollwo Perkin; other members, Captain Bathurst, M.P., Dr. G. T. Beilby, F.R.S., Mr. W. H. Cowan, M.P., Prof. R. A. Gregory, Sir Robert Hadfield, F.R.S., Prof. A. Liversidge, F.R.S., Sir Philip Magnus, M.P., Dr. T. A. Matthews, Mr. Robert Mond, Prof. John Perry, F.R.S., Sir Ronald Ross, K.C.B., F.R.S., Mr. Alan A. Campbell Swinton, F.R.S., Lady Napier Shaw, Mr. Carmichael Thomas, Dr. R. Mullineux Walmsley, Dr. Howard S. Willson, and Colonel Sir John S. Young, C.V.O.

NOTES.

THE Summer Time Bill received the Royal Assent on May 17, and came into force at 2 a.m. on Sunday, May 21. From now until the end of September three systems of time-reckoning will be legal, namely, (1) Greenwich Time, for tides and other occurrences of navigation and astronomy; (2) local time, which is based on distances from Greenwich in latitude and longitude, and determines lighting-up times; and (3) Summer Time, which is an hour in advance of Greenwich Mean Time. The third clause of the Act states that "during the prescribed period any expression of time in any Act of Parliament, Order in Council, order, regulation, rule, or by-law, or in any time-table, notice, advertisement, or other document, is to mean 'Summer Time.'" Orders as to lighting-up must, however, be excluded from the field of operations of this clause, as they refer to an interval and not to a particular hour. Time-tables showing lighting-up times in different parts of the kingdom are in common use, and are given in many calendars and almanacs. These times are determined by actual sunrise or sunset as points of reference, being at present half an hour before and after respectively. The sun rises to-day, for example, at nearly 4 a.m. in London and sets a little before 8 p.m.; lamps of vehicles must, therefore, be lighted up to 3.30 a.m. G.M.T., and after 8.30 p.m. The corresponding times at Glasgow are 4.38 a.m. for sunrise, 8.38 p.m. for sunset, and lighting-up times to about 4 a.m. and after 9 p.m. All these times are ultimately based on Greenwich Time, with the necessary differences; and it will be a problem for many a village policeman to decide when lamps have really to be lighted. *Symons's Meteorological Magazine* for May, in an article deploring the adoption of the measure, prints a letter from Sir Napier Shaw, director of the Meteorological Office, instructing observers to record their observations and attend at their offices and observatories according to the hours of Greenwich Mean Time, as heretofore, which shows that in the Government meteorological service the Act is simply to be ignored, as it must be in meteorological work generally. So far as we know, not a single daily paper has shown an intelligent appreciation of the relation of daylight to time-standards, but we are glad to acknowledge that, in the technical Press, the *Electrical Review* has consistently condemned the principle involved in the new measure, as well as contested the claims put forward by its advocates. It remains to be seen whether the promised social and economic advantages of the Act will justify the use of Summer Time over the whole kingdom either during the war or after.

AT a meeting held at Burlington House on May 23, attended by representatives of many leading firms concerned with chemical industries, it was resolved that British firms engaged in the chemical and allied trades should form an association (1) to promote closer co-operation and to place before the Government the views of the chemical trade generally; (2) to further industrial research; and (3) to facilitate closer co-operation between chemical manufacturers and various universities and technical schools.

IN an interesting and suggestive address delivered at the inaugural meeting of the Ferrous Section of the Metallurgical Committee of the Advisory Council for Scientific Research on May 8, Sir Robert Hadfield put forward a proposal for the establishment of a Central Bureau of information as to materials existing within the British Empire. As he pointed out, when it is a question of the adoption of a new metallurgical invention or development, it is absolutely necessary to know the locality and extent of the materials which will be required. Neither the work of the Geological Survey, nor that of the Department of Mines in the Home Office, nor that of the Imperial Institute really covers this field. It is true that Dr. Strahan, the director of the Geological Survey and Museum, Jermyn Street, has recently begun the issue of a series of special reports on the mineral resources of Great Britain. But something very much broader and bigger than this is required. How restricted is the scope of activities of the Geological Survey may be illustrated from the fact that it does not include Ireland. The ores existing in that country are not known officially in this country at all; and the basis of such information as does exist rests upon the partial work of one man, who is remunerated to the extent of 100*l.* per annum. Moreover, the maps issued by the Geological Survey in this country do not furnish sufficient information as to minerals of economic value. With proper organisation the value of metallurgical products within the British Empire could be very greatly increased, and the proposal made by Sir Robert Hadfield as to the necessity of a Central Imperial Bureau of information is one that will receive the support of everyone acquainted with the actual state of affairs revealed as the war has progressed.

ON the invitation of Sir Alfred Keogh, rector of the Imperial College of Science and Technology, about fifty members of the Commercial Committee and other members of Parliament visited the college on May 18. Mr. Arthur Acland, the chairman of the Executive Committee of the governing body, welcomed them on behalf of the governors, and gave a short historical account of the college, with particulars of the staff, students, and buildings. Referring to education at public schools, Mr. Acland said that boys came to the college very ill-prepared to take up scientific studies; this no doubt was largely due to the bias in favour of the classical as against the modern or scientific side still existing in most schools, and he urged upon the members of Parliament present the necessity of a full inquiry into our public-school system. Dealing with higher education, he showed how technical training had suffered in the past from lack of funds, and the haphazard manner in which successive Governments had dealt with it. In this country there were no benefactions to education on the scale of those given in the United States, nor large State grants as in Germany. He referred to the sites still unbuilt upon in the Imperial College owing to want of money, and made a strong appeal for the development of scientific institutions generally. It was important that development should be systematic, with a view to the future needs of the Empire. On the conclusion of Mr. Acland's speech, the committee proceeded to inspect the departments, including those of chemistry, physics, fuel technology, engineering, mining, metallurgy, geology and oil technology, and plant physiology and pathology. After the tour the members met at the Imperial College Union, and the rector, in reviewing the purposes of the college, illustrated the country's recent dependence on Germany for highly trained men of science by mentioning that when he first came to the college students who had been trained in botany were obliged to go to places like Munich for training in plant physiology and pathology, and that a regular employment agency for economic botanists for the British Empire existed at that time in Berlin. This was now changed by the action of the college. He urged industrial people to bring their industrial problems to the college, where they would be worked out for them. On behalf of the commercial committee, Major Chapple and Sir Archibald Williamson expressed their thanks and the great pleasure the visit had afforded them.

THE annual visitation of the Royal Observatory, Greenwich, will be held on Saturday, June 3.

SIR ALFRED EWING, F.R.S., Director of Naval Education, has been appointed principal of the University of Edinburgh, in succession to the late Sir William Turner.

ON Thursday, June 22, the Royal Society's Croonian lecture will be delivered by Prof. S. J. Hickson, on "Evolution and Symmetry in the Order of the Sea-pens."

WE learn from the *Times* of May 20 that the archæologist, Dr. P. V. Nikitine, vice-president of the Russian Academy of Sciences, died on May 18 in Petrograd.

THE REV. J. LLEWELYN DAVIES died on May 18 at Hampstead at ninety years of age. Mr. Davies was an original member of the Alpine Club, and made the first ascents of the Dom and the Täschhorn. He was elected one of the members of the first London School Board in succession to Huxley. He was associated with F. D. Maurice in the foundation of the Working Men's College in 1854, and was for a time principal of Queen's College, Harley Street, London, W.

THE band of the Coldstream Guards will play at the Royal Botanic Gardens on Saturday and Sunday afternoons during the season, commencing June 3. Future arrangements include the National Rose Show and other events of botanical, social, and charitable purpose.

THE death has occurred of Dr. T. J. Burrill, who was professor of botany at the University of Illinois from 1870 to 1912. From 1891 to 1894, and again in 1904, he was also acting-president of that institution. He was president of the American Microscopical Society during 1885 and 1886, and its secretary from 1886 to 1889. He served as a botanist in connection with the U.S. Agricultural Experiment Station from 1888 to 1912. At the time of his death Dr. Burrill had almost completed his seventy-seventh year.

MR. H. FLOY, who died recently in New York in his fiftieth year, had considerable repute as an electrical engineer in connection with hydraulic and high-tension long-distance transmission work. From 1892 to 1898 he was associated with the Westinghouse Company, and had afterwards practised independently as a consulting engineer. He was a member of the jury of awards at the St. Louis Exposition, and was the author of several works on electrical subjects, as well as of a large number of contributions to technical journals.

THE death is announced of Mr. L. I. Blake, who was professor of physics and electrical engineering at the Rose Polytechnic Institute, Terre Haute, Indiana, from 1884 to 1887, and at the University of Kansas from 1887 to 1906. At various periods he was constructing electrical engineer on the U.S. Lighthouse Board, and chief engineer (afterwards consulting engineer) of the Submarine Signal Co., of Boston. He was also director and engineer of the Blake-Marscher Electric-Static Ore Separating Co., and was a member of several American scientific societies. He was in his sixty-second year at the time of his death.

