THURSDAY, MARCH 19, 1914.

AN ELIZABETHAN COOKERY-BOOK.

A Proper Newe Booke of Cokerye. Edited by Catherine F. Frere. Pp. clxiv + 124. (Cambridge: Heffer and Sons, Ltd., 1913.) Price 7*s.* 6*d.* net.

WHETHER cookery-books should rank as literature is a question upon which opinions may well differ. Charles Lamb, we fear, would have stigmatised the majority of them as among the books which are no books. But whatever exceptions he might have been induced to make, one of them would certainly have been Miss Frere's work. And this because of his reverence for things ancient and of good repute. It would have quickened his instincts as a bibliograph, and he would have chuckled over the evidence of the playful imagination, delicate wit, and subtle humour with which the editor has embellished the setting of her antique and historic jewel. He would have appreciated, too, the element of comedy in the fact that although Miss Frere, as she frankly confesses, has never had the opportunity of acquiring the art of cookery, she should yet have been fated to edit no fewer than four books on the subject.

The origin of the present work may be told in a few words. The good and learned Matthew Parker, Archbishop of Canterbury from 1559 to 1575, and a former Master of Corpus Christi College, Cambridge, from which he had been ejected during Queen Mary's reign, presented a great collection of valuable manuscripts, as well as many printed books, to his old College and to the University Library, concerning which Dr. Berne, the then Vice-Chancellor, wrote of "the singular beauty that the comely order of Your Grace's books doth bring to the University Library, to the great delectation of the Eye of Every man that Shall Enter into the Said Library." Among the printed books given to the College is a little volume bound in vellum, in which, wedged in between political and learned tracts, is a black-letter octavo of twenty-seven pages, entitled "A Proper Newe Booke of Cokerye." This, with the approval of the Master and Fellows, Miss Frere has caused to be reprinted, furnishing it with an admirable introduction, many excellent annotations, and a useful glossary-index.

The original Cambridge edition is dateless, but was probably published during Parker's tenure of the See of Canterbury. According to Hazlitt, the book was often reprinted before 1546, and was, in fact, a recension of the "Book of Cookery" of 1500, of which there was a reprint by John Byddell about 1530. This was often reproduced, with modifications, and under various names, down to 1650, much of it being embodied in the household books of those days, as, for example, in Thomas Dawson's "Good Huswife's Jewell," of 1596.

Of the original author nothing is known, not even his, or her, name; but one may surmise that the compilation was in all probability the work of a monk, to whom the occupation, we may take it, would not be uncongenial. Authoresses, especially of works on cookery, were not plentiful in those days. Even the classical work of Mrs. Glasse, a book of a much later date, was, according to Boswell, written by a mere man, Dr. Hill.

As we turn over the leaves of the "Proper Newe Booke," with its quaint recipes, couched in the "corrupted phonetic" of the golden age of English prose, we gather, as our author says, "a little rushlight illumination on the culinary mysteries of the once busy kitchens, roofless and empty to-day, and on the hospitalities, feasting, and revels of the now silent dining halls of long ago."

Matthew Parker was a large-minded man, who, living in spacious times, did things in a spacious way. Although an abstemious man himself, and not overburdened with the temporalities of his see, he exercised an almost boundless hospitality, both at Canterbury and at Lambeth, and we can well imagine that Mistress Margaret Harlestone, his devoted wife, who, "for her husband's credit," says Strype, "had all things handsome about her—ordering her housekeeping so nobly and splendidly that all things answered that venerable dignity," must have been sorely exercised at times "to avoid the shame of her Lord's table," especially when, as occasionally happened, his Royal Mistress, in one of her many Progresses, intimated her intention of dining with him, together with the whole of her Privy Council. We fancy at such a time there must have been much searching through the scanty pages of the "Proper Newe Booke."

But to the general reader of to-day, perhaps, the most enlightening, as well as the most interesting portion of Miss Frere's book is her introduction, in which she conjures up a vivid picture of "the gay company that rejoiced and feasted, the fighters and revellers, the grave statesmen, prelates, and lawyers, the admirals, bold sea captains, knights, and ladies, the great lords and princes" that revolved, as about a sun, around their imperious Queen, every inch a Tudor, who combined all the strength of will and masterfulness of her father, with, at times, some of the womanly

traits of her luckless mother. Very sympathetic, too, is the word-picture Miss Frere draws of the great archbishop—of his courage, his loyalty, his devotion to duty, his broad catholicism, his steadfastness, integrity, and liberality. It needed such a man to steer the reformed Church through those troubled times, when practically every ruler in Europe was conspiring with a disloyal faction at home to bring England once more under the heel of the Papacy.

But if Miss Frere has an eye for the picturesque, she has also a pretty wit, and enlivens her narrative from time to time with frequent sallies of humour and many a good story. We shall not anticipate the reader's pleasure by repeating these, strong as is the temptation. It must suffice here to say that Miss Frere, by her book, has added to the gaiety of gourmets, if not of nations. M. D. W.

APPLIED ELECTRICITY.

(1) *A Primer on Alternating Currents.* By Dr. W. G. Rhodes. Pp. viii+145. (London: Longmans, Green and Co., 1912.) Price 2*s.* 6*d.* net.

(2) *Single-Phase Commutator Motors.* By F. Creedy. Pp. x+113. (London: Constable and Co., Ltd., 1913.) Price 7*s.* 6*d.* net.

(3) *The Development of the Incandescent Electric Lamp.* By G. Basil Barham. Pp. viii+198. (London: Scott, Greenwood and Son, 1912.) Price 5*s.* net.

(4) *Allgemeine Elektrotechnik. Hochschul-Vorlesungen.* By Prof. P. Janet. Autorisierte Deutsche Bearbeitung von F. Suchting and E. Riecke. Erster Band. Grundlagen Gleichstrome. Bearbeitet von F. Suchting. Pp. vi+269. (Leipzig and Berlin: B. G. Teubner, 1912.) Price 6 marks.

(1) DR. RHODES' book can scarcely be recommended to those students of limited mathematical knowledge for whom it is avowedly written. Throughout, the author seems to employ trigonometrical functions whenever he can get an excuse for doing so, while in many cases he omits vector diagrams which would probably be of more assistance. The book is open to the criticism of being too academic and out of touch with real things. For instance, we might mention the calculation of iron losses from formulæ instead of reading them off directly from the experimental curves; the "design" of a transformer by assuming a certain flux density and then putting in enough iron to get a specified iron loss without any regard as to whether that iron is required or not; the elaboration of formulæ for the efficiency of synchronous machines taking account only of the copper loss; and, finally, the combination of the fluxes produced by the different coils of a polyphase motor by adding them algebraically, after rectification for some obscure reason, instead of taking account of their directions in the usual manner. The reader's confidence in the remainder of the book is scarcely restored by the hazy "due to the influence of the rotor currents," which is advanced as an explanation of the discrepancy between the known facts and the results of this curious proceeding.

(2) Mr. Creedy writes on a subject which he has made his own, and he introduces us to some new and fertile ideas in connection with it. His book requires a very close study to master it, and we cannot but feel that the reader's path would have been much easier if the author had given a *continuous* exposition of his method as applied to a single type of machine, instead of explaining it in snippets with other matter between.

So far as fluxes are concerned, he makes his case fairly clear, but when he applies his ellipses to E.M.F.'s he is less convincing. He employs space diagrams to combine E.M.F.'s in series, for which only time-phase matters, and although the latter does depend on the instantaneous position of the coil, his description brings forward no reason why his construction should give the correct result. The statement as to the equality, at synchronous speeds, of the transformer and motion E.M.F.'s in two mutually perpendicular axes should be proved, particularly as the student will have some difficulty in imagining a winding which will give a constant harmonic distribution about a fixed axis while it itself rotates.

Here and there the book is marred by the use of loose expressions which make a difficult subject still more difficult. Thus, we have "rotating ellipse" to describe a curve which is fixed but the radius of which is supposed to rotate. A greater attention to the agreement between the lettering of the diagrams and the text, and to the suitable juxtaposition of corresponding connection and vector diagrams would have been a help to the reader.

In spite of these little defects, we are strongly of the opinion that this book should be on the shelves of all who are interested in the subject.

(3) The account of the early incandescent lamps and of the carbon and tantalum filaments which Mr. Barham gives will be read with much interest by many outside electrical circles. If only the remainder of the book had been similar, we should have had little but praise for it. But the second half of the book, dealing mostly with tungsten lamps, lacks perspective, and wearies the reader. Even the author seems to feel, in one place, that

the matter is too much an echo of the claims and hopes of the various inventors, as recorded in their patent specifications, and too little an account of processes in actual use in the factories which turn out tungsten filaments on a commercial scale. In fact, very few even of those readers who wade through the whole ninety or so pages about these lamps will have gained the faintest idea of these processes. A reduction of this portion of the book would have given space for a description of the Nernst lamp and its properties, which lamp certainly deserves more than a casual mention.

(4) The last of the books before us can be recommended to those who would prefer to read the matter in German. The ground taken up is, for the most part, thoroughly discussed from the theoretical point of view, and the British reader will probably come across some instructive ideas which are new to him. In places there is a tendency to ignore facts which do not lend themselves to a simple theory, and there is a leaning to the physical side of the subject rather than to the engineering side. There are also some statements which give the reader quite a wrong impression, because they are not accompanied by a statement of the very special conditions to which they apply. For instance, we are told that the E.M.F. of a ring armature is independent of the number of poles, while the power is proportional to that number, in such a way that the reader would take the statement to apply to a given armature, whereas it would only apply if the size of the armature were increased along with the number of poles so that each of the latter might be kept of a constant size. The book does not contain, as a knowledge of English books with equivalent titles might lead one to expect, any structural details or views of machines. Still, it is well worth reading, and certainly merits a more substantial binding than the publisher has given it.

D. R.

SCIENCE AND PHILOSOPHY.

(1) *Proceedings of the Aristotelian Society.* New Series. Vol. xiii. Pp. 375. (London: Williams and Norgate, 1913.) Price 10*s.* 6*d.* net.

(2) *Encyclopædia of the Philosophical Sciences.* Vol. i.: Logic. By A. Ruge, W. Windelband, J. Royce, and others. Translated by B. Ethel Meyer. Pp. x+269. (London: Macmillan and Co., Ltd., 1913.) Price 7*s.* 6*d.* net.

(3) *Evolution by Cooperation.* A Study in Bio-Economics. By H. Reinheimer. Pp. xiv+200. (London: Kegan Paul, Trench, Trübner and Co., Ltd., 1913.) Price 3*s.* 6*d.* net.

(4) *The Science of the Sciences.* By H. Jamyn Brooks. Pp. 312+ix. (London: David Nutt, n.d.) Price 3*s.* 6*d.* net.

(5) *Probleme der Entwicklung des Geistes.* Die Geistesformen. By S. Meyer. Pp. v+429. Leipzig: J. A. Barth, 1913.) Price 13 marks.

(6) *Naturphilosophische Plaudereien.* By H. Potonié. Pp. v+194. (Jena: Gustav Fischer, 1913.) Price 2 marks.

PLATO dreamed of a dialectic that should be the science of the sciences, and philosophers have often assumed that philosophy is the essence of knowledge, into which are distilled the results of empirical research. Metaphysical logic may be considered to assist science by suggesting new modes of generalisation, new points of view for classified facts. Darwin's theory of natural selection was a philosophical view; so is Bergson's estimate of mind. Every *-ism* is of this nature; Weismannism and Mendelism, neo-Darwinism and Pragmatism, are examples. Mathematics is equally suggestive of new generalisations; the work of Galton and of Karl Pearson are cases in point. The $\Phi\hat{\imath}$ formula of Mr. William Schooling is perhaps the most recent. But it is arguable that all such generalisations are ultimately themselves suggested by new facts, and simply show the mind's plasticity of reaction to new environments. It is arguable that they are inevitable and obvious, once given the particular concatenation of facts suggesting them, but that the discovery of new concatenations of facts is not at all beholden to philosophical suggestion. It is said that the inductive idea suggested to Bacon a new mode of research; on the contrary, it was the increase in observed facts and new concatenations of facts that suggested the inductive idea.

The study of forms of thought develops with the material for thought, witness the developments introduced by Poincaré and Bertrand Russell. The latter's analysis, in (1) "The Proceedings of the Aristotelian Society," of the notion of cause is a refreshing proof of philosophical vitality. The word "cause," he says, "is so inextricably bound up with misleading associations as to make its complete extrusion from the philosophical vocabulary desirable." He well points out that advanced sciences like gravitational astronomy, even physics in general, never employ the term "cause." "The reason why physics has ceased to look for causes is that, in fact, there are no such things. The law of causality, I believe, like much that passes muster among philosophers, is a relic of a bygone age, surviving, like the monarchy, only because it is erroneously supposed to do no harm." What scientific laws do,

instead of stating that one event A is always followed by another event B, is to state *functional relations* between certain events at certain times (these are *determinants*), and other events at earlier or later times, or at the same time. No *a priori* category at all is involved.

One of the most elementary philosophical ideas is that of purpose in evolution. Another is evolution. Mr. Arthur Lynch criticises the latter (papers of the Aristotelian Society) in an interesting and anecdotic essay. Very much in point is one of his texts, viz., the remark of Kirchhoff: "There is only one science (mechanics)." But Mr. Lynch's plea for a wider and deeper application of the idea of an all-pervading Purpose is unconvincing, though rhetorical.

The idea of Will dominates the psychology of the day; it belongs, of course, to the Purpose-idea. We could wish that some critical philosopher, such as Mr. Russell, would subject it to a merciless analysis. The same may fitly apply to the philosophy of chance and probability. The papers on these subjects read before the Aristotelian Society show the over-elaboration which often precedes the simplification of an idea. In the first volume of "The Encyclopædia of the Philosophical Sciences" (2) there is a similar elaborate treatment of logic. Prof. Losskij thus states the "new conception of consciousness which is leading Philosophy out of the *cul-de-sac* of psychological Idealism": "Consciousness is the sum-total of everything which stands in a certain unique *relation* to the Ego. . . . Every fact of consciousness is made up of at least *three moments*; every such fact depends for its existence upon the presence of an Ego, of a content of consciousness, and of a relation between the two." This is the old logic writ large. Prof. Couturat more hopefully applies mathematics to the principles of logic. His notion of "propositional functions" is worth serious consideration. The plan of the Encyclopædia is suggested, no doubt, by the inconsistencies of the previous works. It consists, "not of brief articles summary in character, dealing with a great variety of topics, . . . but of original and relatively exhaustive discussions of fundamental aspects of each main subject." The index, significantly, is of authors only.

(3) Mr. Reinheimer agrees with the late M. Novikow in emphasising positive factors in evolution against such negative factors as selection by survival. According to Darwin, death is a main factor; nutrition and work, according to Mr. Reinheimer, are more important. His thesis is a good one; biological cooperation, similar to economic cooperation, must be taken into account. Nutrition represents stored-up organic capital. It is parallel to reproduction. He has interesting observations on the fallacy of in-feeding, which is parallel to in-breeding. The book is suggestive, but, as a key, it only unlocks a side-door of the subject. Some elaboration of the orthogenesis doctrine seems more likely to open the main portal.

(4) Mr. Jamyn Brooks has already received careful critical consideration. In "The Science of the Sciences" he undertakes to correlate the three principal sciences of "Chemistry, Physics, and Metaphysics, or Matter, Force, and Mind." Thus, in his first prefatory sentence, he shows confusion, which becomes worse confounded as the argument proceeds. If he has a new idea, he ought to explain it, but when about to explain he goes off at a tangent to something else. The one idea I have gathered is the existence of mental æther, corresponding to material! The author's notion of construction and expansion as primary motion, and of translation as secondary, is not new. As for the testing of the hypothesis, continually mentioned, it fails to materialise.

(5) Herr Meyer, on the evolution of mind, brings together the latest results of animal-psychology, and treats of them in reference to the human mind. His expository method has the merit of being general; he abstracts the insect's mental life and applies it, in comparison with man's, to the forms of thought, such as space and time. This is a big book, closely reasoned and most comprehensive.