CAPT. R. J. SMITH, of the Lancashire Fusiliers, who was killed in action on May 5, at the age of twenty-nine, was the eldest son of Mr. O. Smith, of Jigginstown House, Naas, Co. Kildare. He was educated at Mountjoy School, Dublin, was a graduate of Dublin University, and secured a science scholarship in the Royal College of Science for Ireland, receiving the associateship of that college in 1908. He taught in Kilkenny College in 1909, and then in the Technical Institute, Newry, Co. Down, from which he entered the works of the British Westinghouse Company, Manchester, as an engineer. He owed his rapid promotion in the Army to the technical knowledge which he was so fully able to apply.

LIEUT. R. L. VALENTINE, of the 7th Batt. Royal Dublin Fusiliers, who died on April 30 from wounds received near Loos, was a scholar and an associate of the Royal College of Science for Ireland, where he devoted himself especially to natural history and geology. He was the youngest son of Mr. W. J. M. Valentine, of Dublin, and received his earlier education at the High School, Dublin. When the war broke out, he was engaged on a research at Hook Point, Co. Wexford, leading to a correlation of the base of the Carboniferous strata with the recognised horizons of the Avonian series in south-western England. He had also just gained, by competition, a post as geologist on the Geological Survey of Ireland, and he completed the Civil Service qualifying examination when actually in military training. During his service he devised an important method for increasing the efficiency of the Lewis machine-gun. He was keen and untiring in any duty that he undertook, and would undoubtedly have made his mark among scientific men in Ireland. His loss is especially felt by those who had looked forward to his comradeship in public work.

THE death is announced of Dr. James William White, professor emeritus of surgery at the University of Pennsylvania. Born in 1850, he graduated in 1871, and then joined the scientific staff of the Hassler Expedition under Agassiz, returning in 1872 after visiting both coasts of South America and the Galapagos Archipelago. He then settled in Philadelphia, becoming first resident surgeon at the Eastern Penitentiary, and afterwards professor of genito-urinary surgery, professor of clinical surgery, John Rhea Barton professor of surgery, and, finally, emeritus professor of surgery of the University of Pennsylvania when appointed a trustee of the University. He was the author of many papers and works on surgery, and in former years was an athlete of many parts. On the occasion of its quatercentenary in 1906 the University of Aberdeen conferred on him the honorary degree of LL.D. When the war broke out Dr. White devoted himself with characteristic energy to the cause of the Allies, and published many articles in order to enlighten American public opinion on the origin of the outbreak. He was a well-known visitor to this country, where he formed many friendships.

THERE has been a poetic simplicity in the quiet life, just over, of Mr. John Griffiths, Welshman, mathematician, and college tutor, for many years past Senior Fellow of Jesus College, Oxford. Childhood in a farm-house at Llangendeirne, near Kidwelly; schooldays at Cowbridge; half a century of congenial study, research, and not too burdensome teaching in the walls of his college; ten years of repose in the village where he was born. His modesty was extreme, his shunning of company excessive. Happy with a few real friends always close, and with Kidwelly for the Tipperary of his heart, he wanted no outer circle of acquaintances. If he cherished any unsatisfied ambition, it was unexpressed. Fortunately he allowed himself to write—impulsively, nervously, cleverly, but too briefly to do himself justice. He produced a quite early volume on the geometry of the triangle, and some thirty or forty notes and papers for the London Mathematical Society and for journals. Some of these deal with geometry, others with elliptic functions. His pupils, even if many passed from his sight, were lastingly attached to him. Among them were H. W. Lloyd Tanner (deceased), Prof. W. J. Lewis, and the present registrar of the University of Oxford.

IT is reported from Amsterdam that Prof. Karl Schwarzschild, director of the Astrophysical Observatory at Potsdam, has died from illness contracted while on military service. In the early part of the war he was said to have been acting as meteorological expert in connection with aeronautics at Namur, but is now described as having been an officer in the artillery. Prof. Schwarzschild was born at Frankfort in 1873, and took his doctor's degree at Munich in 1896. He was appointed assistant at the Von Kuffner Observatory at Vienna in 1896, was *Privatdozent* at Munich from 1899 to 1901, and became professor of astronomy and director of the observatory at Göttingen in 1902. He succeeded Vogel as director of the great observatory at Potsdam in 1910. Prof. Schwarzschild's contributions to astronomy were very numerous and covered a wide range of subjects. His mathematical investigations of the pressure of sunlight, in relation to the dimensions of the particles acted upon, are well known in connection with theories of the solar corona and the constitution of comets. He gave much attention to stellar photometry, and developed important practical methods of observation in this connection; the use of a coarse grating on the object-glass of a telescope, which has yielded such valuable data for photographic magnitudes, was first adopted by him in 1895. He also attacked, with some success, the problem of applying the objective-prism to the determination of radial velocities. Prof. Schwarzschild was a notable contributor to the investigation of stellar motions and the structure of the universe. His name will be especially identified with the "ellipsoidal" hypothesis as an alternative to the hypothesis of two star streams, suggested by Kapteyn. He was elected an associate of the Royal Astronomical Society in 1909. By his death astronomy has lost an investigator of untiring industry and marked originality.

IN spite of the elaborate survey of the pagan tribes of the Malay Peninsula, by Messrs. Skeat and Blagden, much still remains to be done by local workers. In the Journal of the Federated Malay States Museum, vol. vi., part iv., for February last, Mr. J. H. N. Evans, in his account of the aboriginal tribes of Upper Perak, supplies much information interesting to anthropologists. It is generally admitted that the form of the round hut which survives for ritual purposes in Roman temples and Christian churches was originally conditioned by the form assumed in bending by elastic bamboos or branches. But it is curious to note that among most, if not all, of the aboriginal tribes of the peninsula the spells of the magician are performed within a magic circle; in some cases a round hut of leaves is erected within which the magician ensconces himself; in others merely a round frame with hangings is used. This points to a very primitive ritual use of the round hut. The article contains much other valuable information, and is illustrated by photographs of the ethnical types of the tribes visited by Mr. Evans.

THE sixth memoir issued by the South African Institute for Medical Research is a study of the "Trypanosomes of Sleeping Sickness," by Mr. G. P. Maynard, statistician and clinician to the institute. The author, who has applied Prof. Karl Pearson's method of resolving a compound distribution into two "normal" components to a number of length distributions of trypanosomes, adversely criticises several of the conclusions reached by the Sleeping Sickness Commission of the Royal Society. He holds that the published length distributions afford no valid argument as to the identity or otherwise of *T. brucei* and the trypanosome causing disease in man in Nyasaland. Several of Mr. Maynard's conclusions will not pass unchallenged, but his memoir is of great interest, and should be studied by all who wish to master the numerous and perplexing problems suggested by the facts at present known respecting the etiology and epidemiology of sleeping sickness.

THE *Museums Journal* for May contains an excellent and detailed account of the Wellcome Historical Medical Museum, originally formed for the benefit of the seventeenth International Congress of Medicine, held in London in August, 1913. Thanks to the generosity of its founder, Mr. Henry S. Wellcome, the collections then brought together were rearranged and embodied as a permanent institution in 1914. "One of the chief objects of the museum," remarks Mr. C. J. Thompson, its curator, "is to stimulate among medical practitioners of to-day the study of the history of medicine, and thus to suggest fresh fields of research." Mr. Thompson has illustrated his article with some excellent photographs. Other items of interest in this number refer to the considerable extension of museum work in Germany. One new picture gallery and no fewer than sixteen war museums have been founded since hostilities began. This contrasts unfavourably with the efforts, in the name of "economy," which have been made to *close* museums in Great Britain.

MR. H. F. WITHERBY makes his fourth series of records on the moulting and sequences of plumage in the British Passeres in the May number of *British Birds*. This is, of its kind, a most admirable piece of work, and should earn the gratitude of all ornithologists. In the course of the present article he gives a most interesting example at one and the same time of the recapitulation theory and the disappearance of structures by degeneration, or "evolution by loss," as Prof. Bateson has it. To wit, he shows that in the larks the outermost primary in the first, teleoptyle, plumage is almost twice as large as that produced in the next and all subsequent moults, this outermost quill having, for some reason, become superfluous. In the same issue Miss E. L. Turner makes some noteworthy observations on the breeding habits of the sheldrake. She adds to our knowledge of their courtship habits, as well as to that of their post-nuptial behaviour. At one point on Holy Island, the scene of her studies, she found sheldrakes breeding in considerable numbers, and here, while the females were incubating, the males indulged in "regular organised games, and were more or less gregarious." On other parts of the island they were breeding in isolated pairs, and in these cases the males would "sit about in solitary grandeur."

THE results of a botanical exploration of Lower California are given in a useful paper by Mr. E. A. Goldman in Contributions from the United States National Herbarium, vol. xvi., part 14. The author and Mr. Nelson spent nearly a year in traversing this interesting region, which floristically is separable into two main divisions, one identical with that of southern California, the other, in the south, of a more austral type, derived from or related to that of the adjacent Mexican mainland. The higher mountains are crowned by oak and pine forests, and in the more arid parts monstrous forms of plant-life have been developed, which give the landscape an aspect of unreality. Several remarkable genera are peculiar to the peninsula. As a result of the expedition twenty-two new species were discovered. Good plates are given of the more interesting plants, and among those especially noteworthy from the dry regions are *Pachycormus discolor* (Anacardiaceæ), a monotypic genus confined to the peninsula, *Fouquieria peninsularis* and *Idria columnaris* (Fouquieriaceæ), reminding one of the extraordinary desert forms of S.W. Madagascar, and *Ibervillea sonorae* (Cucurbibaceæ), with a large woody base.

THE term aerography is a new one, and probably makes its first appearance in an article by Prof. Alexander McAdie, of Harvard University, in the *Geographical Review* for April (vol. i., No. 4). It is suggested to restrict it to a description of the atmosphere at different levels, or, as the author puts it, a description of the structure of the atmosphere. Prof. McAdie pleads that the base-level of the sea, familiar in meteorology, must be discarded in aerography, and replaced by the base of the stratosphere. In this he agrees with the opinion of Sir Napier Shaw. The paper is a short one and much condensed, but it contains some useful suggestions, such as a plea for maps showing the atmospheric conditions at various levels, and for measurements of the vertical flow of air and its cartographical representation. The construction of charts of air structure would have a practical importance to aviators.

THE provision of a standard scale of seismic intensity is a problem which has for many years engaged the attention of seismologists. In his presidential address last year to the Seismological Society of America (Bulletin, vol. v., 1915, p. 123), Prof. A. McAdie suggested that the well-known Rossi-Forel scale had outlived its usefulness, and that it should be replaced by a dynamical scale of intensity. He offered one on the lines of the Omori and Cancani scales, but consisting of ten degrees, of which the lowest corresponds to an acceleration of 1–10 mm. per sec. per sec., and the highest to one of 5000–10,000 mm. per sec. per sec. Prof. McAdie's suggestion is the subject of an interesting discussion in the last bulletin of the society (pp. 177–89). Though the general opinion seemed to be that some absolute scale would in time be adopted, the difficulty of determining the intensity accurately from seismographic records is noticed, and also, if it were otherwise, the impossibility of providing the instruments in sufficient number. The wide variations of intensity within a limited area, such as Prof. Milne showed to exist in his seismic survey of Tokyo, might also have been mentioned as militating in favour of the Rossi-Forel or a similar scale.

SCIENTIFIC PAPER No. 264 of the U.S. Bureau of Standards, by Messrs. Middlekauff and Skogland, deals with the photometry of gas-filled tungsten incandescent lamps. It is found that when the volts on such a lamp are kept constant the current transmitted and the candle-power are higher when the tip is up than when down. If the lamp is rotated about a vertical axis the current increases, reaches a maximum, decreases to its initial value at a speed depending on the shape and number of loops of the filament, and at higher speeds decreases still further. The changes are greater with the tip up than with it down, and the candle-power in each case changes in the opposite direction to the current. The authors have succeeded in tracing these curious effects to the convection currents in the gas in the lamp. They suggest that in the practical tests of such lamps the speed of rotation should be so chosen that both current and candle-power have the normal values. For lamps of similar construction this speed is fixed, and is in many cases 30 or 40 revolutions per minute.

IN a paper read before the Society of Chemical Industry on April 3, Prof. H. E. Armstrong urged the formation of an Imperial Society of Scientific and Industrial Chemistry, similar in character to the Royal Medical and Chirurgical Society, which in 1907 united the activities of seventeen previously existent societies of medical men. Prof. Armstrong enumerates more than a dozen societies, now entirely independent, which could be made constituent societies of such an Imperial Union. He points out the necessity of co-operation in order to ensure the progress of chemical science and chemical industry, both terms being used in their broadest meaning, lays stress on the evil arising from the ever-increasing specialisation amongst chemists, and emphasises the present waste of effort involved in the publication of so many overlapping journals. Mr. C. T. Kingzett, in an article in the *Chemical Trade Journal* for April 8, develops the same theme. He advocates the establishment of a "real" Institute of Chemistry, to comprise the present Institute, the Chemical Society, Society of Chemical Industry, etc. He also indicates the waste of time, energy, and money involved in the present independent status of the various chemical associations, and remarks on the narrowing influence resulting from the lack of mutual association between them.

THE April part of *Science Progress* contains several articles of interest. Sir Ronald Ross contributes a further instalment of his researches into the theory of equations; Dr. Johnstone, under the slightly misleading title, "The Mathematical Theory of Organic Variability," provides an elementary account of the genesis of Prof. Pearson's family of frequency curves; and Mr. C. Mansell Moullin discusses the natural history of tumours. Other contributors are Prof. Fraser Harris and Mr. Joseph Offord. A valuable feature is a sketch of recent progress in various departments of science under the heading, "Recent Advances in Science." Few readers will dispute the justice of the bitter strictures which bulk largely in the editorial notes upon our national neglect of science.

OUR ASTRONOMICAL COLUMN.

COMET OR NEBULOUS MINOR PLANET?—At the Königstuhl Observatory a photograph taken on April 3 showed what seemed to be a new minor planet, which received the designation 1916 ZK. Its daily motion was −0·6m. and +3′, whilst its magnitude was 13·0 (*Astronomische Nachrichten*, 4841). Three days later, on another photograph, it presented a nebulous appearance. This was more strongly developed by April 27 (*Astronomische Nachrichten*, 4843). Dr. Max Wolf's observations have been confirmed at the Babelsberg Observatory (*Astronomische Nachrichten*, 4843). On April 30 the nebulosity involved a stellar nucleus. This remarkable body evidently bears a likeness to Neujmin's comet 1913*c*, which resembled a minor planet when first discovered, but a few days later developed a weak cometic chevelure; and the latest observations indicate that it is really a new comet. The position of the object on discovery was:—April 3, R.A. 12h. 52·9m., declination +0° 11′; on April 30, 12h. 58·9m., +2° 39·6′. The daily motion on April 27 was −0·5m. and +5′ and the magnitude was 13·3.

THE POLE EFFECT IN THE CALCIUM ARC.—Important quantitative details concerning the pole effect in the arc spectrum of calcium (λλ 3000–4200) are given by Messrs. Gale and Whitney in the *Astrophysical Journal* (vol. xliii., No. 2). The measures of spectra from a horizontal arc 4 mm. long, carrying 4 amperes on a 110-volt circuit, with calcium electrodes 7 to 10 mm. in diameter, indicate a progressive change of from 0·01 to 0·02 tenth metres between positive and negative pole correlated with the series classification of the lines. Although the pole effect seems to be independent of the vapour density of the radiating ions, negativing the suggestion that it is due to the internal pressure of the arc, yet it shows a parallel relationship with the pressure shift. Very significant is the reversal of the gradients of both intensity and pole effect observed when the current is reversed in an arc having one pole of silver, the other being of calcium. The authors suggest that the pole effect depends on the amplitude of vibration of the electrons.

THE ROTATION OF NEBULÆ.—Some additional data concerning rotating nebulæ have been obtained at the Lick Observatory by W. W. Campbell and J. H. Moore (Bulletin No. 278). In spectrograms of the complicated planetary nebula in Aquarius, N.G.C. 7009, taken with the slit set on the major axis of the image, the maximum displacements of the two chief nebular lines indicate a rotational velocity of 6 kilometres per second at a distance of 9 seconds of arc from the nucleus; the inclination of the lines gave a similar result. In the case of N.G.C. 6543, the historic planetary in Draco, the central portion of the nebula, about 6·7″ diameter, is rotating about an axis in P.A. 130°, with a velocity of 5 km./sec. In both cases the nebular lines, in addition to the general inclination, are also somewhat contorted, indicating lower velocities in the outer regions. These observations lead to some very interesting conclusions regarding the probable masses of the nebulæ. Corresponding to an inferior limit of distance of 100 light-years, their respective masses would be 11·3 and 2·8 times solar, whilst the mean density of N.G.C. 7009 would be of the order of 1×10^{-6} times that of hydrogen at 0° C. and 1 mm. of mercury. The density of N.G.C. 6543 appears to be about five times as great. It is considered that the evidence indicates that planetary nebulæ must be regarded as three-dimensional objects. In this connection it was suggested many years ago that a bright ellipsoidal shell viewed from a distance would present the appearance of a ring nebula.

NATIONAL DEFENCE AND DEVELOPMENT IN THE UNITED STATES.

THE proceedings of the American Association for the Advancement of Science at its annual meeting held at Columbus at the end of last year were characterised by a large number of papers read before the section devoted to Social and Economic Science on various aspects of national defence and development, a reprint of which appears to the number of eleven articles in the *Scientific Monthly* of New York for the month of April.

The events of the European war seem to have awakened in the minds of the economists of the association dire anticipations of similar devastating results to the United States so soon as the war is concluded, and they have hastened to recommend the most extraordinary provision and a vast expenditure in order to place the nation in a condition of complete defence by the establishment of a standing army of from half a million to a million men, of a great reserve, and of a navy at least equal to that of the greatest European naval Power. The doctrine of "preparedness" seems to have taken firm root amongst them, together with the dictum quoted from Washington, "To be prepared for war is the most effective means of promoting peace." The success of Germany in the early days of the war, and the efficiency of her military arrangements, have evidently made a deep impression on the American mind. It is pointed out, for example, that England spent 53½ years of the nineteenth century in war, and France not much less, whilst Prussia spent but thirteen years, the result of her extraordinary preparedness. As a result of her efficiency, she "quickly finished her fights and got back to work. The wars of the other nations were long drawn out, due, as we know, to the necessity of their learning and preparing to fight after their wars had begun."