(6) The distinguished botanist, the late Prof. Potonié, has written a charming series of "easy-chair" essays on science. The popularisation of science, the art of explanation, the power of habit, dogma and criticism, knowledge and belief, imagination and science, the concept of purpose, are old subjects treated with freshness. In subjects which bring science and society into relation he is not afraid to speak out.

A. E. CRAWLEY.

OUR BOOKSHELF.

Das Relativitätsprinzip; die jüngste Modenarrheit der Wissenschaft. By Leo Gilbert. Pp. 124. Wissenschaftliche Satyren. Band I. (Brackwede i. W: Dr. W. Breitenbach, 1914.) Price 3 marks.

THE satire as a means of propaganda for scientific ideas is not of modern usage. Fechner was probably one of the last scientific satirists. Its revival in the present instance is the result of the considerable amount of mystification to which the electromagnetic principle of relativity established by Lorentz, Einstein, and Minkowski has

given rise. The description of this principle as "the latest fashionable craze in science" is rather cutting, but as the book is well written and easily read, we can imagine that it will increase rather than lessen the general interest in the work of those eminent theoretical physicists. That the more extravagant conclusions resulting from the extreme adaptations of the principle should be held up to ridicule is quite wholesome, as it reveals the weak points in the argument and prevents the unwary from carrying it too far.

After all, "relativity" is only one among many possible interpretations of the result of a more or less isolated experiment. It asserts that no electrical or optical experiments can ever reveal absolute motion, or show any variation in the velocity of light. It is Einstein's merit to have pointed out the alarming consequences which would result from these two simple propositions. Our notions of time and space become almost interchangeable, and the "present moment" becomes meaningless without considerable restriction so soon as relative motion is involved.

Leo Gilbert burlesques these innovations with much humour and ingenuity, and will no doubt largely prevent them being taken too seriously. Since Einstein himself has practically abandoned the principle of the apparent constancy of the velocity of light in all circumstances, and even his mathematical methods have failed to deal with accelerated motion, there is little left of the imposing mathematical superstructure, and what "craze" there was has given way before a sober appreciation of an interesting speculation on its merits. While enjoying the fun of the satire, we cannot say that the author is at all fortunate where he endeavours to furnish an alternative explanation.

Gipsy Coppersmiths in Liverpool and Birkenhead. By Andreas (Mui Shuko). Pp. vi+66+plates. (Liverpool: H. Young and Sons, 1913.) Price 1*s.* net.

THIS book is a collection of newspaper articles describing the manners and adventures of a band of gypsy coppersmiths, which appeared in Liverpool and Birkenhead in 1912. The writer would have been better advised not to reprint his material in this fragmentary form, but to take the opportunity of preparing a connected narrative. These people were commonly known in this country as Hungarians, but they were really cosmopolitan nomads from Eastern Europe. They settled in Liverpool, where they claimed superiority over the local gypsies, and, though they were lavishly supplied with money and jewelry, professed to make their living by repairing copper cauldrons. They can scarcely be described as attractive. They were most unwilling to give estimates of the cost of work entrusted to them. Like all Orientals they loved bargaining, made preposterous demands of payment for work entrusted to them, refused to be bound by any contract, and tried to enforce their claims by bullying and that form of coercion known to Hindus as "sitting *dharna*." They were shameless beggars, and one of their boys stole the ring of their English friend, and flourished it in his face as they departed by train *en route* to Buenos Ayres. In spite of all this, they had a remarkable sense of personal dignity, and their kindness to one of their boys stricken with epilepsy, for whose treatment sorcery combined with the best medical advice was used, was remarkable. On the whole, we can readily imagine that the people of Liverpool easily reconciled themselves to the departure of their visitors.

Prehistoric Times: as Illustrated by Ancient Remains and the Manners and Customs of Modern Savages. By the late Rt. Hon. Lord Avebury. Seventh edition, thoroughly revised and entirely reset. Pp. iii+623. (London: Williams and Norgate, 1913.) Price 10*s.* 6*d.* net.

THIS, the seventh edition, "entirely reset," was revised by Lord Avebury only a few months before his lamented death. The author was a pioneer in the popularisation of the study of archæology. It is pleasant to be reminded: "This (the Drift period) I have proposed to call the 'Palæolithic' Period," and "For this (the Stone Age) period I have suggested the term 'Neolithic.'" The present edition is specially enriched with coloured illustrations of Palæolithic paintings. For the wide range of its information, and the fairness with which divergent views are discussed, the book well deserves the improved lease of life now given to it as a popular text-book of archæology. Its defects are those of its class. For certain reasons, one had been led to expect that in this edition the author would have set a fashion in works of the kind in including a summary of the astronomical evidence which is but rarely detached from archæological objects. The Stonehenge evidence, it is true, is now too well impressed on the popular mind to be overlooked (pp. 133-4), but it is severely isolated. It is in the interests of young readers or teachers of this text-book that one points to the latter half of the following passage as a questionable statement. "In this country we still habitually call the megalithic monuments 'Druidical,' but it is hardly necessary to mention that there is really no sufficient reason for connecting them with Druidical worship" (p. 126). JOHN GRIFFITH.

A Text-book of Organic Chemistry. By Prof. A. F. Hollemann. Edited by Dr. A. J. Walker, assisted by Dr. O. E. Mott. Fourth English edition, partly re-written. Pp. xviii+621. (New York: John Wiley and Sons; London: Chapman and Hall, Ltd., 1914.) Price 10*s.* 6*d.* net.

THE first English edition of this work was reviewed in NATURE on June 18, 1903 (vol. lxviii., p. 149). One of the chief characteristics of the present issue is the additional space allotted to the applications in organic chemistry of physico-chemical methods. The section on tautomerism has been re-written, and the chapters on the benzene derivatives have been re-arranged.

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.*]

New Units in Aerology.

IN NATURE of February 5, p. 629, is a reference to the new edition of the "Observer's Handbook" of the Meteorological Office, and complimentary mention of the proposed extension of c.g.s. units. On this side of the Atlantic, we have not yet seen the book, but feel that Dr. Shaw and his associates have with characteristic progressiveness done well in opening the campaign for the use of rational units. It will be hard for the present generation to depart from the old notation; but for those who are to follow, the adoption of these units means clearer conceptions of atmospheric motion, fewer mistakes, and great ease of compilation. Briefly, the units are those proposed by Köppen at Monaco in 1909, and advocated by V. Bjerknes at Vienna in 1912. Temperature is given in degrees Centigrade on the absolute scale, and pressure is recorded in *bars* and decimal parts thereof, as decibar, centibar, and millibar.

We began using these units at Blue Hill Observatory, January 1, 1914, and within a fortnight had our attention directed by Prof. Kennelly to the fact that unknown to meteorologists at home (and presumably abroad), the *bar* was in use and had an established meaning among chemists and others. If we continue its use without definition we only add to the confusion already existing.

So far back as 1888 the word *barad* was proposed by a committee of the British Association as a suitable term for the unit of pressure, one dyne per sq. cm. In 1903 Prof. T. W. Richards[1] independently suggested that the pressure of one dyne per sq. cm. be called a *bar*. He also suggested *megabar* for a c.g.s. atmosphere. So far as I can ascertain this is the first clear-cut definition of an absolute atmosphere. Ostwald in 1899 had the idea and advocated the use of one million of the units as a standard pressure, but gave no name to the large unit. Richards has used the bar consistently in his work, likewise Kennelly[2] and others. It has been definitely adopted by the International Congress of Physicists, independently of Richards's proposal under the name *barie* (see Guillaume's "Récents Progrès du Système Métrique," Paris, October, 1904).

It seems almost unnecessary to argue that the smaller bar should be the basic unit and not some multiple. And again, it is doubtful if bar is the most appropriate designation for the pressure of an absolute atmosphere. *Aer* is a more significant word. Megabar is not altogether inappropriate, and, as we have seen, is established in the literature of chemistry, and cannot readily be displaced. The megabar in the notation of the aerologist means the pressure of a million atmospheres, a magnitude not often dealt with; while on the other hand we sometimes need to express pressures smaller than the millibar of the aerologist. Now the bar of the chemist and physicist lends itself nicely to the measurement of these feeble pressures, since it is divisible down to its millibar, *i.e.* the thousandth of a dyne per sq. cm.

To contrast the two systems, I have made the following table, and at the suggestion of Prof. Richards have restricted it to the terms in common use.

Chemist and physicist (To be used by all hereafter)	Aerologist (To be abandoned)	Remarks
—	1 megabar	A million atmospheres; beyond direct measurement
1 megabar	1 bar	The absolute atmosphere; equal to 750·1 mm. Hg, or 0·987 of usual sea-level atmosphere. One megadyne per sq. cm. acting through 1 cubic cm. does 1 megerg of work.
1 kilobar	1 millibar	1 kilodyne per sq. cm.
1 bar	?	1 dyne per sq. cm. acting through 1 cubic cm. does 1 erg of work.

There could be no objection to giving the term megabar or absolute atmosphere some convenient nickname, such as "Aer," if megabar seems too ponderous. Prof. Richards has also suggested that for historical reasons the pressure of ten absolute atmospheres might be named after some pioneer in meteorology as Guericke or Torricelli or Pascal; but this need not be dwelt upon at present.

Fortunately we can change from the aerologist's system to that of the chemist by writing kilobar for millibar, and by substituting "aer" for "bar." This we are doing in the handy conversion tables now in course of preparation at this observatory.

Now is the time to agree upon a logical and available system. The megabar atmosphere seems to me to be the more appropriate; but perhaps some of the readers of NATURE can suggest something better.

ALEXANDER MCADIE.

Weather Forecasting.

MR. MALLOCK quotes in NATURE of February 26 (p. 711) a sentence of the late Sir G. Airy concerning the amassing of millions of useless meteorological observations. Unfortunately, in scientific work a vast amount of work which is not immediately productive has to be done. Indeed, it is not possible to foresee with accuracy what the result of any particular investigation will bring forth. But I do not think that this feeling will deter scientific minds from working, for each advance beyond the frontiers which limit our knowledge makes up for the disappointment resulting from many apparently unsuccessful expeditions.

It is acknowledged that in this country, indeed in this latitude, the weather depends largely upon travelling cyclones which reach us from the Atlantic. Now our knowledge of the nature and origin of cyclones is very limited, and recent researches of the upper atmosphere have shown that a good deal of accepted theory concerning them is unsound. In spite of the millions of observations which have been, and are being, taken, we have no detailed information concerning the conditions obtaining in any one cyclone, and the changes which have occurred in it during its passage over the land or sea. In these circumstances it is not surprising that weather forecasting should be difficult and uncertain. Now whilst such a lamentable want of knowledge concerning atmospheric disturbances exists, it surely cannot be maintained that we already have too much information, and that further research is undesirable.

The main question really is as to the direction such further research should take. Dines enters a plea for further research concerning the condition of the upper atmosphere. Considering that it is this kind of work

[1] Pub. 7 Carnegie Inst., 1903, p. 43; also Jour. Am. Chem. Soc., vol. xxvi., 1904; T. W. Richards, W. K. Stull.

[2] Am. Inst. Elec. Engineers, June, 1909; Kennelly, Wright, and Van Bylevelt.

which has led to such great changes in our views concerning the theory of cyclones, etc., it is reasonable to suppose that still further investigation in this direction would lead to further advances, and that, therefore, the work is one which deserves encouragement in a practical way. My own plea, which gave rise to this discussion, was for better daily charts. At the present time millions of observations are practically buried so far as the individual meteorologist is concerned. A large part of these could be put on the charts and rendered available for all. My suggestion as to the Daily Weather Charts was, that the *wind provinces* should be put in. I found that, even with the information now published, it was possible to do this with fair accuracy during a period of about ten weeks. With a few more wind observations plotted on the diagrams it would be possible to do this accurately. Then the isotherms and humidities of each wind province could be put on the chart. The isobars run from one wind province to another in continuous curves. This is not the case with the isotherms—they terminate more or less abruptly, as do the humidity curves, at the borders of the wind provinces. The winds and isotherms taken together, therefore, render it possible to draw the wind provinces with some accuracy.

It seems probable that daily charts with all the details that have been enumerated plotted on them would not entail great expense, would very likely teach us a great deal concerning cyclones and anticyclonic areas, and prevent so much valuable detail of atmospheric change being buried on the shelves of our institutions and societies.

R. M. DEELEY.

Abbeyfield, Salisbury Avenue, Harpenden, February 28.

The Doppler Effect and Carnot's Principle.

So many objections, based on the Doppler effect, have been made to my application of Carnot's principle to each particular frequency in full radiation, that it seems necessary to show that the two methods are not mutually inconsistent.

According to the Doppler effect, when a beam of light q_1 per sq. cm. per sec. moving with velocity c is directly reflected by a mirror moving with velocity nc in the same direction, the frequency of every component in the beam is reduced by reflection in the ratio $(1-n)/(1+n)$, which according to Wien's displacement law is also the ratio T_2/T_1 of the temperatures of the reflected beam q_2 and the incident beam q_1. The net expenditure of energy by the radiation per sec. per sq. cm. is q_1-q_2, which reduces to $4nq_1/(1+n)^2$, since the energy density varies on reflection as the square of the frequency. Part of this energy $(q_1+q_2)n$, is left in the space nc vacated by the mirror per second. The remainder, $2nq_1(1-n)/(1+n)$, is equal to the work done by the radiation pressure p, namely, pnc per sec. per sq. cm. We thus obtain $p=2q_1T_2/cT_1=2q_2T_1/cT_2=2\sqrt{q_1q_2}/c$, which is true for every component separately, and gives in the limit $p=2q/c$ when the motion is slow, and the incident and reflected beams become equal.

The energy left in the medium, $(q_1+q_2)n$, does *not* give rise to a volume of stationary vibration, *unc*, where $u=p=2q/c$, as commonly assumed, because the frequencies of each component before and after reflection are essentially different on account of the Doppler effect. In order to find the stationary vibration, or the intrinsic energy-density u in the state of equilibrium, we must combine each incident ray with a reflected ray of *the same frequency, before* taking the limit. For any component q in the incident beam, the energy-stream of the component having the same frequency in the reflected beam is $q-(dq/dT)_\nu dT$, where $dT=2nT$ when n is small, and $(dq/dT)_\nu$ is the rate of increase with temperature of an energy-stream of constant frequency ν. The net energy supplied of a particular frequency is $2nT(dq/dT)_\nu$ per second, and is equal to $(u+p)nc$. But since $p=2q/c$, this reduces in the limit to exact agreement with Carnot's principle, $T(dp/dT)_\nu=u+p$; which applies correctly to the equilibrium state. H. L. CALLENDAR.

Ligament Apparently Unaltered in Eocene Oysters.

DURING the examination of some large specimens of *Ostrea bellovacina*, Lam., from the Woolwich beds, sent on February 20 to this office by Mr. A. G. Davis, of Beckenham, a very interesting case of the preservation of what appears to be organic tissue in an unaltered state has come to light.

The ligament in the two specimens examined has a remarkably fresh appearance, and in its aspect and texture compares so closely with that of a recent oyster as to suggest that the fossil specimen has undergone no change, except that it is somewhat softer and the fibres are less coherent.

The whole of the ligament has been removed from one specimen and preserved in spirit, and a portion will be embedded in paraffin and sections cut for microscopical examination.

The specimens were obtained from the lowest bed of the following section :—

Excavation for Sewer in the High Street, Beckenham.

	Soil	3 ft. 0 in.
Oldhaven and Blackheath Beds	Buff coloured sand with scattered pebbles Pale grey sand with seams of clay, the lower part ferruginous, with wood and iron pyrites	9 ft. 0 in.
	Cyrena and Ostrea bed with some pebbles	1 ft. 0 in. to 1 ft. 6 in.
Woolwich Beds	Bluish grey clay with broken Cyrena Bluish grey sandy clay with Ostrea	2 ft. 0 in.
	Bluish grey mudstone and muddy sand slightly cemented. Ostrea, Modiola, etc.	Base not cut through

The preservation of organic tissue in fossils is so extremely rare that this instance is worth recording.