It is claimed that a condition of perpetual and

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universal peace can only be attained when the preponderance of military power has passed into the hands of the pacific peoples. It is, in short, a world in arms that is desiderated. It is argued that as the independence of the States was achieved by an appeal to arms, so its future immunity can only be secured by like means. If force was necessary in the infancy of the nation it is the more essential now, having regard to the command men have secured over the powers of nature. Apprehension is expressed at the eventual attitude of Great Britain as the greatest naval Power, but really with but little justification, since a war with the United States on the part of Great Britain, however much provoked by unscrupulous commercial enterprise or methods, is entirely unthinkable. Rightly considered, the position of the United States is unassailable by any European Power, and having regard to its immense natural resources, to its great and increasing population, to its vast potential and acquired wealth, it occupies a unique position in the civilised world as a preponderating, moderating influence for good in the comity of nations. It is a great factor for the future well-being of mankind that so vast an extent of territory should be under one flag and subject to one polity, and that its people should be mainly concerned with the internal development of its great possibilities.

Science in all its varied aspects has an immense field in the United States, whether in its application to the development of agriculture (the country is now the greatest grain-producing area of the globe, with the lowest yield per acre), to the electrical utilisation of its abundant water-power, to the exploitation of its vast and varied mineral deposits, to the creation of a great mercantile marine, or to the applications of scientific discovery to the production of synthetic products of all kinds. The example of Germany may fitly be followed here. Much has undoubtedly been done in the establishment since 1861 in all the States of well-equipped agricultural colleges and by the extraordinary munificence of her wealthy citizens in founding and endowing colleges and universities. The example of Germany has taught the people much, and it has been accentuated by the efficiency displayed in the course of the war.

The best minds in the States are deeply engaged in the consideration of the factors which will in their application make for the betterment of all classes of the people, not the least of which is education, widespread and sound in all its grades, in which science will play its effective and humanising part, not as a destructive, but as an ameliorating agency.

The vast expenditure it is recommended to incur upon "preparedness" for war would, if devoted to measures for the better education and amelioration of the conditions of life of the people, be a surer guarantee of peace than any warlike preparations, however effective, with the added advantage that the best interests and the highest happiness of the nation would be secured and advanced.

THE PEAT INDUSTRIES OF WISCONSIN.[1]

IN a report recently published upon the peat resources of Wisconsin, Mr. F. W. Huels describes the attempts which have been made to utilise peat in that State. In one of these, the Lamartine Peat, Light and Power Company manufactured machine-turf on a moor near Fond du Lac during the years 1905 and 1906. The peat, which was raised from the bog by a dredger, was macerated and moulded in a modified form of pug-mill. The air-dried turf was sold for twenty-five shillings per ton at Fond du Lac—the nearest town—which was seven miles from the factory. As the fuel contained about 17 per cent. of ash, it is obvious that, at the price, it could not compete with coal. The factory was closed in 1906 and has not since been reopened.

The Whitewater Peat Company in 1902, at a bog more favourably situated with regard to transport facilities than that of Fond du Lac, manufactured press-turf for a short time. The estimated cost of the product was eight shillings per ton. With a view of avoiding the necessity of waiting five weeks for the air-drying of the peat, attempts to introduce artificial drying were made, and, as might have been foreseen, the failure of the company followed.

As a result of a detailed examination of the whole question, Mr. Huels concludes that little use will be made of the Wisconsin peat deposits until at some period in the distant future fuel has become scarce and expensive. This conclusion, although justifiable in the case of peat, like that of Wisconsin, with high ash content, does not apply to peat of low ash content, such as that found on many of the European moors, and, indeed, it is even possible that the further prosecution of the experiments on the manufacture of power-gas from peat, carried out at the University of Wisconsin, may lead him to a reconsideration of his decision.

There is now no doubt that, in districts where peat is plentiful and coal is dear, peat of low ash content can be economically utilised for the manufacture of producer-gas or of semi-water gas. Thus the town of Skabersjo, in Sweden, for the past eleven years has been supplied with electricity for illumination and power purposes by a high-voltage current transmitted from a bog three miles from the town, where it is generated in dynamos driven by engines supplied with semi-water gas made from machine-turf in a suction power-gas producer of the Koerting type. A horse-power hour requires about $4\frac{1}{2}$ lb. of air-dried turf, which at the power station costs less than four shillings per ton. Similarly at Visby, turf costing about five shillings per ton is converted into semi-water gas and employed to drive the machinery of a cement works.

Apart from its use as moss-litter, peat can be economically employed as a fuel in the immediate neighbourhood of a moor, or on a larger scale it can be converted with advantage into producer-gas, the latter serving as fuel for the manufacture of substances such as glass, or into semi-water gas for power purposes, like that for which it is utilised at Visby.

THE OXIDATION OF DRYING-OILS.

MUCH attention is now being paid to the scientific aspects of the phenomenon of "drying" whereby, for instance, boiled linseed oil on exposure to the air is converted by oxidation into a hard varnish-like product. The experiments by which Dr. R. S. Morrell was able to isolate a crystalline component from a drying-oil (Trans. Chem. Soc., 1912, vol. ci., 2082), namely, by the action of light upon Hankow "Chinese wood oil," have already been noted in these columns. A further advance is recorded in a paper by Dr. A. H. Salway, which has recently appeared in the Chemical Society's Journal (vol. cix., pp. 138–45). This investigator has oxidised linseed oil by shaking it with oxygen at 100°, and trapping the volatile products in a wash-bottle containing water. Not only was the odour of acrolein, $CH_2{:}CH{\cdot}CHO$, observed, but the solution showed the chemical reactions of an aldehyde, and on shaking with silver oxide gave a sufficient quantity of silver acrylate, $CH_2{:}CH{\cdot}CO{\cdot}OAg$,

[1] Wisconsin Geological and Natural History Survey. Bulletin No. xlv. Economic Series No. 20. The Peat Resources of Wisconsin. By F. W. Huels. Pp. xvii+274. (Madison, Wis.: Published by the State, 1915.)

Wisconsin – Industries and resources

Oils and fats
animal fats animal oils

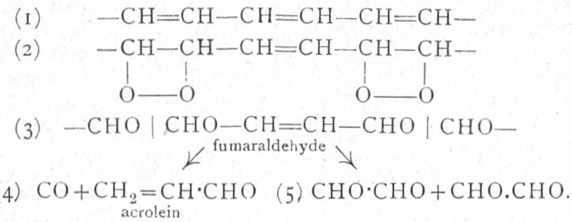
Vegetable oils

Oil

for identification by estimation of the silver contained in it.

Since acrolein is easily produced by the dehydration of glycerine, it has usually been assumed, when the odour of this compound has been detected, that it was derived from the glycerine of the glycerides which constitute the drying-oil. This assumption has been disproved in the present instance, since acrolein was also obtained by oxidising in a similar manner the free fatty acids obtained by hydrolysing the oil, as well as by oxidising the linolenic acid which is the chief product of this hydrolysis. No acrolein was formed in the oxidation of oleic acid, and it is doubtful if linoleic acid would give any acrolein if it could be obtained quite free from linolenic acid.

In order to explain these observations, it is suggested that linolenic acid contains three copulated double-bonds, of which the two outer ones only would unite with oxygen to form an oxygenide, and then rupture with formation of pairs of aldehydic groups, thus—



The hexatriene group would thus give rise to fumaraldehyde, from which acrolein could be produced by removal of carbon monoxide (or by oxidation with removal of carbon dioxide), whilst oxidation of the double-bond would give rise to glyoxal, CHO·CHO. It is suggested that this formation of aldehydes by oxidation is an essential feature of the process of drying, and that the varnish-like product, to which the name linoxyn has been given, is essentially a mixture of polymerised aldehydes, including polymerisation products of acrolein and glyoxal.

It is an encouraging sign of the times that investigations such as these should be undertaken by important commercial companies, as a normal part of the work of their research laboratories; no better omen could be discovered for the stability of British chemical industries in face of the severe competition which may be anticipated in the near future. T. M. L.

INDUSTRIAL RESEARCH IN THE UNITED STATES.[1]

WHILE research is receiving increasing recognition as an essential factor in industrial work, little attention has been given to the manner in which scientific resources in this country can best be directed to meet national industrial needs. A description of the manner in which the United States is dealing with this matter may be useful in throwing some light on our problem, and incidentally the evidence of the progress in that country of industrial research may be inspiring to English manufacturers, who are somewhat sceptical as to the value of science in industry.

The term "industrial research" is often very loosely applied, and it is necessary first of all to define what it really comprises. One may consider it to be focussed in a simple fundamental principle that an industry depends for progress on a continual influx of new knowledge, and it may be conceived that industrial research embraces all means whereby this new knowledge having application in industry can be obtained, whether it is from the accumulated experience of individual workers, or from the efforts of trained investigators directing their efforts to the solution of manufacturing problems impeding the progress of industry, requisitioning where necessary the aid of contemporary science; or whether from new discoveries resulting from investigations in pure science which ultimately find their application in industry.

Industrial research in the United States is mainly accomplished by individual firms, although a good deal is done in the universities and national institutions. With certain exceptions, noted later, the greater part of the university work, however, is directed to pure science investigations having no immediate commercial object.

As regards the work of individual firms, during the past ten years there have been very considerable sums spent by the leading manufacturing corporations to provide facilities for scientific investigation. Annual expenditures for this purpose of 25,000*l*., 50,000*l*., and even 100,000*l*. are not uncommon. The leading firms possessing private research laboratories include the General Electric Co., Schenectady; Westinghouse Electrical and Manufacturing Co., East Pittsburg; Eastman Kodak Co., Rochester, New York, this firm representing the manufacture of photographic chemicals and apparatus; the Du Pont Powder Co.; the American Rolling Mill Co., producing sheet iron and steel; the National Electric Lamp Association, representing a large number of electric lamp manufacturers; the General Chemical Co.; General Bakelite Co.; United States Steel Corporation; the Edison Laboratories; Pennsylvania Railway Co., which deals with all kinds of materials and investigations pertaining to railway requirements; and many others.

Among the important features of the work of many of these laboratories is the equipment of full-scale manufacturing plant, which enables discoveries in the laboratory to be fully tried out and manufacturing methods perfected, relieving the manufacturing departments from the hampering effects of new developments. Many of the laboratories also are equipped for the manufacture on a commercial scale of some of the commodities developed from their discoveries which are not of a character adapted to production in the manufacturing departments. The laboratory production in such cases is continued until it reaches such dimensions as justify the starting of a separate works. There is a growing tendency in many of the research laboratories to devote more and more attention to investigations in pure science having no immediate commercial object in view, with an appreciation of the fact that almost invariably such investigations result in industrial application, sometimes bringing about the development of entirely new industries. Prominent examples of this kind are represented by the work of the General Electric Co.'s laboratory at Schenectady and the National Electric Lamp Association. In connection with such work, a very broad-minded policy is shown by the publication of the scientific investigations carried out.

It is also noteworthy that these research laboratories serve as very effective advertising means by inspiring confidence in the minds of purchasers as a result of such visible evidence of scientific working.

There appears to be no doubt that these laboratories have proved financially successful, not only in that they afford the greatest possible assistance to the works with which they are connected in solving manufacturing troubles, developing new materials, methods, tools, and making discoveries which result in new industrial developments, but also in the direct manufacture and

[1] Synopsis of an address delivered before the Engineers' Club, Manchester, at the Municipal School of Technology, on April 4, by A. P. M. Fleming.

sale in many cases of valuable products straight from the laboratory.

A great deal of the research work of the universities is devoted to purely scientific investigations arising in connection with the preparation of degree theses by students, and from work done by the staff in their spare time. Apart from this, however, many investigations directed to the solution of particular manufacturing problems are carried out for private firms, and in a number of cases experiment stations have been arranged, the staff of which devote all their time, or at least most of it, to research investigations. Prominent examples of such experiment stations are those of the Illinois State University, Massachusetts Institute of Technology (now incorporated with the School of Engineering, Harvard University), Ohio State University (the experiment station of which has recently been inaugurated), and the Universities of Iowa, Kansas, etc.

In connection with Columbia University, it is proposed to erect a laboratory specifically devoted to research, the cost of which it is estimated will be of the order of 130,000*l.* for buildings and equipment, and it is expected that an endowment fund for extension and maintenance of from 400,000*l.* to 1,000,000*l.* will be required. This proposal appears to be inspired to some extent by the success of the research laboratories associated with the large industrial corporations already referred to, and it is realised that there are many smaller manufacturers who are unable to support individually the burden of such laboratories who would be glad to avail themselves of the opportunities which this university research laboratory would afford.

An important feature of the proposal is the intention of devoting means to the collection of all possible information bearing on the industrial problems that are likely to be considered.

The most striking feature of the research work of the universities is this provision of research facilities and the use of a staff of highly trained scientific men who can devote their whole efforts to scientific investigation without the handicap of a great deal of teaching work, and as well as of financial anxiety. It is also noticeable that increasing numbers of young men who have taken their bachelor's degree proceed to a doctor's degree, possibly on account of the opportunities for employment now presented by the increasing number of research laboratories for men of the highest scientific training.

While the students themselves do not generally participate in the investigational work of the experiment stations, this work cannot fail to be of considerable inspirational value to them.

The researches of the experiment stations are freely published, and in connection with the Illinois State University more than eighty important bulletins have already been issued, some of them comprising the most authoritative work on the subjects with which they deal.

The work of the Mellon Institute of Industrial Research, associated with the University of Pittsburg, has often been described in the English Press. Manufacturers are invited to bring their problems to the director of the institute, and to provide fellowships to support the men who will carry out their investigations. Usually these fellowships are tenable for a period of one or more years, and may be of the value of from 100*l.* to 400*l.* or 500*l.*, according to the nature of the investigation. The director then selects suitable men from the universities or other institutions, who proceed to the manufacturer's works, study the problem under practical conditions, and then carry out the investigational work in the laboratories provided by the institute, under the supervision of a permanent scientific staff. Some seventy-five researches have already been carried out during the past four years, including such subjects as copper leaching, cement manufacture, timber preservation, smoke prevention, glass production, bread-making, paper manufacturing, etc.

Important features of the work of the institute comprise the educative influence it has on the manufacturers in focussing their attention on the possibilities of industrial research, and the fact that many of the young men who have successfully carried out researches have been absorbed into the industry with which they were temporarily associated, and in this way become powerful advocates for industrial research. To a limited extent this process tends to the permeation of industry with young men having keen appreciation of the application of science in industry.

Of the national institutions, the most important is that of the Bureau of Standards, which at present does a great deal of investigational work for the Government departments, and is prepared to carry out researches where it can be shown that these are likely to benefit an appreciable section of the public, in which case it is done at the public expense. Already in this connection much valuable work has been done in such subjects as the manufacture of refrigerating machinery, paper-making, investigation of alloys, etc.

A series of publications is issued by the Bureau of Standards comprising popular and technological bulletins, and bulletins recording the results of scientific investigations.

The Department of Agriculture is of some interest in that it carries on a scheme of investigational work on national lines. Connected with it are some hundreds of experiment stations in different parts of the States, which deal with experimental work relating to the growth of crops, including fertilisers, pests, etc., cattle-breeding, including the treatment of various diseases. Bulletins are issued to the agricultural communities, both in popular and scientific form, and the organisation provides for lectures dealing with special features of interest to different sections of the agricultural community.

While there is as yet no national plan of industrial research, there are tendencies in that direction, some of which are directed to linking up the efforts of the universities, the extension of the experiment station scheme to a number of universities and colleges, and the co-ordination of the work of some of the existing laboratories connected with industrial concerns. In this connection there is always the evidence of the successful working of the Department of Agriculture to serve as an inspiration to those who desire to see national scientific facilities made applicable to manufacturing interests.

The work done in the United States is of considerable value in enabling us to shape our own schemes with reference to research, and although this country is considerably behind in the development of such schemes, considerable advantage accrues in being able to make use of the experience the States have already gained. Of that experience full use should be made.

The distinguishing feature of work done in America is that it is mainly in the hands of private companies, and is carried out in order that one company may compete more effectively with another. The development of the internal resources of the country has occupied most attention, and little work has been done with a view to encouraging export trade. In this country our export trade is of the first importance, and it is here that the country feels the pinch of German competition. The opportunity, therefore, arises to take the greatest possible advantage of laxity in the past and at the same time to take steps to conserve our overseas trade.

This can only effectively be done by co-operating and pooling our scientific resources, which have hitherto lacked organisation. Doubtless many manufacturers will in future provide themselves with small laboratories where manufacturing difficulties peculiar to their own works can be solved, but the big advance in the future can only come by concentrating advanced research in a large central institution. The materials, tools, and processes which are common to any industry would be considered in such an institution, and efforts devoted to improving them for the common benefit of the industry. Processes which are the monopoly of any individual firm would have to be left out of such a scheme. Differences of factory organisation and management and methods of distribution would still enable manufacturers to compete among each other, but the whole industry would be lifted to a higher plane through discoveries arising from work done at a research institution, which would enable foreign competition to be met most successfully.

Such an institution would comprise a laboratory for each of the great industries—engineering, shipbuilding, soap-making, dyeing, rubber, paper, metal, and textile manufacture, mining, etc.—housed in a large central building. Much of the work done would be along lines of pure science investigation, so as to ensure priority of new applications in industry. Patents would be taken out by the Board of Control, and manufacturers in this country or the Colonies licensed to manufacture at a nominal charge.

The advantages of such a scheme over a system of isolated laboratories in different centres are as follows:—

(1) Work would be done without the overlapping which inevitably occurs among a number of different institutions, and results in great lack of economy.

(2) Administrative expenses would be reduced to a minimum.

(3) Since one research frequently leads to others quite unsuspected originally, if all the work were done in one centre fresh investigations could be carried out with the least loss of time and the greatest possible efficiency.

(4) The problem of collecting information on problems considered would be reduced to a minimum by housing copies of all matter required in one library.