Further examination is being made.

R. W. POCOCK.

Geological Survey, Jermyn Street, S.W., March 13.

Experiments Bearing upon the Origin of Spectra.

IN connection with Prof. Strutt's letter under the above title in NATURE of March 12, it may be of interest to direct attention to some previous work of Prof. Lenard's which contains results bearing on the same subject. Lenard (*Annalen der Physik*, vol. xvii., 1905, p. 197), as a result of a study of the light emission of the electric arc and the Bunsen flame containing metallic salts, showed that the principal and subordinate series are emitted by different distinct regions of the luminous source, and are thus due to different centres of emission. Further, he demonstrated that the centres emitting the different series behave differently in an electric field, and came to the conclusion that while the centres which emit the principal series are neutral metallic atoms (as has been also contended by Wien for the canal rays), the centres of the subordinate series are atoms rendered positive by the loss of one or more electrons, one for the first series, two for the second, and so on. This theory is strikingly borne out by Prof. Strutt's experiments, all of which seem to be explicable by it; in any case, this independent confirmation seems to place beyond doubt the different electrical state of the centres emitting the different series. E. N. DA C. ANDRADE.

University of Manchester, March 13.

The First Description of a Kangaroo.

I HAVE just read in NATURE of February 26 (p. 715) a letter by Mr. W. B. Alexander concerning the discovery of Australia and the first description of a kangaroo. It is stated there that the first discovery of this animal was made, not by Sir Joseph Banks on Captain Cook's first voyage in 1770, but by Pelsart in 1629. May I be allowed to point out that a description of a kangaroo is to be found at a much earlier date, viz., in the "Decades" of Peter Martyr, published shortly after 1500. Unfortunately this book is not accessible to me at present, so I must only point to numerous publications of Mr. Edward A. Petherick, of the Federal Government Library, Melbourne, concerning the discovery of Australia, who claims this honour for Amerigo Vespucci. According to Mr. Petherick, Peter Martyr states that in 1499 a southern coast was discovered (probably by Vespucci) in which trees grew of such magnitude that sixteen men standing around one could scarcely encompass it (this would correspond to south-west Australia, between King George's Sound and Cape Leeuwin). Amongst these big trees was found a monstrous beast, with the head of a fox, the hands of a man, the tail of a monkey, and that wonderful provision of nature, a bag in which to carry its young. The beast so described was caught alive with its young, but during the long voyage both died. The carcase of the dam was taken to the Court of Ferdinand and Isabella in the year 1500. This description is not as detailed as that by Pelsart; nevertheless it cannot easily be doubted that it refers to a kangaroo, which seems to have been known for the first time so far back as the end of the fifteenth century.

The coast in question is supposed to have been discovered by Diego de Lepe, whose pilot was Vespucci.

TAD. ESTREICHER.
Laboratoire de Chimie II., Université de
Fribourg (Suisse), March 3.

The Movements of Floating Particles.

WILL any physicist be good enough to explain the following to an ignorant amateur? If a clean saucer be half-filled with a decoction of tea on the surface of which bubbles or unwetted shreds of ash (as from the consumed paper round the lighted end of a cigarette) are floating but not in a continuous layer, then if the decoction, after coming to rest, be gently rocked the floating particles will partake of its perpendicular, but little, if at all, of its lateral motion. Sunken particles, on the other hand, will partake of the lateral motion. Again, if the saucer be gently tilted the fluid will flow away, but each floating particle will remain stationary, and will be deposited under its original position.

Why do not the particles partake of the lateral motion? Does the surface of the decoction form an incompressible, but flexible, film, which (in the saucer) may be added to but not subtracted from, under which the rest of the fluid slides with little friction. And when the fluid flows away does this film remain behind to form that portion of the fluid that wets the saucer? Or do solid, but invisible, particles come up and form a continuous sheet on the surface? Against the latter supposition is the fact that particles dropped on the advancing edge of the decoction remain stationary. Particles floating on the surface of ordinary tap water move with it much more freely; water in which table salt has been dissolved behaves like tap water. But even in sea water we see froth left behind by receding ripples.

G. ARCHDALL REID.
"Netherby," 9 Victoria Road South, Southsea.
March 13.

KINEMATOGRAPHY AND ITS APPLICATIONS.

MR. TALBOT is to be congratulated on having produced a book which must appeal strongly to the interest of the general reader, even though he may have no intention whatever of becoming a "kinematographer." A word here on this terrible term. It may be correctly derived from the Greek, while it certainly admits of many pronunciations, variously wrong, but the frequent collision with these six syllables when otherwise interested must impress upon the reader of Mr. Talbot's book the desirability of finding some new word of one syllable, not derived anyhow, such, for instance, as the mechanic and the electrician have found in the words crank and boost, so that neither attention may be arrested nor printing ink and paper wasted.

The main purpose of the book is to show what has been done in many different fields and the nature and cost of the apparatus which an amateur would be likely to use, rather than to give instruction in the details of the art. Incidentally, the commercial value of lucky-chance films of the amateur is pointed out, but it is not very clear what the cost of the unlucky-chance miles of film that will be worth nothing is likely to be.

On first opening the book the reader will see a picture of a fine cow which appears to have suffered at the hands of the cattle-maiming gang. Closer inspection will show that the injury is a door in the side of the beast, which, according to the legend below, is 15 ft. high. It was made by Messrs. Newman of *papier-mâché*, so that the operator might get inside with his camera with the intention of taking lions and other beasts unawares. Passing on from this testimonial to the credulity of the savage beast, we find numerous full-page or half-page enlargements of single pictures taken from the strip, so perfect in focus and detail that it is scarcely possible to believe that it has all been derived from a miniature $1 \times \frac{3}{4}$ in. only in size. A reference to some of these only will indicate the great variety of subject which is open to those who practise this new art. There are lions at lunch in the jungle, a polar bear diving in the arctic sea, birds feeding their young, a vulture preparing to fly, and taken at such close quarters that every feather is clearly defined, eighteen successive photographs taken during a single beat of a pigeon's wing, and fifteen of the opening of a convolvulus, both from the Marey Institute, two X-ray films from the same institute by M. Cavallo, one of sixty pictures showing digestion in the intestine of a frog, and thirty of the movements of the gizzard in a fowl, and others from the same quarter.

Then by the aid of the microscope and the "ultra-microscope," smaller forms of life may be seen in motion. For instance, there is the head of a spiny monster which is nothing more than a blue-bottle eating honey from off a needle, and there might have been, but are not, illustrations

1 "Practical Kinematography and its Applications." By Frederick A. Talbot. Pp. xii+262+plates (London: W. Heinemann, 1913.) Price 3*s.* 6*d.* net.

of the blood corpuscles, phagocytes, and microbes in human blood in a state of violent activity and warfare. Then there is a group of pictures taken from an American film, which was produced with the object of showing the actual movements of a highly-skilled mechanic, so that those who take too long about their work might learn how to avoid useless movements. There is an account of the beautiful instrument of M. Bull described in NATURE of July 28, 1910 (vol. lxxxiv., p. 112), by means of which stereoscopic pictures may be taken at the rate of 2000 a second of such objects as a fly flying; and the somewhat similar apparatus of Prof. Cranz is also described. There is also an account of the most startling development of kinematography. It is called the "Life Target." In this device a moving picture is projected on the screen; it may be, for instance, of cavalry crossing the screen or of an elephant charging straight at the spectators. These are provided with rifles and shoot at the screen. The explosion wave, by suitable mechanism, causes the film to be arrested for an instant only, when the bullet hole is clearly seen as a white spot, which disappears when the film continues its movement. Other interesting pictures show the hatching of a chick, a fight between a lobster and an octopus, and many other things.

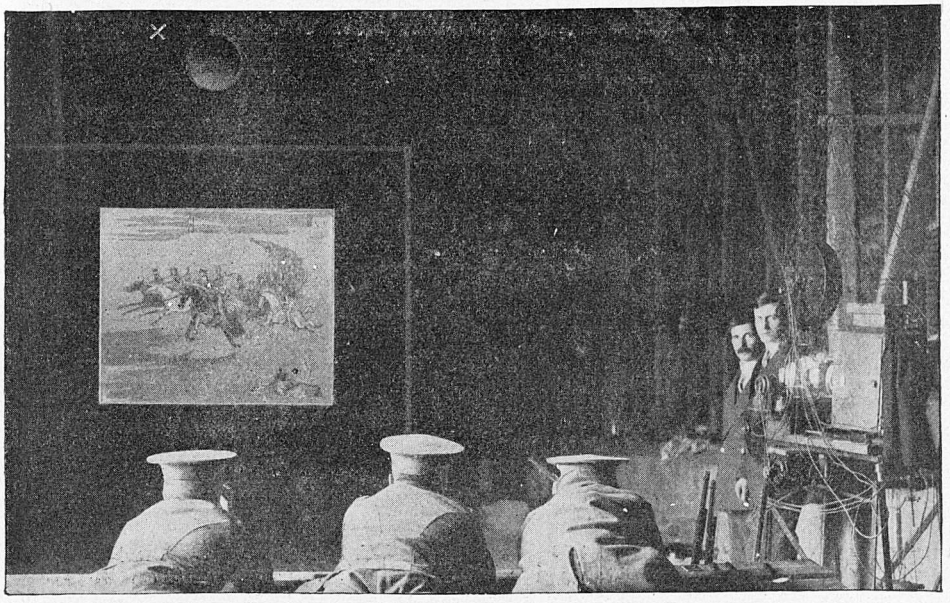

FIG. 1.—Soldiers firing at the "Life Target." The picture on the screen is thrown from the projector at right, and the picture is held stationary by the action of the report of the rifle caught by the microphone (marked ×) upon the lantern mechanism. From "Practical Kinematography and its Applications."

A very good account is given of the construction of several of the simpler machines, and in particular of the "Aeroscope," or moving-picture camera, in which air previously compressed in a light tubular reservoir by means of a bicycle pump drives a minute engine and so moves the mechanism at the desired rate, while the operator, having both hands free, may hold the machine up over his head in a crowd and secure at close quarters some stirring incident. It is with this instrument that Mr. Cherry Kearton has obtained some of his most wonderful results.

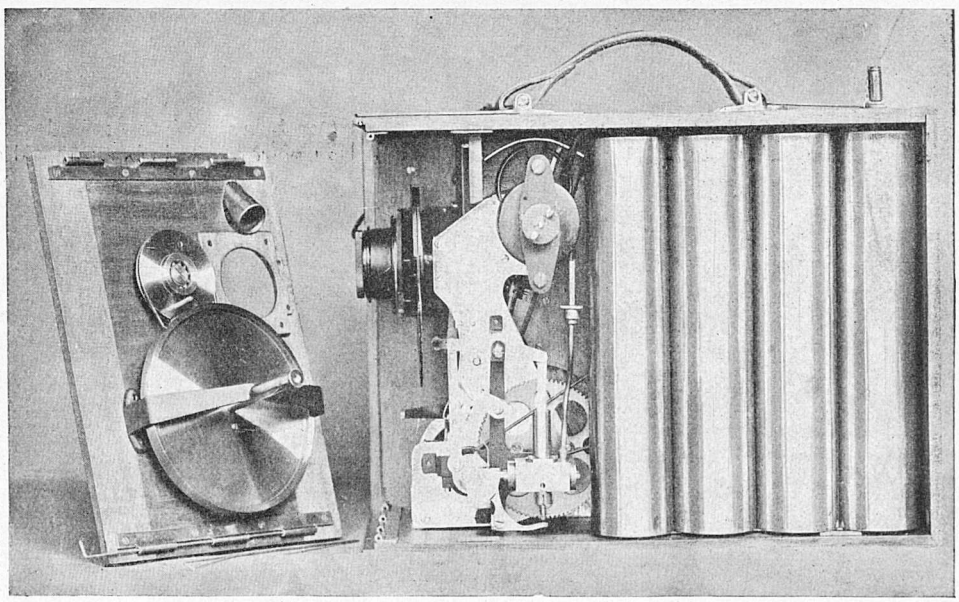

FIG. 2.—The compressed air reservoirs of the "Aeroscope" camera. One charge is sufficient to expose 600 ft. of film. From "Practical Kinematography and its Applications."

The methods used for developing and printing, of course, are described, but, curiously, no mention is made of colour work, whether two colour such as is so popular at the Scala Theatre, or

three colour as represented a year or two ago at the Royal Institution by M. Gaumont, with such amazing fidelity to the colours of Nature.

Space is not available for more than a bare recitation of some of the things described or illustrated; sufficient, however, has been said to show that a most interesting and attractive book has been produced.

On p. 171 reference is made to a difficulty met with when photographing live microbes in consequence of their being killed by the heat from the concentrated beam from the powerful arc lamp. The use of a water cell in the beam is described as a method of reducing this trouble. While the ever-repeated fallacy of alum solution finds no place here, the author or Dr. Comandon, whose work is being described, do not appear to have known of the use of freshly-prepared solution of $FeSO_4$, of such a strength that its colour is just visible, as an effective heat absorber.

C. V. BOYS.

EARLY FOSSIL BRACHIOPODS.[1]

THE work before us, which treats of the Cambrian brachiopods of the whole world, must arouse the admiration of all who understand the difficulties of a comprehensive palæontological study of such magnitude. It is a splendid monument to the ability and perseverance of its eminent author, whose previous reputation as an investigator of the Cambrian faunas was so widely established as not to need the further proof afforded by these two handsome volumes. It is a matter both for surprise and congratulation that Dr. Walcott has found opportunity, amidst his many activities, to bring to completion a task so overwhelming: small wonder that it has occupied his available time for ten years or more.

If the wealth and good preservation of the Palæozoic Brachiopoda found in North America has provided an abundance of material favourable for study, how worthily have the palæontologists of the United States utilised their advantages! It may be granted that they owe some measure of their success to generous practical support and to freedom from conservative traditions in the matters of outlook and treatment of their subjects: these are advantages denied to most workers in Europe. Yet no consideration of such favouring circumstances can diminish our indebtedness to those brilliant investigators in the United States who have contributed so largely to the rapid advancement of modern palæontology in all its branches. For models of comprehensive systematic work, for suggestive and original phylogenetic studies, and for inspiring aid in applying the facts of palæontology to many problems of philosophic biology, we in Europe have become more and more accustomed to look westward. Dr. Walcott is one among several of his compatriots who have advanced our knowledge of the Palæozoic brachiopods in an extraordinary degree.

It is impossible for a single reviewer either to criticise in detail a work of such wide scope as the present monograph or to do justice to its merits. It must therefore suffice to indicate briefly some of its special features. In this book are described "44 genera, 15 subgenera, 477 species, and 59 varieties of Cambrian Brachiopoda," and "3 genera, 1 subgenus, 42 species, and 1 variety of Ordovician Brachiopoda." The descriptive part of the text occupies nearly 500 pages; yet, bearing in mind that this will remain the standard work of reference on the Cambrian brachiopods of all countries for many years to come, the author appears to have erred on the side of brevity. There are instances where the specific characters might with advantage have been set out more fully and the comparative observations amplified, though the appearance of an unduly meagre treatment may sometimes be owing to limitations in the material itself. The whole descriptive portion of the work affords ample evidence of the author's extensive knowledge and scholarly thoroughness. The 76 figures, chiefly in half-tone process, which are scattered throughout the text are clearly reproduced, while the letterpress is very well printed and edited.

The various tables in which are set forth synonymic references and the geographical and stratigraphical distribution of the brachiopods, are outstanding features of the work. The table of synonyms, giving the names now adopted set in a column alongside those previously applied to the same species, will be of great service to all workers in this field of study. Geographical distribution is shown in a synoptic table arranged according to continents and faunal provinces (pp. 114–122). Another elaborate table, giving the detailed stratigraphical distribution of the Cambrian and some Ordovician species, occupies 34 pages. This is arranged alphabetically according to states or countries, and contains a vast amount of concisely arranged information. Here are included summaries of many local or regional sections, with references to individual localities which are described in detail on subsequent pages: also lists of the brachiopods found at the various horizons and certain leading species of other classes.

The section of the work headed "Zoological Discussion" (pp. 291–326) is of importance to all students of the Brachiopoda. Here are to be found terminological definitions and an account of the morphological characters of the shells; also short chapters on evolution and classification, which strike us as unduly condensed. The bibliography (pp. 13–26) is very full, and should prove of great help to other workers. We miss here a reference to Mr. F. R. C. Reed's memoir on "The Cambrian Fossils of Spiti" (Palæontologia Indica), published in the summer of 1910, and the species of brachiopods there recorded are omitted from the descriptive portion of the text. Presumably that work appeared too late to be utilised;

[1] "Cambrian Brachiopoda." By Charles D. Walcott. Monographs of the United States Geological Survey, vol. li.: part i., pp. 872+76 figs.; part ii., pp. 363+civ plates. (Washington: Government Printing Office, 1912.)

but if this be the case, two years seems a too generous allowance of time to be occupied in passage through the press, to the exclusion of belated additions, even in the case of an elaborate monograph such as that under review. The volume of text concludes with a full and well-planned index, while there is the useful luxury of a second index at the end of the volume of plates.

Special praise must be accorded to the plates, upwards of 100 in number, which illustrate this work. These are well reproduced in collotype process from beautifully executed drawings, mainly by Miss Frances Wieser, of the United States Geological Survey. The careful and detailed work of the artist is a fine achievement. To many who have little acquaintance with the Cambrian brachiopods beyond the scanty assemblage found in our own country, the perusal of this volume of plates will prove a revelation. It is indeed astonishing to find that such a profusion of species had been evolved and such elaborate specialisation had been attained by many of them in those remote ages. One can only picture in imagination the long and slowly evolving lines of precursors of which no trace has yet been found.

Dr. Walcott deserves the warmest thanks of all palæontologists and geologists for a treatise which must long remain a classic. The public department which has issued the work in such handsome form is also to be congratulated. What higher service can such a department perform than thus to give practical encouragement to arduous scientific labour? F. L. K.

THE TRANSMISSION OF PLAGUE BY FLEAS.

THE third Plague Supplement of the *Journal of Hygiene* maintains the high standard both of research and of editing set by the previous numbers. It contains eight good articles, chiefly by S. Rowland and R. St. John Brooks, on the bacteriology of plague and by A. W. Bacot on the rat flea. The former articles deal with the influence of cultivation in serum-containing media upon the virulence and immunising properties of the plague bacillus; upon the facility with which it is ingested by human leucocytes; and upon its virulence—all points of importance in regard to bacteriology in general. Mr. Bacot's most laborious and well-set-out researches upon the influence of temperature and humidity upon the pathophores and on the effect of vapours as insecticides deserve much commendation; but perhaps the most interesting article is by him and Prof. C. J. Martin on the mechanism and transmission of plague by fleas. They sum up a very careful paper by the following remarks:—

"Under conditions precluding the possibility of infection by dejecta it was found that two species of rat fleas, *Xenopsylla cheopis* and *Ceratophyllus fasciatus*, fed upon septicæmic blood, can transmit plague during the act of sucking, and that certain individuals suffering from a temporary obstruction at the entrance to the stomach were responsible for most of the infections obtained, and probably for all. In a proportion of infected fleas the development of the bacilli was found to take place to such an extent as to occlude the alimentary canal at the entrance to the stomach. The culture of pest appears to start in the intercellular recesses of the proventriculus, and grows so abundantly as to choke this organ and extend into the œsophagus. Fleas in this condition are not prevented from sucking blood as the pump is in the pharynx, but they only succeed in distending an already contaminated œsophagus, and, on the cessation of the pumping act, some of the blood is forced back into the wound. Such fleas are persistent in their endeavours to feed, and this renders them particularly dangerous." R. R.

NOTES.

WE announce with deep regret the death on March 16, as the result of a motor accident, of Sir John Murray, K.C.B., F.R.S., the distinguished naturalist and oceanographer.

THE Right Hon. Sir Francis Hopwood has been appointed by the president and council of the Royal Society to a seat on the general board and executive committee of the National Physical Laboratory, in succession to Sir Arthur Rücker, F.R.S., resigned.

WE notice with regret a Reuter message from New York reporting the death on March 16 of Prof. E. S. Holden, director of the Lick Observatory from 1888 to 1898, and author of a number of papers and other works on astronomical subjects.

THE death is announced, on March 7, at seventy-three years of age, of Prof. Antonino Salinas, professor of archæology at the University of Palermo and director of the Archæological Museum.

PROF. J. G. ADAMI, F.R.S., Strathcona professor of pathology and bacteriology, McGill University, Montreal, has been awarded the Fothergill gold medal of the Medical Society of London for 1914, for his work on pathology and its application to practical medicine and surgery.

THE death is announced, in his sixty-seventh year, of Dr. E. J. Houston, one of the inventors of the Thomson-Houston system of arc lighting. He was twice elected president of the American Institute of Electrical Engineers, and was the author of more than fifty books, mainly on electricity and allied subjects.

PROF. F. KEEBLE, F.R.S., professor of botany, University College, Reading, has been appointed director of the Royal Horticultural Society's garden at Wisley, with the view of making it of more general practical service. Mr. F. Chittenden will remain in charge of the educational section, and Mr. S. T. Wright will continue to act as superintendent of the garden.

MISS A. CANNON, whose critical examination of Harvard College Observatory photographs has led her to the discovery of many new variable stars and other objects of interest, has been elected an honorary mem-

ber of the Royal Astronomical Society. At the meeting of the society on Friday last, the president, Major E. H. Hills, in announcing the council's decision, remarked that Miss Cannon had acquired remarkable skill in distinguishing the type to which a star spectrum belongs and had completed the classification of 150,000 stars in this way.

MR. MARCONI appears to have secured some remarkable results with his new wireless telephonic apparatus. According to the daily newspapers, experiments have been carried out from Italian warships off the Sicilian coast, and on one occasion signals were received from Canada, 4062 miles away, by means of wireless telephony. In another experiment communication was set up between two ships forty-five miles apart, and the connection continued uninterruptedly for twelve hours. On March 14 the wireless telegraphic station at Nauen, near Berlin, exchanged clear signals with the Windhuk station in German South-West Africa, a distance of more than 6000 miles.

WE regret to announce the death, on March 15, of Dr. Harry Burrows, senior lecturer on chemistry at the Sir John Cass Technical Institute, at the early age of forty-two. Dr. Burrows received his academic training at the Royal College of Science and at Heidelberg University, and was a research scholar and subsequently an assistant demonstrator at the Royal College under Sir William Tilden. For the past ten years he had been on the staff of the Sir John Cass Technical Institute, where his successful work as a teacher was valued and appreciated both by the governors of the institute and by the students. Dr. Burrows contributed several papers to the Transactions of the Chemical Society.

THE Faraday Society has arranged a general discussion on optical rotatory power, to be held in the afternoon and evening of Friday, March 27, in the rooms of the Chemical Society, Burlington House, London, W. Prof. H. E. Armstrong will preside at the afternoon session, and will deliver an introductory address. Prof. Percy F. Frankland will preside at the evening session. Papers on various aspects of the subject will be read by Prof. Hans Rupe (Basle), Prof. H. Grossmann (Berlin), Prof. Leo Tschugaeff (St. Petersburg), Dr. Darmois (Paris), Dr. T. M. Lowry, Mr. T. W. Dickson, Mr. H. H. Abram, Dr. R. H. Pickard, Mr. J. Kenyon, and Dr. T. S. Patterson.

THE Royal Society for the Protection of Birds has issued a manifesto signed by the president (the Duchess of Portland) and other ladies of distinction in favour of the Importation of Plumage Prohibition Bill now before Parliament. The manifesto says:—"The present Bill is the result of careful and prolonged investigations. The export of the plumage of wild birds has been prohibited from India, and from the majority of the Crown Colonies. The United States of America and the Commonwealth of Australia have sifted the question, and passed laws prohibiting both export and import. A strong feeling in favour of legislation on these lines is growing in Germany, France, Austria, Holland, Sweden, Denmark, and Belgium. Attempts to regulate the traffic would be futile on account of the insurmountable difficulties with respect to laws and their enforcement in the countries from which a large proportion of the birds come; therefore, the most effectual way to preserve wild birds is by the enactment of laws prohibiting importation in support of the regulations which forbid export."

THE report of the Royal Society for the Protection of Birds, presented to the meeting held at the Westminster Palace Hotel on March 5, shows that the growth of the society has been well maintained. Further funds are required if the society is to do the work which lies before it. "The watchers' committee is continually asked to undertake fresh work and accept new responsibilities; educational work could proceed far more rapidly were there funds for its support; it is probable that the work at the lighthouses will demand large additional outlay; and the legislative work before the society for 1914 is the heaviest it has yet had to encounter." The work at the lighthouses, it may be explained, takes the form of erecting rails on which flights of migrants may perch.

UNDER the powers of the Ancient Monuments Consolidation and Amendment Act, 1913, the following Advisory Boards have been appointed for England, Scotland, and Wales:—*England*—Mr. Lionel Earle (chairman), Lord Burghclere, Lord Crawford, Sir Aston Webb, Mr. R. Blomfield, Sir C. Hercules Read, Mr. C. P. Trevelyan, Prof. F. J. Haverfield, Prof. W. R. Lethaby, Mr. R. A. Smith. *Scotland*—Sir John Stirling-Maxwell, Bart. (chairman), Sir Herbert Maxwell, Bart., Mr. A. O. Curle, Dr. G. Macdonald, the Hon. Sir Schomberg K. McDonnell, Sir James Guthrie, Sir Robert Lorimer, Mr. J. R. Findlay. *Wales*—Sir E. Vincent-Evans (chairman), Lieut.-Col. W. E. Ll. Morgan, Mr. W. Edwards, Sir E. Stafford Howard, Mr. E. Neil Baynes, Prof. R. C. Bosanquet, Dr. W. E. Hoyle, Prof. J. Edward Lloyd. Mr. C. R. Peers, Chief Inspector of Ancient Monuments, is also a member of each board.

THE death is announced of Mr. George Westinghouse, the inventor of the air brake. Born at Central Bridge, Schoharie County, New York, in 1846, he was educated at public and high schools, and at Union College, where he graduated Ph.D. The air brake which has made his name famous throughout the world was invented in 1868. It has been computed that Mr. Westinghouse's genius as an inventor has brought into being undertakings with a capital of 130 millions of dollars, giving employment to 50,000 skilled artisans. He founded works in many American centres, as well as in Manchester and London, at Havre, and in Germany, Russia, Austria, and Italy. Among the decorations bestowed on him were the Legion of Honour, the Order of the Royal Crown of Italy, and of Leopold of Belgium. He was also the recipient of the Edison gold medal in 1912, and in the following year of the Grashof gold medal, conferred annually by the engineering profession of Germany in memory of Franz Grashof.

A PARAGRAPH in the *Times* of March 12 records the arrival at the Natural History Branch of the British Museum of a consignment of specimens illustrating the whales of the Antarctic. They were obtained by the museum taxidermist who accompanied the late Major Barrett-Hamilton to South Georgia, and were brought home *gratis* by Messrs. Salvesan, of Leith, their united weight being about 8 tons. The specimens—which represent three species, namely, the blue or Sibbald's rorqual (*Balaenoptera sibbaldi*), the common finner (*B. musculus*), and the southern humpback (*Megaptera lalandei*)—include the whalebone, flippers, a trunk-vertebra, and ear-bones. Plaster casts of the flippers are now being made, which will in due course be placed on exhibition. The blue rorqual was the second largest specimen on record, measuring close on 100 ft. in total length. To this species pertains the aforesaid vertebra, which is of enormous dimensions, largely exceeding those of the vertebræ of the sauropod dinosaurs from the Wealden of the Isle of Wight.

THERE is something reminiscent of a Latin-American frontier dispute in the controversy which has arisen regarding the base in the Weddell Sea of the respective Antarctic expeditions of Sir Ernest Shackleton and Dr. Koenig, but the parallel unfortunately does not hold good so far as to suggest arbitration by an impartial umpire. It is admitted on Dr. Koenig's side that, before his expedition was spoken of, Sir E. Shackleton had expressed in general terms his hope of undertaking a journey from the Weddell Sea to the pole. Dr. Koenig, on the other hand, produced detailed plans before Sir E. Shackleton did so, and the question turns simply on a point of opinion whether the latter's previous general statement gives him a basis of claim to priority, or not. The Royal and Imperial Geographical Society in Vienna has committed itself to the negative opinion, and there the matter appears likely to rest: either side may claim what it will but cannot enforce any claim upon the other; so that so far as concerns work in the Weddell Sea area (for the published statements do not make it clear that a crossing of the Antarctic continent is part of the Austrian, as it is of the British, scheme) science may be compelled to fall back upon any satisfaction and value which it may be possible to derive from a comparison between independent sets of observations in the same field.

THE concluding meeting of the Optical Convention was held on Thursday, March 12, in connection with the meeting of the Optical Society of that date. The report presented contained many points of special interest, conspicuous among which was an experiment made by the Board of Education in accommodating the exhibition of the Optical Convention in the buildings of the Science Museum at South Kensington. The experiment appears to have given complete satisfaction to the committee and members of the convention. We believe that it is regarded as having been successful by the authorities of the museum, and as it is very evident that such an employment, when practicable, of our public museums must tend materially to enlarge their usefulness, it may be hoped that the precedent will not be lost sight of in the future. From another point of view the report must have been equally satisfactory to the members of the convention, for it appears that in the result the committee has been able to wind up the business without making any formal call upon its guarantors. The most important outcome of the convention was the formation of a technical committee charged with the duty of establishing an effective cooperation between the users of scientific instruments on one hand, and the manufacturers of such instruments on the other. The report of that committee, which was the most interesting feature of the proceedings, shows that the committee found some very useful work ready to its hand in connection with a communication from the War Office referring to the standardisation of the cells and other parts of telescopes and binoculars. A sub-committee has been formed to consider the matter, and it is hoped that through the instrumentality of the Optical Society, and with the cooperation of British manufacturers of telescopes and binoculars, the necessary work of standardisation will soon be carried out.

IN connection with the Panama-Pacific International Exposition in San Francisco next year, there will be an International Engineering Congress, during the week September 20–25, 1915, in which engineers throughout the world, representing all branches of the profession, are invited to participate. The congress is to be conducted under the auspices of five engineering societies, namely, the American Society of Civil Engineers, the American Institute of Mining Engineers, the American Society of Mechanical Engineers, the American Institute of Electrical Engineers, and the Society of Naval Architects and Marine Engineers. Colonel G. W. Goethals, chairman and chief engineer of the Isthmian Canal Commission, has consented to act as honorary president of the congress. The general field of engineering to be covered by the congress has been divided into ten groups or branches, which, together with the special field of the Panama Canal, will constitute eleven divisions or sections, as follows:—(1) The Panama Canal; (2) Waterways and Irrigation; (3) Railways; (4) Municipal Engineering; (5) Materials of Engineering Construction; (6) Mechanical Engineering; (7) Electrical Engineering; (8) Mining Engineering and Metallurgy; (9) Naval Architecture and Marine Engineering; (10) Military Engineering; (11) Miscellaneous. The offices of the committee of management of the congress are at Foxcroft Buildings, San Francisco, Cal., U.S.A.

MR. B. QUARITCH, of 11 Grafton Street, London, W., is about to publish an elaborate work entitled "British Flowering Plants," in four volumes, royal quarto, at twelve guineas if ordered before the date of publication, March 28, or fifteen guineas after that date. The main feature of the work consists in three hundred coloured plates, reproduced from water-colour drawings by Mrs. Perrin. Copies of the first volume of the work, together with the original drawings, and the plates for the book, are on view (March 13-27) at the Dudley Gallery, 169 Piccadilly, where we inspected

them on Saturday last, and were equally struck by the beauty of the original drawings and the remarkable fidelity of the plates reproduced from them. Thirty of the plates consist of floral dissections, but those inspected were somewhat too small and lacking in detail to be of much service to the student; such analytical illustrations are usually better done in black and white, except where they are on a large scale, as in the well-known coloured sections of flowers given in Dr. Church's "Types of Floral Mechanism." The British flowering plants are receiving a large amount of attention from artists and photographers at the present time, and the appearance of so many attractive books is a welcome sign of increasing interest in our wild flowers, while it should swell the numbers of field naturalists.