(5) The problem of distribution of information would in the same way give as little trouble as possible if handled by a bureau attached to the institution.

(6) It is of the greatest possible value to have a number of men engaged in research problems housed in one building where opportunities arise for frequent meetings. The stimulation arising from intercourse in this way can scarcely be over-estimated. This would be very largely lost in a system of isolated laboratories.

The advantages the above scheme presents over any proposal to distribute the research work among the universities are equally obvious. The universities are now mainly teaching centres, and the importance of the research work done by the students lies mainly in its educational value. Lecturers and professors are generally too much occupied with teaching to devote time continuously to research, and the complexity of modern research demands, above all things, continuity of application. If the universities adopt the plan of having two separate staffs, one for teaching and the other for research, then there would be an obvious gain in transferring the research workers to the central institution, where the best possible equipment and facilities would be obtainable. At present good research workers at the universities are often spoiled by having to undertake teaching, while really capable lecturers seldom make first-class research men.

On the other hand, the existing facilities of the universities comprising equipment and staff could be utilised as an auxiliary to the central institution for dealing with those problems for which their scientific apparatus and experience are best suited. In this way the whole of the scientific resources of the country could be co-ordinated and utilised in the national industrial interests.

British people seem to possess a certain industrial genius which assured them priority in the industrial world in the past, and the records of her inventors and discoverers lead to the belief that what has happened in the past may, with suitable organisation, be repeated in future.

In view of the fact that industrial research can be made to pay for itself, it would be an excellent investment if manufacturers in this country would devote the necessary percentage of the gross profits arising from industrial processes to equip and maintain a research laboratory planned on a comprehensive scale.

A critical survey of the work already accomplished in the States affords evidence in favour of the success of such a national attempt at industrial research, and ultimately such a scheme might be extended to embrace, not only the interests of this country, but also to link up the efforts made in our overseas Dominions, such as those of the recently established Institute of Science and Industry for the Commonwealth of Australia.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

AT the forthcoming annual conference of the Association of Education Committees a demand is to be made for the appointment of a Royal Commission to inquire into and consider the whole question of the organisation of our educational system and its adaptation to the new national needs which will arise after the war. The association will urge that there should be no delay in the appointment of such a Commission, and that the necessary inquiries should commence forthwith, so that the coming of peace may find us in possession of the facts as to the directions in which modifications and developments are desirable. To provide a complete and satisfactory system which will ensure the best education for all students up to the limit of their capabilities will of necessity be a costly undertaking, though, from the national point of view, it will be a highly remunerative investment. It is the duty of all who influence public opinion to insist upon this national need, and to explain that recent reductions in educational expenditure by local authorities is a mistaken and unwise economy.

IN a recent Convocation address by Dr. Ewing, the Vice-Chancellor of the Punjab University, attention was directed to the necessity that urgently exists of broadening the basis of higher education in India. Dr. Ewing said:—"I have dreamed of the establishment here of a College of Commerce as an integral part of our activities; of the foundation of industrial fellowships for the investigation of specific problems connected with industry." With this as a text, the *Pioneer Mail* of March 25 includes a convincing article pointing out the enormous numbers of graduates which are being turned out by Indian universities, the great majority of whom are only fitted by their training for various posts in Government employ and for the practice of the law. These two professions are, and have been for years, largely overcrowded. Relatively few graduates take up engineering or medicine, and still fewer take up commerce, trade, or agriculture. It is pointed out that many of these highly educated Indians, trained largely on a literary basis, must of necessity remain unemployed, and the *Pioneer Mail* remarks that "an educated and unemployable residuum, ever growing bigger and bigger, may develop into a very real danger." The efforts which were made during Lord Curzon's Viceroyalty, and have been continued since, to make education in India more practical appear to have had rather slow growth, and it is to be hoped that further efforts will be made in this direction, as indicated by Dr. Ewing in his Convocation address.

A COPY of the calendar for 1915–16 of the University of Hongkong has been received. The historical sketch which the calendar contains shows that the idea of establishing a University in Hongkong was first suggested in 1905, but it was two years later before the matter took definite shape. In 1907 Mr. H. N. Mody offered to erect the necessary buildings at a cost of 30,000*l.*, and to give 6000*l.* towards an endowment fund. In 1908 it was proposed to accept this offer, and to erect a building in which the existing Hongkong College of Medicine and a Technical Institute should be located, and to incorporate a University under Ordinance. The scheme was somewhat modified in view of its cost, and Mr. Mody undertook to erect the buildings whatever the expense, but if this exceeded 36,000*l.* not to be responsible for any endowment or for furnishing. Before the end of 1909 the Endowment and Equipment Fund had reached 255,833*l.* The University was incorporated, and came into existence on March 30, 1911. By March, 1912, the main building was practically completed, and the University formally opened. Sir Charles Eliot, Vice-Chancellor of the University of Sheffield, was appointed principal and vice-chancellor, and arrived in Hongkong in June, 1912. The cost of the buildings and the preparation of the ground was 69,000*l.*; the value of the sites given by the Government is estimated at 35,260*l.*; the cost of the anatomical school is estimated at about 6000*l.*, most of which was raised separately by the Chinese. By the founding of the University a service has been rendered already to all the schools of South China, and the success of the University seems assured. Its interests are represented in London by a consulting committee, many members of which have been nominated by scientific and technical bodies.

THE ninth report of the Executive Committee of the Fund for Advanced University Education and Research at University College, London, has just been issued. Since the issue of the previous report the committee has been reorganised under the presidency of H.R.H. Prince Arthur of Connaught. The attention of the committee during the period under review (1914–15) has been chiefly directed to the completion of the new chemistry building. The work accomplished was the completion of the building itself and installation of the fixed fittings, such as benches and cupboards, and gas and water supplies. This enabled the transference of the department from its old quarters to take place during the summer vacation, 1915. The apparatus and chemicals now being used in the new department are the old and antiquated stock from the old building, and are hopelessly inadequate. The completion of the scheme for an up-to-date laboratory falls into two main sections. The first is the technical laboratory and the physical chemistry laboratories for teaching and research, to the completion of which the chemical staff attaches the greatest importance. These cannot be finished or equipped until the money, estimated at 10,000*l.*, is available. It may be pointed out that Germany's success in chemical industry has been largely due to the application of the methods and principles of physical chemistry to technical problems, and that for the study of this branch of the subject laboratories have hitherto offered few facilities. For the equipment of the rest of the building a sum of 4000*l.* is required, and a further sum of 6000*l.* is considered necessary for the development of research during the next few years. Towards the estimated total cost of 20,000*l.* several donations have been promised; of these the most important is one of 5000*l.* by Sir Ralph C. Forster, Bart., provided that the balance of 15,000*l.* is subscribed promptly. Anyone interested in this development of opportunities for study in this important subject can obtain further information on application to the Provost, or to the Professors of Chemistry, at University College.

A NOTEWORTHY article by M. Paul Rivals, professor of industrial chemistry in the faculty of science at Marseilles, bearing upon the organisation of higher technical instruction in the universities of France appears in the *Revue Générale des Sciences* for March 30. It discusses a proposal submitted by M. le Sénateur Goy for the establishment by law of new faculties of applied science, for the conversion of certain faculties of science into faculties of applied science, and for the transfer of the technical institutions now under the jurisdiction of the faculties of science to the control of the new faculties, the staffs of which would be appointed irrespective of academic diplomas and because of their technical attainments, and the students would be recruited from licentiates in science and from those possessing certificates of higher studies. The faculties would be empowered in certain cases to confer the degree of Doctor of Applied Science. The necessity for the reinforcement and enlargement of the means of higher technical instruction in France is admitted, and that the universities should co-operate in the work, but the proposed measures are not the best, says Prof. Rivals, to achieve this purpose. In the first place there should be established higher technical institutions fully recognised by the universities, and in the second place they should be autonomous institutions, the sole aim of which should be the training of the technician, whose ultimate worth would be established by his achievements in the workshop rather than by his researches in the laboratory. His object is not to become a *savant*, but to be a thoroughly sound, well-trained, and practical technician. There is an essential difference between pure science and scientific teaching, and technology and the training of the technician. They cannot be run in the same mould; nevertheless, there should be the closest relation between them, and they should equally enjoy the protection and encouragement of the university of which they form part. The director of the technical institution will be a technician who, with a mind sufficiently wide and cultivated, will be able and alert to utilise and co-ordinate the enormous and unsuspected resources which lurk in the least of the faculties of science, and yet able, because he is an acknowledged master in his own sphere, to inspire in the students the fullest confidence.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, May 18.—Sir J. J. Thomson, president, in the chair.—Hon. R. J. **Strutt**: An active modification of nitrogen. (1) The production of active nitrogen in various regions of the steady discharge has been studied. It is greatest near the kathode, falls off to a minimum in the Faraday dark space, and increases again in the positive column to a value which is constant along that column, but less than that at the kathode. (2) With a given value of the current, much more active nitrogen is obtained from the positive column in a narrow tube than in a wide one. (3) The yield of active nitrogen comes to a limit as the length of positive column traversed by the gas is increased. (4) A trace of oxygen (or almost any other admixture) is known greatly to increase the yield of active nitrogen. The amount of oxygen required to do this considerably increases the fall of potential at the kathode, but it does not measurably affect the fall of potential in the positive column. (5) Active nitrogen is produced by the spark at atmospheric pressure. (6) The metal scattered from a copper kathode when the discharge passes can be made to emit its line spectrum in a stream of active nitrogen.—Dr. R. A. **Houstoun**: A theory of colour vision. The paper explains the facts of colour-mixing by assuming the existence of *one* class of oscillators in the retina with a free period in the middle of the spectrum. Owing to disturbing influences, the vibrations of these oscillators are never monochromatic, but, when represented by a Fourier integral, contain a range of wave-lengths. Thus, even if the incident light is pure red or pure green, the vibrations contain yellow as well. Hence, if the vibrations of the oscillators are identified with subjective light, simultaneous excitation of the eye with red and green produces yellow.—Col. R. L. **Hippisley**: Linkages illustrating the cubic transformation of elliptic functions. The linkage consists of three parts. First, a closed linkage consisting of three identical three-bar linkages in various phases of deformation connected together by bars equal in length to the traversing links, which, as has been described in the Proc. Lond. Math. Society, series 2, vol. xi., indicates the positions of the points where the poristic triangle touches its inscribed circle. Secondly, three positive Peaucellier cells which point out the positions of the vertices of the triangle. Thirdly, a closed linkage similar to the first, which gives the position of the orthocentre. This orthocentre describes a circle, and it can be shown by a few lines of vector geometry that its angular displacement is the sum of the angular displacements of the circumradii of the vertices of the triangle. The angles which these radii make with the axis are the double amplitudes of the elliptic functions which express the positions of the vertices, namely, $am(u+\frac{2}{3}s'K)(s'=0, 1, 2)$.