MR. ARTHUR MACDONALD, of Washington, D.C., has sent us a leaflet entitled "The Study of Man," the object of which is to urge the desirability of laboratories to investigate the bodily and mental characteristics of the criminal, pauper, and defective classes. This leaflet he has sent to the Home Secretary, Mr. McKenna, with a letter directing his attention to the importance of such work as a means of throwing light on the causation of crime, and as likely to furnish a more rational basis for methods of reform. With Mr. MacDonald's object we are in complete agreement, but in fairness to the Home Office it must be said the claims of the anthropological and psychological study of criminals have already met with some official recognition, as is evidenced by the recent publication in the form of a Blue-book of "The English Convict," by Dr. Goring, the deputy-medical officer of Parkhurst Prison. Yet the contents of this memoir are perhaps the most convincing indication that could be brought forward of the need for the establishment of laboratories, each equipped, not necessarily with costly and elaborate apparatus, but certainly with a properly qualified staff. For Dr. Goring's results clearly demonstrate the importance of the problems depending for their solution on work of this nature, while at the same time the poverty of the psychological data which he had at his disposal indicates the need for more advanced experimental work as to the mental nature of criminals.

IN the issue of *Man* for March Sir H. H. Johnston discusses the origin of the horse-shoe arch. He suggests that it and the Mahràb, or holy recess, in the Mohammadan mosque, were based on a Phœnician sex-cult introduced into the West by Phœnicians, and that the horse-shoe arch, under their influence, may have arisen independently in southern Spain as it likewise arose in Cœle-Syria and southern Tunis. "But if so," he adds, "it is perplexing to find it as a pre-Islamic feature in Visigothic buildings of *northern* Spain, whither the Phœnician influence can have scarcely penetrated."

PROF. ARTHUR KEITH'S discourse on an anthropological study of some portraits of Shakespeare and of Burns, delivered at the Royal Institution on February 20, is printed in the issue of the *British Medical Journal* for February 28. In the case of Shakespeare, Prof. Keith uses a terra-cotta mask recently found in one of the midland counties, the bust in the church at Stratford, and the Droeshout portrait; for Burns a cast of the poet's skull in the possession of Mr. Barrington Nash, and portraits by Raeburn and Nasmyth. Examination of the head of Shakespeare proves him to be a representative example of the short-headed type, not of the early British breed, but of the round-headed race which entered Britain in the Bronze period, about 2000 B.C. His brain capacity was more than 1900 cm., as compared with 1477 in an average Englishman. Burns, on the contrary, represents an exceptional example of the long-headed type, with a brain capacity of 1730 cm., at least 200 cm. above the average of his countrymen. His skull displays a close analogy with those found by Prof. Bryce in Arran cairns. He sprang from families settled round the Firth of Clyde, and he is thus a direct descendant of the long-headed people who lived in England and Scotland during the later Neolithic period. We may call Shakespeare a "Celt" in the sense in which this term is used on the Continent, while Burns comes from the western fringe, usually called "Celtic," but really pre-Celtic. "Is it possible," asks Prof. Keith, "that we may explain the extraordinary difference in the working of their brains by the diversity of their racial origin?"

THE third All-India Sanitary Conference, held at Lucknow on January 19–27, was attended by delegates from all parts of India and Ceylon, including the Portuguese possessions. Sir Harcourt Butler, in his presidential address, reviewed the work that is being carried on in the study and practice of Indian sanitation, but pointed out that progress is necessarily slow in a land where the habits and prejudices of centuries are arrayed against the sanitary reformer, and where it is impossible to benefit fully by the discoveries of the secrets of disease and mortality until the people are educated to receive and profit by the results of scientific investigation. An introductory address to the opening meeting of the research section was given by Sir Pardey Lukis, Director-General of the Indian Medical Service, who reviewed the present state of knowledge concerning the etiology and prevention of the more prevalent Indian diseases. A number of important papers were read before the conference, and led to interesting discussions on various problems of sanitation and disease, while affording striking evidence as to the energy and thoroughness with which investigations upon such problems are being carried on by the medical officers of our Indian Empire.

AT the last meeting of the Entomological Society of London, a communication was received from Mr. J. C. Hawkshaw on the subject of the cocoon spun by the larva of *Lyonetia clerkella*, a small moth of the family Tineidæ. The cocoon is slung like a hammock between silken threads attached to the surface of a leaf. On each side of the area bounded by the supporting threads, a fine web is spun 3 or 4 mm. wide, and very loosely attached to the leaf. If any attempt is made to detach the cocoon with the point of a knife or similar instrument, the cocoon and webs become a

shapeless mass, which sticks persistently to the point, and is with difficulty transferred to any other object. Mr. Hawkshaw suggests that this structure serves as a protection against ants, which are constantly seen to be searching the trees inhabited by the Lyonetia. An ant wishing to seize the cocoon would first have to wade through the loose, flattened web, which forms an outwork in the defence, and in this its legs would become hopelessly entangled. If the ant ventured further, its head and antennæ would also become entangled, and would carry the whole away with it. The assailant would probably be quite unable to bring its biting apparatus to bear on the cocoon. A specimen was exhibited in illustration, in which the supporting strands and flanking webs were clearly seen.

THE list of the zoological gardens of the world drawn up by Capt. S. S. Flower, and apparently published at Cairo by the Egyptian Government, has been revised, and a new issue printed, bearing date January, 1914. Inclusive of a few large private collections, such as that of the Duke of Bedford at Woburn Abbey, the number of establishments of this nature known to the compiler is 166.

ACCORDING to an illustrated article by Dr. F. A. Lucas in the January number of the *American Museum Journal*, the late Mr. E. T. Booth, whose well-known collection of British birds is now the property of the Corporation of Brighton, has the best claim to be the founder of the plan of exhibiting in museums groups of animals mounted amid artificial imitations of their natural surroundings. He was followed by Mr. Montagu Brown, then curator of the Leicester Museum, and soon after by the late Dr. R. B. Sharpe, in the Natural History Branch of the British Museum, where a group of coots formed the commencement of the splendid series of exhibits which is now the delight of visitors to the bird gallery. The rise and progress of the practice—especially in America—are fully described in the article, of which a continuation is promised.

PAPERS on various groups of insects from the Philippines and Japan form the greater part of vol. viii., No. 4, of Section D of the *Philippine Journal of Science*. In one of these, dealing with Japanese termites, Mr. Masamitsu Oshima reproves Mr. N. Holmgren for having given new specific names to certain members of that group, previously named by himself in Japanese. Whether technical names proposed in languages unfamiliar in western Europe should be accepted may, perhaps, be open to argument, although it would be somewhat difficult to decide where to draw the line. In papers written in Russian the names of new species and genera are frequently printed in English characters, which at least renders them legible by zoologists of other nationalities. If this was not done in the case of the Japanese papers, the argument for the rejection of the names is strengthened. The names proposed, both by Oshima and Holmgren, were published in 1912, but only the latter appear in the *Zoological Record* for that year, although some of Oshima's publications are quoted in the volumes for 1909 and 1911.

IN an article in *The Indian Forester*, December, 1913, p. 568, Mr. H. M. Glover directs attention to the difficulty of protecting the forests of *Pinus longifolia* in the Panjab from disastrous fires. The accumulation in a few years of fallen needles, dead wood, and old grass render such forests very inflammable; and the fires which are inevitable, owing to the carelessness of the natives, are very fierce, and cause much damage. Mr. Glover advocates, as the result of numerous experiments, the running of a slow fire over limited areas in these forests during winter, when the soil covering is much less inflammable than in the hot weather. Such fires do no harm to pines more than 6 in. in diameter, as stems of this size are covered with a protective thick bark. This method has proved very efficacious, the artificial firing being done during December, January, and February, over areas well under control, from which young growth is absent. Burnt-over sections can be artificially seeded, as seedlings come up in profusion when the refuse has been destroyed.

AS a supplement to the paper on the monthly and annual rainfall normals at Indian stations (NATURE, June 26, 1913), the director-general of observatories has recently published a volume containing averages of the monthly and annual number of rainy days at all stations where records for at least five years are available. For some purposes this summary is perhaps even more valuable than the previous one, as it shows whether the monthly amounts were distributed over several days instead of possibly being due to torrential downpours. In the absence of any discussion of the normals it may be interesting to quote the average annual number of rain-days referring to some of the extreme values at stations quoted in the issue of NATURE above-mentioned:—Cherrapunji (Assam), 159·1; Málcompeth (Bombay), 122·3; Launglon (Burma), 145·6; Rújanpur (Panjab), 7·7; Rohri (Bombay), 6·3; Jhatput (Baluchistan), 6·1. The definition given of a rainy day is one on which 0·1 in. or more rain is recorded. This differs materially from the definition for a rainy day in this country, viz., 0·01 in. or more.

THE January number of *Le Radium*, which reached us at the beginning of the present month, contains a valuable collection of tables of radio-active constants brought up to date by M. L. Kolowrat. It is proposed to publish the table annually in order to keep readers supplied with the most trustworthy data. References to the original authorities are given, and the tables are accompanied by a few pages of explanations and remarks.

PART 2 of the *Verhandlungen* of the German Physical Society for 1914 contains a communication from Dr. G. Wiedmann and Prof. W. Hallwachs, of the Technical High School, Dresden, on the part played by the surrounding or absorbed gas in the production of the photo-electric effects exhibited by metals. Although the observations of Prof. Hallwachs and his pupils have all tended to show that the gas plays an essential part in the phenomenon, the idea that the photo-electric process is due to the metal only seems

still to persist. With a view of showing how far such an opinion is out of touch with the actual facts the authors have by repeated distillations of potassium got rid of the large amount of hydrogen dissolved in the metal, and have shown that the reduction of the gas is accompanied by a decrease of the photo-electric action. After the fourth distillation the effect was reduced from a current giving 850 mm. deflection to one too small to detect. The result amply confirms the view that the effect is due to the gas absorbed by the metal.

THE inaugural lecture delivered by Dr. W. C. McC. Lewis, the successor of Prof. Donnan in the Brunner chair of physical chemistry at the University of Liverpool, has been issued in pamphlet form, with the title, "Physical Chemistry and Scientific Thought." It is mainly devoted to the significance of research from the purely scientific aspect, especially in connection with some of the problems of physical chemistry.

SINCE Wöhler's first synthesis of a natural organic compound, the chemist has succeeded in building up nearly all the natural compounds from their constituent elements in his laboratory; indeed, the synthesis of the sugars, the polypeptides, the alkaloids, uric acid and its derivatives are some of the greatest triumphs of the chemist. Much of the success in this field is due to the genius of Emil Fischer, and though he has celebrated his sixtieth birthday he shows no signs of relaxing his labours, being now responsible for another great achievement. The importance of the nucleus in the cell needs no emphasis, and therefore the value of the recent work, more particularly of Levene and his collaborators, in America, on its chemical composition has been widely recognised. In brief, the nucleic acids are composed of glucosidic compounds of purine derivatives combined with the carbohydrates to which phosphoric acid is also coupled. The synthesis of such a glucosidic compound of sugar and purine has long been essayed, but it is only now brought to a successful conclusion. Once the principle of the method of making them has been made clear all kinds of purine derivatives can be coupled with the carbohydrates, and when phosphoric acid has been introduced into the molecule the complete synthesis of the nucleic acids will have been achieved.

Engineering for March 13 gives an illustrated account of the new water supply scheme for New York. The actual water supply is derived from the Croton River by impounding this river and its tributaries thus providing 325 millions of gallons a day. The population has increased very rapidly, and the present consumption amounts to more than 500 millions of gallons daily. The additional water supply system, now under construction, is derived from the various watersheds of the Catskill Mountains, from which 800 millions of gallons daily could be obtained. The Esopus watershed is the only one to be developed at present, and has necessitated the construction of a great dam at Olive Bridge. This dam consists of a central masonry portion 1000 ft. long, and rising to a height of 210 ft. above the bed of Esopus Creek. Each end of the masonry is flanked by an earthen wing, which together are about 3600 ft. in length. The greatest thickness at the base is 200 ft., while the top, which is traversed by a roadway, is 26 ft. in width. The up- and down-stream faces are formed by concrete blocks of large dimensions, while the great bulk of the interior masonry is made of cyclopean concrete. Expansion joints are provided, and run through the entire thickness. The roadway on the top of the dam will be 20 ft. higher than the water level, and thus will be free from the action of ice and waves.

THE directors of Messrs. Pathé Frères have agreed to permit the Research Defence Society to hire any nine of their excellent medical and biological films for the modest fee of two guineas. Nine films afford ample illustration for a lecture of an hour's duration, and as a kinema machine can be hired in most large towns, it should prove possible, in view of the generous concession of Messrs. Pathé Frères, to arrange lectures in support of the work of the Research Defence Society at a comparatively small cost. Further particulars of this promising scheme for educating the public in the value of modern medical research can be obtained from the honorary secretary to the society, Mr. Stephen Paget, 21 Ladbroke Square, London, W.

MESSRS. LONGMANS AND CO. announce as in preparation, "Principles of General Physiology," by Prof. W. M. Bayliss. In the volume special attention will be given to reactions in colloidal systems, oxidation, action on surfaces, secretion, excitation, inhibition, nutrition, etc. Messrs. Longmans and Co. also give notice of a new series of monographs on physiology which will be under the editorship of Prof. E. H. Starling. The following volumes are in preparation:—"The Involuntary Nervous System," Dr. W. H. Gaskell; "The Physiology of Reflex Action," Prof. C. S. Sherrington; "The Conduction of the Nervous Impulse," Dr. K. Lucas; "The Physiological Basis of the Action of Drugs," Dr. H. H. Dale; "The Secretion of Urine," Prof. A. R. Cushny; "The Contraction of Voluntary Muscle," Dr. W. M. Fletcher; "The Cerebral Mechanisms of Speech," Dr. F. W. Mott; "The Chemical Mechanisms of Integration in the Animal Body," Prof. E. H. Starling.

OUR ASTRONOMICAL COLUMN.

ELECTRIC WAVES AND THE COMING TOTAL SOLAR ECLIPSE.—It is hoped that the forthcoming total solar eclipse of August 21 will be fully utilised to study the effect of the propagation of electric waves, as this event affords an exceptional and important opportunity of adding to the existing knowledge of the propagation of electric waves in sunlight and in darkness and across the boundaries of illuminated and unilluminated regions. The total eclipse track passes across Greenland, Norway, Sweden, Russia, and Persia to the mouths of the Indus; in Russia the duration of totality will be a little more than two minutes. A circular, distributed by the British Association committee for radio-telegraphic investigation sets forth details of this special kind of investigation and this committee would be greatly aided in the organisation of this piece of research if those possessing the necessary facilities and willing to make ob-

servations during the eclipse would communicate with the honorary secretary, Dr. W. Eccles, University College, London, W.C., at the earliest possible date. The committee proposes to prepare and circulate special forms for the collection of statistics of signals and strays, especially within the hemisphere likely to be affected by the eclipse. It will endeavour to make provision for the transmission of special signals at times to be indicated on the forms. It will also offer for the consideration of the authorities controlling stations near the central line a simple programme of work. The discussion of the observations, and the comparison with meteorological data will be carried out by the committee, and digests of the statistics, together with the conclusions drawn from the analysis, will be published in due course.

THE CURIOUS METEORIC DISPLAY OF FEBRUARY 9, 1913.—A brief account was given in NATURE of September 18 last (vol. xcii., p. 87) of what was described as an "extraordinary meteoric display," which was observed over a very extensive line in Canada and America. The display took the form of a procession of meteors, brilliant and coloured, and was compared with a fleet of battleships or airships proceeding at night across the sky. The Journal of the Royal Astronomical Society of Canada for November–December, 1913 (vol. vii., No. 6, pp. 404 and 438) publishes some further information and correspondence relating to this extraordinary display which will be read with great interest. In the first instance, Mr. W. F. Denning communicates an interesting discussion, having gone over the work again, after Prof. Chant's investigation, with the result of obtaining a good general agreement with the latter's conclusions. Even so experienced an observer as Mr. Denning describes the fall as "unique." The further information is supplied by Col. W. R. Winter, of Bermuda, who has been able to collect additional facts since his first report. It shows that the general appearance of the display at Bermuda differed considerably from that observed in Canada, for most of the large leading bodies had disappeared while the number of trailers and groups had greatly increased. Prof. Chant discusses these various opinions and new observations in the article in question.

THE GENERAL DISPLACEMENT OF LINES IN THE SOLAR SPECTRUM.—Some results of a comparison of arc and solar wave-lengths of certain iron lines appear in Bulletin No. xxxvi. of the Kodaikanal Observatory by which Mr. Evershed has been led to a new interpretation of the general displacement of lines in the solar spectrum towards the red. The completion of the electric installation has enabled use of the arc to obtain spectra of the sun and laboratory source of light on the same plate, thus permitting more accurate determination of absolute and relative shifts of the lines in the solar spectrum. Some of the plates have been measured by the positive on negative method recently noted in this column. Mr. Evershed's determination of the difference between sun and arc agree, in the main, very well with the figures which MM. Fabry and Buisson have obtained by the interference method. The pressure explanation of the origin of the shifts is now found to be quite incompatible with the observations in three different directions: (1) King's low-level lines show *least* shifts in the sun; (2) the lines showing greatest shifts under pressure in the laboratory show least shift in the sun; and (3) the lines in the red do not show the greatly increased shifts they would be expected to if Duffield's exponential law were followed. It is found that lines in the red show the least shifts, and that the strong (high-level lines) are most affected. These two facts receive adequate explanation on the supposition that in the higher levels there is a movement of descent with a negative acceleration. The motion for the strong lines amounts to 0·93 km./sec., while for the weak lines it is less than 0·3 km./sec. The director is to be congratulated on the early advantage he has taken of the increased facilities afforded by the completed electric installation.

ORIGIN OF PLANETARY SURFACE FEATURES.—M. Emile Belot has communicated to the French Academy of Sciences a tentative theory of the mode of formation of the external features of some planetary bodies, more especially those of the earth (*Comptes rendus*, vol. clviii., p. 647). Whilst one does not feel by any means compelled to accept all the suggestions there put forward, the paper is nevertheless intensely interesting, and contains some highly original ideas regarding the development of the heart-shaped figure of the earth and the formation of land areas based on the hypothesis of a relative movement of translation of the earth (also the moon and Mars, which are regarded as resembling the earth) in the primitive nebula, the movement being in the direction of the axis of rotation from south to north. M. Belot regards the main land features as cognate with water. He supposes, indeed, that they were formed by the deposition of material carried by surface torroidal currents flowing away from the south pole, completing a stupendous circulation generated by the resistance offered by the nebula to the movement of translation. The vertical cool descending current in the Antarctic region marked that as the site of the condensation of the water of the ocean.

SMOKE ABATEMENT IN EUROPE AND AMERICA.

THE movement for lessening the evils of smoke, both factory and domestic, is extending and increasing in weight and importance. In our own country, the health authorities of sixteen cities have commenced to make accurate observations upon the extent and character of the soot- and dust-fall, by a standard method and apparatus.

Classes for the instruction of stokers and engineers in the scientific principles of combustion are now included in the curriculum of the majority of the larger technical schools and institutes; and a movement is in progress to obtain higher wages and a better status for the men who have passed satisfactorily through these courses of training, and have obtained a certificate of efficiency. Glasgow has made most progress in this direction, and has also carried on for several winters a series of popular lectures, designed to bring home to the general public the losses and evils arising from smoke, and the best methods of minimising these, both in the works and in the home. The classes and lectures have been carried on in Glasgow, by the West of Scotland Branch of the Smoke Abatement League; in Manchester, Liverpool, and other towns and cities, the classes are run by the local education authorities.

In Germany, the Hamburg "Verein für Feuerungsbetrieb und Rauchbekämpfung" continues to flourish, and can show a membership of nearly 500 members, the majority of whom own boilers or other heating appliances, and are thus large users of fuel. The officers of the Verein are now directing their attention to the emission of smoke from steamers lying in the port of Hamburg, and are seeking to extend the benefits of their system of supervision to the Mercantile Marine.

In America, the most notable event of the past twelve months has been the publication by the Mellon

Institute of Industrial Research in the University of Pittsburg of a series of bulletins dealing with the results of the inquiry into the black smoke problem in that district of the U.S.A. Five bulletins have been issued so far: No. 1 deals with the "Outline of the Investigation," No. 2 is a "Bibliography," No. 3 discusses the "Psychological Aspects of the Problem," No. 4 deals with the "Economic Cost of the Smoke-Nuisance in Pittsburg," and No. 5 with the "Meteorological Aspect of the Smoke Problem."

Bulletin No. 4 contains the following summary of the losses annually incurred in Pittsburg, as a result of the damage and dirt produced by smoke:—

	£
(1) Cost to the smoke-maker, by imperfect combustion	304,150
(2) Cost to the individual: laundry and dry-cleaning bills	450,000
(3) Cost to the householder: painting, cleaning, and decorating	466,400
(4) Cost to the proprietors of wholesale and retail stores: cleaning, lighting, depreciation of stock	735,000
(5) Cost to the owners of office buildings, hotels, and hospitals	43,400
Total	£1,998,950

This estimate, it must be noted, covers the losses per annum in one American city alone, the population of which at the present time is about 350,000. Calculated for each head of the population, the loss is therefore about 5*l.* 13*s.* per annum.

Assuming that London is only suffering pecuniary losses from the smoke evil to one-half the extent of Pittsburg, the total will represent a loss of well over ten million pounds per annum, or more than double the estimate given by the Hon. Rollo Russell, in a paper read at the Building Trades Exhibition and Conference, held in London in 1899.

J. B. C. K.

THE AFRICAN MAMMAL FAUNA.

FROM a zoological point of view the year which has just come to a close will be noteworthy on account of the extraordinary number of new specific and subspecific names applied to members of the African mammal fauna. In the case of the larger forms a great proportion of these names have been proposed as the result of the detailed examination of the vast series of East African mammals collected during the Roosevelt expedition, by Mr. E. Heller, who, in various issues of the Smithsonian Miscellaneous Collections, has described as new a number of local races of monkeys, antelopes, and Carnivora. To some of these reference has been already made in NATURE, with mention of the very slight differences by which many of the new races are distinguished. The same naturalist has also, during 1912 and 1913, made several well-known antelopes the types of new genera, separating, for instance, the lesser kudu as Ammelaphus, and Hunter's hartebeest as Beatragus, the latter term being formed by combining "B.E.A.," the initials of British East Africa, with the Greek τράγος—a combination which would have made the classically educated naturalists of a previous generation recoil with horror.

Local races of the arui or North African wild sheep have been described in "Novitates Zoologicæ," by the Hon. Walter Rothschild, who has also, in the December issue of the *Ann. Mag. Nat. Hist.*, given names to various local races of antelopes, among these being the Congo representative of the giant eland, which appears to be the largest form of that species. A new race of the ordinary eland, as well as various monkeys, have been named by Dr. P. Matschie, respectively in the *Sitzber. Ges. nat. Freunde* and the *Revue Zool. Africaine*; while several local forms of antelopes have received new names from Mr. E. Schwarz in the *Ann. Mag. Nat. Hist.* Nor does this exhaust the list of antelopes, as Mr. Gilbert Blaine, in the journal last cited, has named a new gazelle from Erythrœa, as well as two races of reedbucks.

Among the smaller mammals particular interest attaches to the description of a second species of the remarkable insectivorous genus Massoutiera from the Algerian Sahara, by Mr. O. Thomas, in vol. xx. of the "Novitates"; while various new African bats and shrews have been named by the same writer in two issues of the *Ann. Mag. Nat. Hist.* By far the largest number of additions to the list of African Micromammalia has, however, been made by Mr. Austen Roberts, who, in vol. iv., part 2, of the Annals of the Transvaal Museum, has described as new no fewer than twenty-eight species and subspecies from the Transvaal and neighbouring South African States.

Although many of the races to which separate names have been applied during the year are undoubtedly worthy of recognition and distinction, those based on minute and unimportant colour-differences make the thoughtful naturalist wonder where the splitting process is to end, and what advantage accrues to science when it is carried to the excess which is now in vogue. R. L.

THE INSTITUTE OF METALS.

WE have received a copy of the tenth volume of the Journal of the Institute of Metals, containing, principally, an account of the papers read and discussions at the autumn meeting of the institute, held at Ghent in September last. The volume reflects the flourishing state of the institute, which has now held its first meeting abroad, and with marked success.

The most important feature of the volume is the second report to the corrosion committee, in which Dr. Bengough and Mr. Jones, of Liverpool University, give an account of their work on this subject. This has included laboratory experiments and also trials with an experimental condenser erected with the funds collected by the corrosion committee. This somewhat costly form of investigation has, however, fully justified itself, and its continuance is assured by the further financial support received from some of those most interested in condenser-tube corrosion. The report constitutes an important forward step in our knowledge of the corrosion of brass by the process of "de-zincification." It is shown that in a simple 70/30 brass this occurs normally in contact with sea-water, particularly if the temperature is raised to the vicinity of 40° C. A white zinc-salt, of the nature of a basic chloride, is formed, and acts as a species of catalytic agent, leading to the continued solution of zinc with constant re-formation of the basic chloride. Muntz metal is found much inferior to brass in this connection, but a brass containing 1 per cent. of tin, or, better still, 2 per cent. of lead, is found to resist this form of corrosion far better than a pure zinc-copper alloy. A remarkable result brought out by the report is the negligible influence exerted on dezincification by local electric cells, such as those formed by adherent particles of other metals or of carbon.

Among the other papers may be mentioned a further contribution to the theory of an amorphous intercrystalline cement, by Dr. Rosenhain and Mr. D.

Ewen, which deals with the nature and causes of the brittleness of even the purest metals at temperatures near their melting points. Mr. H. Garland, of Cairo, contributes a paper on the micro-structure of ancient Egyptian metal specimens, showing that the metastable structure of cored solid solutions has persisted through many thousands of years. Prof. Hoyt deals with the constitution of the "kalchoids," by which repellent name he denotes the alloys of zinc, tin, and copper, while Prof. Guertler, of Berlin, contributes a discussion of the relation between alloy constitution and specific volume. All the papers attain a very high standard of scientific and technical interest.

HYDROLOGY IN THE PACIFIC.[1]

IT is a "far cry" to the Sandwich Islands, and equally a "far cry" to the days of Captain Cook with his intrepid crew, pioneers in the exploration of Polynesia. Many changes have taken place since the black day in 1778 when the renowned navigator came to his tragic end on the snowy sand beach of Hawaii. The modern traveller who wanders so far will find the Hawaii of to-day a fully civilised community, the streets of the principal town of which, Honolulu, besides being laid with tramways and electric mains, are so covered with a network of telephone wires as to give the impression of a huge spider's web amid the palm-trees.

The Sandwich or Hawaiian, Islands are eight in number, forming a chain about 400 miles long, distant some 2,000 miles from the North American continent and from the United States, of which they constitute a territory. The principal unit is Hawaii, which gives its name to the group, and is in area more than double any of the others. The capital lies on the island of Oahu. The industry is chiefly agricultural. Practically the whole of the exports—99 per cent.—are products of the soil (rice, sugar, taro, etc.), and of these 93 per cent. are either absolutely dependent on irrigation for growth, or require the application of water at some period or other to stimulate their development, and produce the most satisfactory yield. Such being the case, the administration and conservation of the water resources of the islands are matters of obvious and fundamental importance, in regard to which the United States Government shows no sign of neglecting its responsibilities. The volume just published is an account of the investigations made during the period 1909–11 into the conditions and factors influencing the flow and economic development of the surface waters. It is replete with statistical data and full of strange names of streams and places, the pronunciation of which (Awaawapuhi, Puuwaawaa, Kukuihaele, for instance), though no doubt musical enough when correctly rendered, seems to be beset with difficulty for the uninitiated. B. C.

THE RESEARCH CHEMIST AND THE TEXTILE INDUSTRY.[2]

THE textile industry of this country shows a gross value amounting to the considerable total of 333,000,000*l.*; materials to the value of 235,000,000*l.* were used in their manufacture; and 1,253,000 persons were employed in their manipulation. The power used amounted to 1,987,000 h.p., and 77 per cent. of the firms engaged in their work made a return that they had used during the same period 8,137,000*l.* worth of coal. These figures indicate that there must be under modern conditions an ever-increasing call for research chemists in this industry. If the standard that one chemist is required for every 2000 persons employed in the textile industry were set up, there would be room for no fewer than 620 highly trained chemists, who would each be dealing with an "average gross output" of the value of more than 500,000*l.* per annum.

When it is remembered that a Continental combine in the aniline dye industry employs more than 600 chemists, the above estimate of ultimate requirements cannot be considered unreasonable. The effect of this army of chemists working in the interests of the textile industry would naturally lead to astonishing developments and to considerable improvements in detail.

The student who enters a works on the research side, after having received a university education (or having equivalent qualifications), will, undoubtedly, possess a knowledge of chemistry which will rank as an immediate asset. In a way, the college training will also have prepared him for actual working conditions by indicating their nature.

In addition to this knowledge of theory, the student will make immediate use of any experience he may have gained in ordinary analytical operations. It will often be necessary to devise new methods of analysis, or, at least, modify old ones, before they can be utilised in industrial investigation. A knowledge of the principles which underlie such work is, therefore, a very necessary equipment for the young investigator. This also involves a training which has a special value to those entering this, and most other, industries. In many cases, work will rest on the borderland of industrial research, where the actual analysis of certain products can replace actual experiment in very few cases. It is the latter which counts. The former is generally of secondary value.

The research chemist will probably enter the works at an early age. If he has finished his college course at twenty, a year or two of teaching work will do no harm. It will consolidate his knowledge of theory under the stress of imparting it to others. Better still, if it is possible to determine, at that stage, the direction of his future work, he may engage in a post-graduate course of research. The actual time of coming in contact with works conditions should not be delayed beyond the age of twenty-two years, for the mind must be capable of readily adjusting itself to industrial conditions, which are naturally different from those surrounding the student in a college laboratory.

The introduction of a time factor in its relation to cost of production will alone have a great influence. Work in the factory may be practically continuous in its operation. The young chemist will, therefore, quickly realise that he has to deal with entirely new conditions. These will at once claim his interest by reason of their novelty and importance. He will soon be engaged in the attempt to control, or modify, operations proceeding on a scale possibly measured in tons, or thousands of yards.

The raw material will enter at one end of the factory. At the other end, it will leave in a more or less "finished" state. This operation may, in some cases, take months to complete, during which time the material may be subjected to innumerable processes which may possibly modify both its physical and chemical properties. The chemist will endeavour to understand, and so control, these operations that, during transit through the works, material may receive a minimum of treatment to produce a maximum effect; for this generally means satisfactory working conditions, and low cost of production.

[1] "Water Resources of Hawaii, 1909-11." Prepared under the direction of M. O. Leighton by W. F. Martin and C. H. Pierce. Pp. 552+11 plates +3 maps. (Washington Government Printing Office, 1913.)

[2] From lectures delivered before the Institute of Chemistry, October and November, 1913, by W. P. Dreaper.

What general effect can the successful investigator have on the methods and processes employed in work of this nature? He must aim at a position under which determining methods of working are being constantly modified in detail; or even in nature. Under the most successful conditions he may, in time, find himself working three years in advance of those who are not taking full advantage of modern methods of investigation. It is difficult for an industrial chemist to hide from his experienced rivals a process or method which can be detected in the finished product by ordinary, or even special, means. Many improvements are, however, of such a nature that they cannot be detected in this way, and then the above condition may be found to apply. In most cases this standard is a reasonable one to aim at. More than this can scarcely be expected, unless the Patent Law comes in to protect ideas and methods for a longer period. When this is realised, there is obviously no finality to work of this nature, and as a result a condition of continual change will probably be set up in the factory.