Linnean Society, May 4.—Prof. E. B. Poulton, president, in the chair.—E. A. **Bunyard**: The origin of the garden red currant. The red currant has been cultivated from the early fifteenth century, and was at first pure *R. vulgare*; for 100 years no variations were recorded. *R. petraeum* was introduced into gardens in 1561 by Konrad Gesner, and a few years after Camerarius mentions the "old" red and a new variety, "baccis rubris majoribus." *R. rubrum* seems to have come into currant history at a later date. The author considers that interhybridisation of the three species—*R. vulgare, R. rubrum,* and *R. petraeum*—is sufficient to account for the numerous varieties of the red currant as grown in gardens to-day, and the supposed effects of cultivation need not in this case be invoked.—Dr. J. C. **Willis**: The dispersal of organisms, as illustrated by the floras of Ceylon and New Zealand. In two recent papers on the flora of Ceylon, and in a forthcoming one on the flora of New Zealand, the author had brought forward conclusions on geographical distribution which, if accepted, will remove that subject from the immediate realm of evolution, and show that it may be largely studied by arithmetical methods. Once a species is evolved, its distribution depends upon causes which act mechanically. As all families and genera behave alike, it seems to him that one cause only must be responsible for their behaviour, but a combination of causes may be acting, though in that case each cause must act mechanically on all alike. The cause which seems the determining factor in dispersal is *age* within the country concerned.—R. J. **Tillyard**: A study of the rectal breathing apparatus in the larvæ of the Anisopterid dragonflies.—W. E. **Collinge**: Description of a new species of Idotea (Isopoda) from the Sea of Marmora.

Zoological Society, May 9.—Dr. S. F. Harmer, vice-president, in the chair.—Miss Dorothea M. A. **Bate**: A collection of vertebrate remains from the Har Dalam Cavern, Malta. Birds are most numerously represented, and include some bones of an Anserine bird showing a reduction in its powers of flight. It is believed to be a hitherto undescribed species, and is referred to the genus Cygnus. A list is given of all the species of vertebrates recorded from the Pleistocene cave and fissure deposits of the island.—Dr. J. C. **Mottram**: An experimental determination of the factors which cause patterns to appear conspicuous in Nature. A series of experiments was carried out with artificial patterns and backgrounds under controlled conditions of lighting, and a large number of determining factors were discovered, both as regards plain and patterned objects and backgrounds. Finally, the experiments showed that the most conspicuous shape and pattern which an object can have, when viewed against a series of plain and patterned backgrounds, was presented by a circular disc of black, with a central circular area of white. Having arrived at this conclusion, the Indian diurnal Lepidoptera were completely examined, in order to discover whether any species presented patterns approaching this ideal conspicuous pattern. It was found that a considerable number presented patterns scarcely removed from this ideal, and that a large proportion of these insects are considered to be "protected" species presenting "warning coloration."

Geological Society, May 10.—Dr. Alfred Harker, president, in the chair.—F. R. C. **Reed**: Carboniferous fossils from Siam. The fossils described in this paper were collected by the Skeat Expedition from Cambridge in the year 1899, at a locality called Kuan Lin Soh, in the Patalung district of Lower Siam, and were briefly mentioned in the "reports" of the British Association for 1900 and 1901. They occur in a pale, fine-grained, jointed siliceous rock, with an irregular or subconchoidal fracture. The field-relations of the beds have not been recorded. The general facies of the small fauna which the available material has yielded indicates a Lower Carboniferous age for the beds, and the affinities of the species seem to be European, and suggest the Culm Series.—H. G. **Smith**: The Lurgecombe Mill lamprophyre and its inclusions. A lamprophyre-dyke intrusive into Culm Shales has recently been exposed at Lurgecombe Mill, near Ashburton (South Devon). The rock is compact and fine-grained, small crystals of biotite imparting to it a characteristic lamprophyric appearance; vesicles with secondary minerals appear towards the margins. In thin section, idiomorphic biotite, olivine-pseudomorphs, and felspars are seen to make up the bulk of the rock; chlorite and secondary quartz occupy the interstices. One of the thin sections was seen to contain crystals of blue corundum associated with magnetite, in a patch which was obviously foreign to the rock. With the object of obtaining additional examples many slices were cut, sections being made of those that seemed promising. In this way several of these inclusions were obtained, the largest being about 0·3 in. in diameter. All contain corundum and magnetite, but in some cases staurolite also is present and, more rarely, green spinel.

Royal Meteorological Society, May 17.—Major H. G. Lyons, president, in the chair.—L. C. W. **Bonacina**: The readjustment of pressure differences: two species of atmospheric circulation and their connection. The paper dealt with a dynamical connection between two essentially distinct types of atmospheric circulation, familiarly exemplified in cyclonic gales on one hand, and in thunderstorms on the other.

DUBLIN.

Royal Dublin Society, April 18.—Prof. Hugh Ryan in the chair.—Prof. G. T. **Morgan**: Utilisation of nitre cake. Among many sources of economic waste occasioned by the war, one of the most extensive is the loss of sulphuric acid and alkali involved in the throwing away of enormous quantities of nitre cake (crude sodium hydrogen sulphate), the by-product of the manufacture of nitric acid from Chili saltpetre. Many proposals have been made for the profitable disposal of this waste product, some of which have been put into practice. In experiments carried out by the author in the Royal College of Science for Ireland this nitre cake was converted into glass or into an insoluble frit suitable for making glasses or glazes. Nitre itself is difficult to transport or to store because of its highly corrosive nature. When fused with sand it is converted into an insoluble, innocuous frit. Preferably it can be fused with sand and limestone, when soda-lime glass is produced, and more than two-thirds of the contained sulphur can be recovered as sulphuric acid and free sulphur. Nitre cake can be used in making soda-lead glass, which, when tinted with coloured oxides, is suitable for ornamental glass. Nitre cake should certainly not be dumped into the sea, as at present practised, without the attempt being made to utilise its contained soda and sulphur in a profitable manner. The experiments were made largely on materials obtained in Ireland. namely, nitric cake from Arklow. sand from County Donegal, Skerries limestone, and lead from Ballycorus.

PARIS.

Academy of Sciences, May 8.—M. Camille Jordan in the chair.—G. **Humbert**: Certain principal circle groups connected with the quadratic forms of Hermite.—G. **Lemoine**: The catalysis of hydrogen peroxide in heterogeneous medium. Third part: Experiments with oxides. The catalytic effect of ferric oxide varied greatly with the physical condition of the oxide. Data are given for experiments with alumina, ceria, silica (in two forms), and thoria. The possibility of the formation of peroxides with the insoluble oxides is discussed.—H. **Le Chatelier** and F. **Bogitch**: The estimation of carbon by the Eggertz method. The experiments vary from the usual method of solution in that the nitric acid is always kept at its boiling point. Each of the factors—concentration of acid, speed of attack, exposure to light, comparison temperature, turbidity of the liquid, duration of heating, volume of the acid liquid, and purity of the acid—has been studied separately with respect to its effect on the colour produced.—W. **Sierpinski**: The theory of ensembles: a general property of ensembles of points.—M. **Etienne**: The working of the electrolytic detector. —G. **Lecointre**: Some results of a geological expedition in the Gharb (western Morocco) in 1914.—P. **Lecène** and A. **Frouin**: New researches showing the reality of latent microbism in cicatrised shot wounds. Twenty-four cases of wounded were examined for the presence of organisms, capable of cultivation, at the surface of projectiles enclosed in the tissues. In all of these the wounds were perfectly cicatrised, and after several months there was no trace of inflammation. In three cases the projectile gave a sterile culture; in seventeen various micro-organisms, including staphylococci, streptococci, and bacilli, were obtained from the bullet. In four cases the projectile and the fibrous envelope were removed together, like a small tumour. The projectiles themselves proved to be sterile, but the internal wall of the fibrous clot gave both cocci and bacilli on cultivation. The bearing of these results on the surgical treatment of projectile wounds is discussed.