It is surprising to what an extent secret working has in some cases secured a monopoly. Especially is this so, when the effect of a process, or use of a machine is not self-evident or easily traced in the finished article. Under such conditions, and more particularly where an industry has not adopted a scientific control, a certain sequence of operations has been known to remain the monopoly of a firm, or a limited number of firms, over many years—as witness the Turkey Red industry.

Even where a close examination of the finished product might suggest, to the experienced investigator, the method of treatment employed, its presence is often overlooked or unsuspected because of difficulties in the way of identification or analysis. A slight and inexpensive change in manufacture may add 10 per cent. to the apparent value of a textile material. What this means on a large output can easily be imagined, as the ordinary net profit on manufacture may be somewhere between 20 and 35 per cent.

The research chemist is, therefore, constantly trying to improve or devise methods of investigation which will enable him to keep in touch with the work of those who, for the time being, may be regarded as his competitors; and the methods utilised to this end are based more often upon personal experience than published results. Such processes generally deal with the recognition of certain physical or chemical changes which occur when the material is subjected to tests corresponding to those in actual practice. Owing to their value to the investigator, such methods are not generally disclosed. Work in this direction, or modifications in accepted processes of analysis, and in the proper interpretation of results, are often carefully guarded, until through some change in procedure, they no longer retain their original value. Many such examples will occur to the technical chemist.

The aim of the chemist in this respect is to obtain some clue of a physical or chemical nature which will suggest to the experienced investigator the nature of superior working methods. Such methods of obtaining an insight into hitherto unknown processes or applications are of considerable value. They can only be successfully used by the investigator who has a practical knowledge of manufacture in addition to an ordinary laboratory experience. Thus, to the industrial research chemist, analysis may have a different meaning to what it has to the general consulting chemist. It is a means to an end which possibly may be the discovery of the nature of a process. Analysis is also utilised to obtain the correct working conditions of a new process, or the better control of an old one. It will be gathered from these remarks that procedure must in many cases be empirical in its nature.

The research chemist often has to watch ordinary manufacturing operations over extended periods before any plan of control or improvement can be devised. Light is sometimes thrown upon such a position by the occurrence of irregular results in the daily output, or a systematic examination of the effects produced by accidental, or predetermined, variations in working conditions. Many problems have been successfully investigated by such means. Such variations, as they occur in everyday practice, may often lead to important improvements, or even suggest new processes. Thus, the research chemist will soon realise that his right place is in the works. He will use the laboratory mainly to follow up ideas in detail.

The introduction of new methods naturally calls for an immediate re-examination of the conditions of working of existing processes. This may often secure to them an extended lease of life, as in the case of the collodion method of preparing artificial silk. In these days of costly apparatus for plant, this factor must not be lost sight of. It is the first point to consider when the chemist finds he has to deal with, and equal, the results obtained, by the introduction of a more efficient process, leading to the production of a better or cheaper product.

The successful worker must, however, go further than this. Experience indicates that important results have generally been obtained by striking out boldly in a new direction. The risk connected with such pioneer work can always be minimised by working on a moderate scale, and making sure of the details of every step as it occurs in a natural sequence. With long experience, it is sometimes possible to experiment at once on a large scale with a reasonable chance of success, but this course should never be followed by the beginner. Such conditions are comparatively rare, and generally governed by some secondary consideration, such as the prohibitive cost of new apparatus, as compared with the utilisation of that already available in the works.

In industrial research, it is sometimes more important to know what not to do than the reverse. This restraining influence must be developed equally with originality. In this, the worker will naturally be guided by instinct, which may be defined as the tempering of past experience by an untiring caution.

Once more, the young chemist may be urged to spend most of his time in the works, only working in the laboratory when some work requires systematic investigation. Many manufacturers have objected to this procedure in the past, but with tact, such opposition, where it still exists, can generally be overcome. The industrial chemist who remains in his laboratory will be hopelessly left behind in the race for progress.

It is impossible to say how far the chemist should experiment in the laboratory, or when he must carry out the necessary investigation in the works itself. In the latter case, it is well to leave such labour as does not entail exact measurement in the hands of the workman. The chemist must, however, *know how to carry on such work*, and in cases of difficulty, be able to do so under the eyes of the workman. This is sometimes a rather trying experience to the novice, but it must be faced.

Be careful, when starting experimental works, and reasonably certain that all data which can be obtained on a laboratory scale are already secured. Only then should the establishment of experimental works be attempted. Much can be done in the way of experimental plant, etc., in the laboratory with 100*l*. An experimental works will probably absorb anything be-

tween 3000*l.* and 10,000*l.* before any important results or improvements can be obtained.

It sometimes happens that preliminary operations of a seemingly innocent nature induce material changes which cause endless difficulties in subsequent treatment. These disturbing causes will be entirely overlooked if the chemist does not carry his investigations back to the raw material and examine processes on the broadest lines.

In the process of mercerising the fibre must be kept under a condition of strain during at least one part of the process; and a long staple cotton (Egyptian) must be used if the treatment is to have its maximum effect. The mere chemical operation of mercerising was, in itself, ineffective (Figs. 1 and 2).

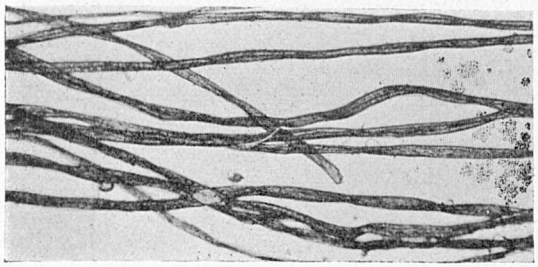

FIG. 1.—Cotton fibres (×100).

Thus, it is evident that the modern chemist must be prepared to carry his investigation to the extreme limits of experiment, or satisfactory results will not be obtained. Also that he must extend his work beyond the realm of chemistry proper. A more general knowledge and scheme of working are necessary if the laboratory is not to remain a mere adjunct to the engineering department. The term, "chemical technologist," is one which possibly best describes the qualifications of the industrial investigator, and the knowledge he must possess.

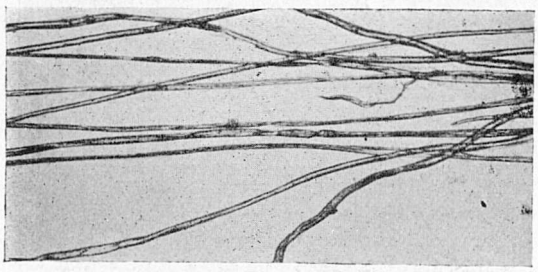

FIG. 2.—Cotton fibres after mercerising under tension (×100).

When the student considers such processes, he will realise that the difficulties and nature of modern industrial research are closely concerned with detail. This is always so. Many problems of similar importance undoubtedly still exist in the textile industry, but these will be solved only by the trained investigator who attends to this essential point.

Thus, success is often closely associated with the art of carrying existing processes a stage further. It is with the careful working out of additional detail that it is associated.

In numberless cases, progress is only secured by following up a seemingly unimportant point. This being so, the importance of a training, be it self-inflicted or otherwise, which qualifies a man to deal with such problems is evident. In its absence, progress can only be realised by the more slowly working aid of rule-of-thumb.

The presence of this factor has given the rule-of-thumb man great power in the past, for he has at his command a wonderfully accurate instrument in the trained eye. The chemist with all his apparatus is in some cases no match for him.

The investigator, sooner or later, realises the essential value of empirical methods, and if he is wise lets the worker know that he does so. In this way, the chemist gains the worker's confidence, and the latter more clearly realises the true aim of research. Once this position is established, the workman will naturally direct attention to any variations in working which may occur, or make suggestions of distinct value. The workman has a great advantage. His mind is continuously concentrated on one operation. Thus, it often happens that only by a careful study of deviations from the normal will the research chemist be able to report progress. His aim is to explain and control, the workman's to manipulate.

Facts which are but "curiosities" to the workman, and have remained so for many years in some cases, must be carefully investigated in detail by the chemist. They often represent the starting point for improvement—a first aid to progress, when all other means have failed. Time given to such investigation is never lost, for experience in the ways of processes is a commanding asset to the industrial chemist.

Where operations are conducted on a large scale there is a greater chance of recognising such conditions. An improvement when applied on a larger scale has also a greater value. It is, therefore, better for the young chemist to get into a large works; unless he is compelled to enter a single department, in which case the greater freedom in a small works may be more valuable in spite of restricted output.

Attention may be directed to a list of the probable actions which may be involved during dyeing operations, which I advanced some time ago.

(1) A solution state of the dye within certain limits of aggregation as determined by the laws of solution.

(2) A fibre state corresponding to this state of aggregation and of a permeable nature.

(3) Localisation of dyestuff within the fibre area through surface concentration effects.

(4) Localisation of salts, acids, etc. (assistants), within the fibre area from the same cause.

(5) The direct entrance of dye aggregates by molecular migration, with subsequent reformation of aggregates within the fibre area.

(6) De-solution, due to surface concentration effects ("salting out"), or secondary attraction, between the fibre substance and the dyes.

(7) Primary or chemical action, which may play some part at this stage, and may even in some cases take the place of, or cause, de-solution phenomena.

(8) De-solution effects in the case of basic dyes, which may lead to alteration in constitution, and the production of basic salts in a state of high molecular aggregation (insoluble) within the fibre area.

In recent years, Perrin has suggested that the action of dyeing is a purely electrical phenomena, and this suggestion has been followed up in some detail by Gee and Harrison in this country.

It is only in certain cases that the chemist has a voice in the purchase of textile fibres, when certain physical or even chemical factors are recognised as being in question.

The need for such supervision may be seen in the agitation which has been actively carried on by trade associations and others concerning the methods used in South Africa in the dipping of sheep.

For some reason best known to the authorities, a sheep dip is officially recommended which consists of

a mixture of slaked lime and caustic soda. The effect of this on the wool itself is sufficiently injurious, for the selling price of South African wool to be materially affected, and endless trouble introduced in subsequent manufacturing processes.

It is said that the breaking strength tests show a loss of 18 per cent. in the treated wool. Although wool buyers and English chambers of commerce have protested since 1899 against this treatment, it is still carried on, and the directions, issued in the *Government Journal of the Union of South Africa* so recently as March, 1913, still recommend its use, and give particulars of its preparation.

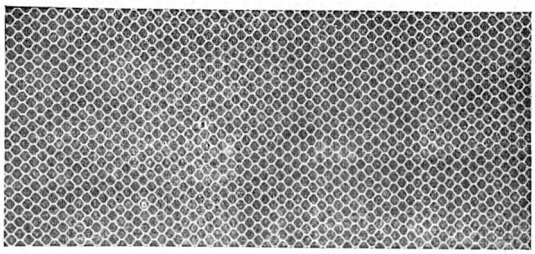

FIG. .—Artificial cellulose fabric (natural size).

This example must be the only one which can be discussed on the present occasion. Many of the methods used to determine certain differences in the nature of raw materials which count in the subsequent manufacture, as they have been noted, or even controlled, by chemists, are considered to be of a more or less secret nature.

Although we are not directly concerned with the rebleaching of goods, the use of electrolytic bleaching liquors may be strongly recommended for the laundry trade. As the sodium hypochlorite leaves the electrolyser it gives better bleaching with weak solutions than the older bleaching liquor does with strong ones. Two of the best-known types of electrolysers are those of Kellner, and that sold by Messrs. Mather and Platt. In the modern type, the original salt or brine solution passes in a serpentine course between the platinum or carbon electrodes. The salt employed in the solution is never entirely converted on grounds of economy, and care has to be taken to adjust the cost of current to that of the salt to secure economical results. Under present conditions, the cost of electrical energy must be low, but in view of the many advantages which the use of the sodium salt gives the bleacher, the new process will obviously be put to more extended use.

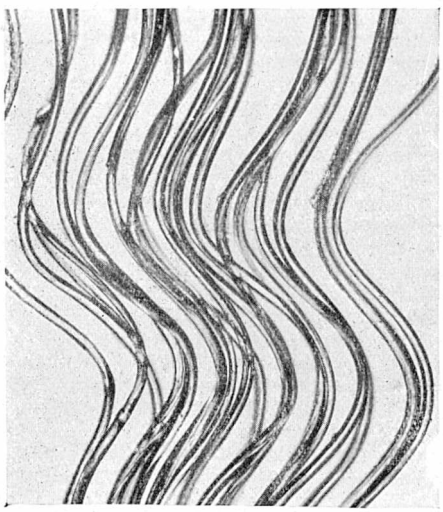

FIG. 4.—Artificial silk thread (×80).

It is a mistake, however, to imagine that the chemist's work in the textile industry is chiefly concerned with the adulteration of material and supplying the public with something which is not what it appears to be. Such work is mainly constructive, and its influence has been for good. Extraordinary results have been achieved in the last twenty years in the direction of actual improvements in manufacture as well as in the cheapening of production.

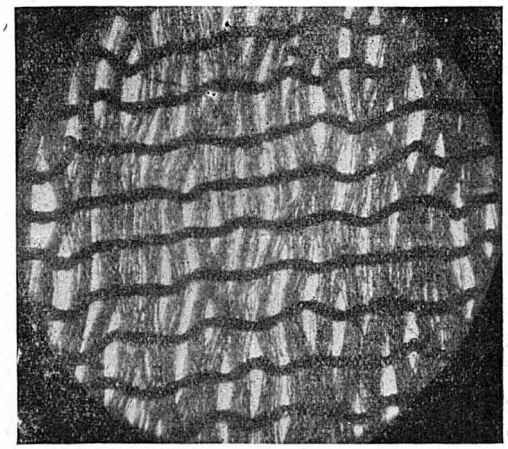

FIG. 5.—Crêpe de Chine, satisfactory finish (×30).

The manufacture of artificial fabrics direct from a solution of cellulose is a case in point (see Fig. 3), or that of artificial silk as shown in Fig. 4.

The use made of the microscope is seen in Figs. 5 and 6, where the difference in certain finishing operations is clearly disclosed and explained.

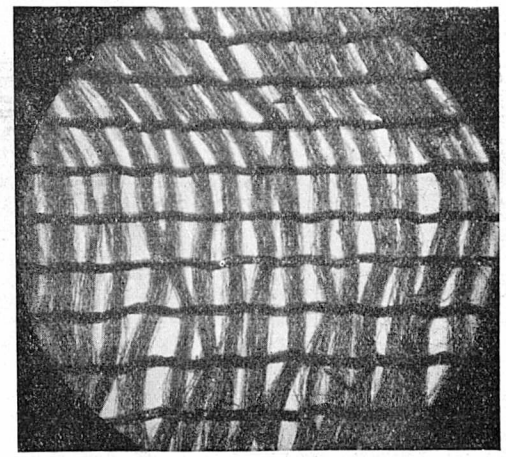

FIG. 6.—Same material, unsatisfactory finish (×30).

It will be gathered from the remarks made generally in these lectures that the influence of moisture, in its relation to the many operations of finishing adopted in this industry, is paramount. It is probably the most important influence which the investigator has to consider. The presence of moisture in a fibre gives rise to many conditions, which seem to indicate that it is present in more than one condition. This materially adds to

the difficulty in determining its true influence. The fact that all the fibres take up moisture, and that this influences them in different ways, is one of the most perplexing problems met with in this industry. It will probably be many years before this matter is properly understood, or explained scientifically; but when this is achieved, light will undoubtedly be thrown on many phenomena which are so obscure to-day; and which, under present conditions, can only be dealt with on empirical lines.

The relative position of the chemist and engineer in the works has given rise to discussion in the past, and still shows signs of not being altogether understood.

The opposition to the chemist which is said to exist in some quarters has probably been much overestimated. In the majority of cases the chemist obtains all the necessary aid he may require from the engineering department. As a matter of fact, the engineer always seems interested in the chemist's work. This is due, no doubt, to the different method of attack adopted by the latter, which, in itself, fully justifies the presence of the chemist in any works.