BOOKS RECEIVED.

Department of Commerce. U.S. Coast and Geodetic Survey. Serial No. 19: Results of Observations made at the U.S. Coast and Geodetic Survey Magnetic Observatory at Cheltenham, Maryland, 1913 and 1914. By D. L. Hazard. Pp. 98. (Washington: Government Printing Office.)

The Stars as Guides for Night Marching in North Latitude 50°. By E. W. Maunder. Pp. 72. (London: C. H. Kelly.) 2*s.* net.

The Respiratory Exchange of Animals and Man. By Dr. A. Krogh. Pp. viii+173. (London: Longmans and Co.) 6*s.* net.

Plants in Health and Disease. By Prof. F. E. Weiss, Dr. A. D. Imms, and W. Robinson. Pp. viii+143. (Manchester: The University Press; London: Longmans and Co.) 1*s.* 6*d.* net.

Agriculture after the War. By A. D. Hall. Pp. vii+137. (London: J. Murray.) 3*s.* 6*d.* net.

Tuberculosis and the Working Man. By P. C. Varrier-Jones. Pp. 47. (Cambridge: W. Heffer and Sons, Ltd.) 6*d.* net.

Board of Agriculture and Fisheries. Agricultural Statistics, 1915. Vol. l., part 1. Acreage and Live Stock Returns of England and Wales. Pp. 75. (London: H.M.S.O.; Wyman and Sons.) [Cd. 8240.] 4*d.*

Department of Commerce. Circular of the Bureau of Standards, No. 58. Invar and Related Nickel Steels. Pp. 68. Technologic Papers of the Bureau of Standards. No. 71. Effect of Certain Pigments on Linseed Oil. Pp. 16. By E. W. Broughton. Scientific Papers of the Bureau of Standards, No. 273. General Design of Critically Damped Galvanometers. By F. Wenner. (Washington: Government Printing Office.)

The Effects of Radio-active Ores and Residues on Plant Life. Bulletin No. 7. A Report of the Second Series of Experiments carried out at Reading, 1915. Pp. 20. (Reading: Sutton and Sons.) 2*s.* 6*d.* net.

University of Hongkong. Calendar, 1915–16. Pp. 124. (Hongkong.)

Annuaire général de Madagascar et Dépendances. (Modifications à l'Annuaire, 1914.) Pp. 227. (Tananarive.)

Department of Agriculture and Technical Instruction for Ireland. Programme of the Irish Training School of Domestic Economy. Session 1916–17. Pp. 21. (Dublin.)

The Brooklyn Institute of Arts and Sciences. Brooklyn Museum Science Bulletin, vol. iii., No. 1. Long Island Fauna. iv., The Sharks. By J. T. Nichols and R. C. Murphy. (Brooklyn, N.Y.)

Annals of Tropical Medicine and Parasitology. Vol. x., No. 1. April 29. Pp. 164. (Liverpool: University Press.) 7*s.* 6*d.* net.

The Journal of the Royal Agricultural Society of England. Vol. lxxvi. Pp. 8+364. (London: John Murray.) 10s.

The Microscopy of Vegetable Foods. By Dr. A. L. Winton, Prof. J. Moeller, and Dr. K. B. Winton. Second edition. Pp. xiv+701. (New York: J. Wiley and Sons, Inc.; London: Chapman and Hall, Ltd.) 27s. 6d. net.

Sewerage: The Designing, Construction, and Maintenance of Sewerage Systems. By A. P. Folwell. Seventh edition. Pp. x+540. (New York: J. Wiley and Sons, Inc.; London: Chapman and Hall, Ltd.) 12s. 6d. net.

The Journal of the South African Ornithologists' Union. Vol. xi., No. 1. December, 1915. Pp. 118. (Pretoria; London: Witherby and Co.) 7s.

The Nestorian Monument in China. By Prof. P. Y. Saeki. Pp. x+342. (London: S.P.C.K.) 10s. 6d. net.

Text-Book of Mechanics. By Prof. L. A. Martin, jun. Vol. vi., Thermodynamics. Pp. xviii+313. (New York: J. Wiley and Sons, Inc.; London: Chapman and Hall, Ltd.) 7s. 6d. net.

Geodetic Surveying. By Prof. E. R. Cary. Pp. ix+279. (New York: J. Wiley and Sons, Inc.; London: Chapman and Hall, Ltd.) 10s. 6d. net.

Interpolated Six-place Tables of the Logarithms of Numbers and the Natural and Logarithmic Trigonometric Functions. Edited by H. W. Marsh. Pp. xii+155. (New York: J. Wiley and Sons, Inc.; London: Chapman and Hall, Ltd.) 5s. 6d. net.

The Thermodynamic Properties of Ammonia. By F. G. Keyes and R. B. Brownlee. Pp. v+73. (New York: J. Wiley and Sons, Inc.; London: Chapman and Hall, Ltd.) 4s. 6d. net.

The Universal Mind and the Great War. By E. Drake. Pp. vi+100. (London: C. W. Daniel, Ltd.) 2s. 6d. net.

Methods in Practical Petrology. By H. B. Milner and G. M. Part. Pp. vii+68. (Cambridge: W. Heffer and Sons, Ltd.) 2s. 6d. net.

Record of a Prehistoric Industry in Tabular Flint at Brambridge and Highfield, near Southampton. By R. E. Nicholas. Pp. 92. (Southampton: Toogood and Sons.)

Alfred Russel Wallace: Letters and Reminiscences. By J. Marchant. Vol. i., pp. xi+320. Vol. ii., pp. vi+291. (London: Cassell and Co., Ltd.) 25s. net.

The Design of Aeroplanes. By A. W. Judge. Pp. viii+212. (London: Whittaker and Co.) 9s. net.

The Small Grains. By M. A. Carleton. Pp. xxxii+699. (New York: The Macmillan Co.; London: Macmillan and Co., Ltd.) 7s. 6d. net.

Steering by the Stars: for Night-flying, Night-marching, and Night Boat-work between Latitudes 40° N. and 60° N. By Dr. J. D. White. Pp. 32. (London: J. D. Potter.) 1s.

Tunbridge Wells and Neighbourhood: A Chronicle of the Town from 1608 to 1915. By H. R. Knipe. Pp. 207. (Tunbridge Wells: Pelton.)

DIARY OF SOCIETIES.

THURSDAY, MAY 25.

ROYAL SOCIETY, at 4.30.—Bakerian Lecture: X-Rays and the Theory of Radiation: Prof. C. G. Barkla.

ROYAL INSTITUTION, at 3.—The Beginnings of the Orchestra and its Instrumental Combinations: Sir Alexander Mackenzie.

OPTICAL SOCIETY, at 8.—Sands used in Glass-making, with Especial Reference to Optical Glass: Dr. P. G. H. Boswell.

FRIDAY, MAY 26.

ROYAL INSTITUTION, at 5.30.—X-Rays: Prof. C. G. Barkla.

PHYSICAL SOCIETY, at 5.—The Correction of Chromatic Aberrations when the External Media are Dispersive: T. Smith.—Note on the Use of the Auto-collimating Telescope in the Measurement of Angles: J. Guild.—The Viscosity of Colloidal Solutions: E. Hatschek.

SATURDAY, MAY 27.

ROYAL INSTITUTION, at 3.—The Finance of the Great War: Prof. H. S. Foxwell.

TUESDAY, MAY 30.

ROYAL INSTITUTION, at 3.—Optical Research and Chemical Progress: Dr. T. M. Lowry.

THURSDAY, JUNE 1.

ROYAL SOCIETY, at 4.30.—*Probable Papers:* The Scattering of Plane Electric Waves by Spheres: Dr. T. J. I'a Bromwich.—Numerical Results of the Theory of the Diffraction of a Plane Electromagnetic Wave by a perfectly conducting Sphere: J. Proudman, A. T. Doodson, and G. Kennedy.—Motion of Solids in Fluids when the Flow is not Irrotational: G. I. Taylor.

ROYAL INSTITUTION, at 3.—Chamber Music and its Revival in England: Sir Alexander Mackenzie.

ROYAL SOCIETY OF ARTS, at 4.30.—The Work of the Imperial Institute for India: Prof. W. R. Dunstan.

FRIDAY, JUNE 2.

ROYAL INSTITUTION, at 5.30.—La France dans l'Histoire comme Champion du Droit: Lieut. P. H. Loyson.

GEOLOGISTS' ASSOCIATION, at 7.—The Petrology of the North Sea Drift and Suffolk Brick-earths: Dr. P. G. H. Boswell.—Notes on Erosion Phenomena in Egypt: Mary S. Johnston.

SATURDAY, JUNE 3.

ROYAL INSTITUTION, at 3.—Folk-lore in the Old Testament: Sir James G. Frazer.

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