Under normal conditions the engineer frankly helps the chemist in his experimental work, and this aid is of real service in many ways. Quite apart from his previous training, the chemist will pick up a fair knowledge on the engineering side in the works, which will be particularly useful in cases where he subsequently acts as manager of a department, or even of the works itself.

The chemist should be just as anxious to make friends with the engineer as with the heads of other departments; and the best way to gain experience and knowledge in this direction is to keep in touch with any new experimental plant which may be in course of erection.

In some cases, work will develop in directions which are not naturally covered by any existing department. If the operations involved are complicated, it may be better for the process to remain under his direct management or control. In this case, one or more experimental departments may, in time, be associated with the laboratory.

It is then necessary to borrow men from the engineering department, and to direct their operations. When this happens, the work of the chemist becomes still more general in its nature, and additional experience is gained in the management of men and processes.

Where experimental work is rapidly translated into full-scale operations under normal conditions, the control will pass to one of the works departments. This should be encouraged, for the chemist is then more free to continue research in any other directions which may present themselves. But he must always be ready, and able, to resume temporary control if things go wrong, or where further developments are in progress.

The evidence that a merely chemical training is insufficient is fast accumulating, and may be emphasised. The chemist may, for weeks, be working in directions which are physical or even mechanical in their nature rather than chemical. The important point is that *his method of attack is based on a past training in chemistry*; and that, because of this, it will be different from that adopted by the engineer. In this its value rests. This is the point I have tried to emphasise in these lectures. Also that success in almost every case depends upon attention to detail. Thus, an inferior mind may sometimes succeed when once a main idea has been grasped. These are the points I would especially bring to the notice of the young chemist who is entering the textile industry on the research side.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

BIRMINGHAM.—The council of the University has appointed Prof. Charles Lapworth emeritus professor of geology in recognition of his services during his occupation of the chair of geology. The Senate recently signalised his retirement by the presentation of an address and a gift of plate, and on March 11 another presentation was made to him by a large number of his old students. Prof. Boulton was in the chair, and Dr. Walcot Gibson, who spoke on behalf of the old students, gave happy expression to the affectionate esteem in which Prof. Lapworth is held by all who have had the good fortune to come under his influence.

CAMBRIDGE.—The Observatory Syndicate has appointed Prof. A. S. Eddington, Plumian Professor of Astronomy, to be director of the observatory.

Mr. A. V. Hill has been appointed to the Humphrey Owen Jones Lectureship in Physical Chemistry.

DR. PRAFULLA CHANDRA RÂY has been appointed to the Sir Taraknath Palit professorship of chemistry in the Presidency College, Calcutta, and Mr. C. V. Raman to the Sir Taraknath Palit professorship of physics in the same institution.

IT is announced in the *London University Gazette* that a course of eight lectures on the rate of the blood-flow in man in health and disease will be given in the physiological laboratory of the University, South Kensington, by Prof. G. N. Stewart, professor of experimental medicine, Western Reserve University, Cleveland, U.S.A., at 5 p.m., on Tuesdays, from May 5 to June 23 next. The lectures are addressed to advanced students of the University and to others interested in the subject. Admission is free, without ticket.

AN article on careers for university men, by Mr. H A. Roberts, the secretary of the Appointments Board in connection with the University of Cambridge, contributed to the *Cambridge Magazine* in 1912, has been issued in pamphlet form by Messrs. Bowes and Bowes, of Cambridge, at the price of 6*d*. net. The account given of the work of the Appointments Board at Cambridge shows the usefulness of such an agency in bringing together employers of labour and university men who desire appointments. Graduates will find invaluable the information here brought together as to public posts open to suitable university men, and the facts as to the salaries to be expected at the beginning of a career should save much disillusionment later.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, March 12.—Sir William Crookes, president, in the chair.—Sir James **Stirling**: Note on a functional equation employed by Sir George Stokes.—Prof. J. C. **McLennan** and A. R. **McLeod**: The mercury green line $\lambda=5461$ as resolved by glass and quartz Lummer plates and on its Zeeman components.—H. **Hartley**: The electrical condition of a gold surface during the absorption of gases and their catalytic combustion. At the suggestion of Prof. W. A. Bone, the author has carried out experiments on the electrical conditions of a gold surface during its absorption of hydrogen, carbon monoxide, and oxygen, respectively, at temperatures between 300° and 400°, in order to establish certain data relative to surface combustion phenomena. The results have proved (1)

that the metal acquires a *negative* charge during the catalytic combustion of gases in contact with it (thus confirming previous unpublished observations by Bone and Makower), which effect is probably antecedent to the actual combustion, and primarily due to "occlusion" phenomena; (2) that the metal becomes *negatively* charged (0·5 to 1·5 volts) during the occlusion of the combustible gas (hydrogen or carbon monoxide), and *positively* charged (0·8 volt) during the occlusion of oxygen; and (3) that such electrical effects are probably due to occluded gas which is *leaving* (rather than *entering*) the surface. The experiments indirectly lend support to the view that the well-known electronic emission from incandescent solids is probably dependent upon the occlusion of gas.—J. H. **Mackie**: The diffusion of electrons through a slit.—Dr. A. **Holt**: The rate of solution of hydrogen by palladium. The rate of solution of hydrogen at constant (atmospheric) pressure by palladium in the form of black, thin and thick foil has been examined. The rate curves in the case of palladium black are simple and of continuous curvature, but for the foil a more or less pronounced discontinuity of curvature is always observed. The discontinuity is accounted for by considering that the gas is dissolved in two different forms of the metal, the rate of solution being different in the two forms. Palladium black is believed to consist almost wholly of one form, and hence gives a simple rate curve, whilst the foil (which is mainly crystalline) contains both varieties of metal, and so gives two rates, the first rate passing into the second when solution in both forms becomes equally rapid.—Dr. R. A. **Houstoun**: The dispersion of a light pulse by a prism. A light pulse of a form giving the Wien energy distribution is incident on a prism, and expressions are derived (1) for the disturbance in the region immediately behind the prism where the different colours overlap; and (2) for the disturbance in the focal plane of the telescope. The first expression holds only for a particular law of dispersion, but the second is for any law of dispersion. They are both in accordance with results obtained by Lord Rayleigh by considerations of stationary phase and hydrodynamical analogy, but they go further. For example, it is definitely stated how the amplitude varies in the front and rear of and throughout the train of waves given rise to by the pulse in the different parts of the spectrum.

Geological Society, February 20.—Dr. Aubrey Strahan, president, in the chair.—Annual General Meeting.—President's address: As his main subject, the president referred to that part of the work of George Darwin and Wallace which bore on the history and age of the earth, and commented on the vagueness of the evidence on which estimates of the rapidity of denudation in past times are founded. Before attempting estimates of primeval time, it should be shown that some degree of precision is attainable in calculating the amount of denudation effected in post-Glacial times, and the time required to effect it. It is now possible to distinguish the features in the landscape which are due to post-Glacial erosion. River-gorges, dissected plateaus, fans, and deltas of gravel are presented for consideration. In some there seems to be a possibility of estimating the bulk of the material which has been moved, and the rapidity with which the transporting agents are working. Fans spread on the flat bottoms of valleys by tributary streams, or deltas formed in lakes, are of common occurrence. In all cases it would be of value to determine a relation between three factors, namely, the size of the fan or delta, the discharge of the stream, and the character of the ground from which the material was derived. Dammed-up rivers give opportunities for observing the amount of material transported by rolling. The distances over which rivers are now transporting material should be ascertainable by observing the composition of recent alluvial deposits. Few roll gravel directly into the sea, for the gradients in the lower parts of their courses are too low for transportation and favour deposition. An investigation on English rivers has been proceeding for some years, with the object of ascertaining (1) the discharge, (2) the suspended and dissolved impurities, (3) the rainfall, (4) the areas of the basins, and (5) the character of the rocks. The rivers suitable for the investigation are limited to those with a single definite mouth. Fen-rivers have a number of outlets, and cannot be gauged. The amount of material now being rolled by the Exe, for example, is determined from records of dredgings. Rainfall is dealt with by the British Rainfall Organisation, as also the methods of eliminating the error in calculating average rainfall, due to the preponderance of rain-gauges in the lower ground. It was concluded that, although in this country a hydrographic survey may not be essential on the ground of utility, yet more systematic observations on the work of denudation are within the reach of geologists.

February 25.—Dr. A. Smith Woodward, president, in the chair.—Rachel W. **McRobert**: Acid and intermediate intrusions and associated ash-necks in the neighbourhood of Melrose (Roxburghshire). The age usually assigned to the igneous intrusions is a late period in the history of the "plateau-eruptions" of Calciferous Sandstone times. The igneous rocks occur as laccolites and sills, as dykes, and in volcanic necks. The chief rock-types present in the area are porphyritic and non-porphyritic sanidine-trachytes, quartz-trachytes, riebeckite-felsites, quartz-porphyries, basalts, and volcanic agglomerates. The salient features of the suite of rocks described are the high content of alkalies, and the presence of soda-bearing minerals such as riebeckite, ægirine-augite, primary albite, and soda-orthoclase. Nepheline was found to be absent from most of the rocks.—A. **Vaughan**: Correlation of Dinantian and Avonian. The results are given of applying the time-scale deduced from the South-Western Province to the Belgian sequence, and shows that the faunal succession is practically the same in both provinces. If the midland and northern developments of England and Wales are compared with that of Belgium, striking identities are observed. The lateral variation of Mid-Avonian lithology is exhibited in a diagram. Correlation of the Belgian sequence with that of the South-Western Province demonstrates that the periods of partial emergence took place consecutively and not simultaneously. The palæontological section contains descriptions of several gentes that are common in Belgium, but rare in Britain. The facts concerning migration and evolution are importants results of extending the area of observation.

Linnean Society, March 5.—Prof. E. B. Poulton, president, in the chair.—Miss K. **Foot** and Miss E. C. **Strobell**: Results of crossing *Euschistus variolarius* and *E. servus*, with reference to the inheritance of an exclusively male character. The specific character is a distinct black spot on the genital segment of *E. variolarius*, which is wanting in the female, and entirely absent from *E. servus*. The authors explained the methods adopted during five consecutive summers, for raising these Hemiptera in captivity. Detailed accounts are given of the history of their specimens, their crossing, and the results in the F_1 and F_2 generations. The exclusively male character, the genital spot, can be inherited without the aid of the Y-chromosome or of the X-chromosome. The genital spot does not behave as a Mendelian unit; neither the

spot nor its absence is dominant in the F_1 hybrids; F_2 generation shows even greater variability.—C. F. M. **Swynnerton**: Short cuts by birds to nectaries. Certain birds, and some individuals more than others, apparently disliked being besprinkled with pollen, and tended always to enter flowers by breaches made by themselves or their predecessors. Other birds tried, contrariwise, to enter the flowers by their natural openings and so to be of use to them for cross-fertilisation excepting in the case of individual flowers that happen, through inconvenience in their own or the bird's position, etc., to offer some difficulty. If these were insufficiently protected as well, they were often either pierced or the openings already made in them by the more indiscriminating birds were utilised. Insects also tended to utilise the breaches made by birds, and so probably in large part failed to counteract the latter's discriminative influence. In most cases the eliminative effect, if any, of the damage was not traced. In two instances it was (for individuals) immediate and clear, flowers of a certain type being bodily removed.

Mathematical Society, March 12.—Prof. A. E. H. Love, president, in the chair.—Prof. W. **Burnside**: The rational solutions of the equation $x^3+y^3+z^3=0$ in quadratic fields.—Prof. H. **Hilton** and Miss R. E. **Colomb**: Orthoptic and isoptic loci of plane curves.—G. H. **Hardy**: The roots of the Riemann ζ-function.—Dr. T. J. I'A. **Bromwich**: Normal coordinates in dynamics.

MANCHESTER.

Literary and Philosophical Society, February 10.—Mr. R. L. Taylor in the chair.—R. F. **Gwyther**: The specification of the elements of stress. Part III.—The definition of the dynamical specification and a test of the elastic specification. A chapter on elasticity. The author proposed to simplify the methods current in the treatment of stresses in an elastic body in treatises and papers on elasticity. The chief point of the paper is that full attention should be paid at the outset to the dynamical (or Newtonian) conditions and that the elastic (or Hooke's) conditions should not have the exclusive prominence given to them which has been the established practice.

February 24.—Mr. F. Nicholson, president, in the chair.—M. **Copisarow**: Carbon: its molecular structure and mode of oxidation.—J. B. **Hubrecht**: Studies in solar rotation. An account of a spectrographic determination of the solar rotation, as observed at Cambridge. Photographs were taken showing the displacement of the absorption lines due to the rotation of the sun. The law which has been found by earlier investigators to govern the solar rotation was on the whole confirmed. Two new points, however, appear to be definitely established for the period of observation (fourteen days): (1) that there is a difference in the rotation velocities of the northern and southern hemispheres of the sun amounting to about 54 metres a second; (2) the latitude law expressing the retardation of the rotation away from the equator was found to be more complicated than usual for the period of time in which the observations were made.

BOOKS RECEIVED.

A Junior Trigonometry. By W. G. Borchardt and the Rev. A. D. Perrott. Pp. xv+220+xvii+xx. (London: G. Bell and Sons, Ltd.) 3*s*. 6*d*.

Photo-Electricity. By Prof. A. L. Hughes. Pp. viii+144. (Cambridge University Press.) 6*s*. net.

The Elementary Principles of General Biology. By Prof. J. F. Abbott. Pp. xvi+329. (London: Macmillan and Co., Ltd.) 6*s*. 6*d*. net.

A History of Japanese Mathematics. By D. E. Smith and Y. Mikami. Pp. vii+288. (Chicago and London: The Open Court Publishing Company.) 12*s*. net.

The Respiratory Function of the Blood. By J. Barcroft. Pp. x+320. (Cambridge: University Press.) 18*s*. net.

Memoirs of the Geological Survey of England and Wales. Explanation of Sheet 316. The Geology of the Country near Fareham and Havant. By H. J. Osborne White. Pp. iv+96, map (Sheet 316). (London: H.M.S.O.; E. Stanford, Ltd.) 1*s*. 9*d*. and 1*s*. 6*d*. respectively.

Odd Hours with Nature. By A. Urquhart. Pp. 323+plates. (London: T. F. Unwin.) 5*s*. net.

Interpretations and Forecasts. By V. Branford. Pp v+411. (London: Duckworth and Co.) 7*s*. 6*d*. net.

Kapillarchemie und Physiologie. By Prof. H. Freundlich. Zweite Auflage. Pp. 48. (Dresden und Leipzig: T. Steinkopff.) 1.50 marks.

Introduction to Botany. By J. Y. Bergen and Dr. C. W. Caldwell. Pp. vii+368. (Boston and London: Ginn and Co.) 5*s*.

Investigating an Industry. By W. Kent. Pp. xi+126. (New York: J. Wiley and Sons, Inc.; London: Chapman and Hall, Ltd.) 4*s*. 6*d*. net.

Mechanical Refrigeration. By Prof. H. J. Macintire. Pp. ix+346. (New York: J. Wiley and Sons, Inc.; London: Chapman and Hall, Ltd.) 17*s*. net.

Suspension Bridges, Arch Ribs, and Cantilevers. By Prof. W. H. Burr. Pp. xi+417. (New York: J. Wiley and Sons, Inc.; London: Chapman and Hall, Ltd.) 19*s*. net.

The Elements of Electricity. By Prof. W. Robinson. Pp. xv+596. (New York: J. Wiley and Sons, Inc.; London: Chapman and Hall, Ltd.) 10*s*. 6*d*. net.

Die Europaeischen Schlangen. By Dr. F. Steinheil. Heft 5. Plates 21–25. (Jena: G. Fischer.) 3 marks.

The Montessori Method and the American School. By Prof. F. E. Ward. Pp. xvi+243. (London: Macmillan and Co., Ltd.) 5*s*. 6*d*. net.

Principles of Economics. By Prof. H. R. Seager. Pp. xx+650. (London: G. Bell and Sons, Ltd.; New York: H. Holt and Co.) 10*s*. 6*d*. net.

Knowledge. Vol. xxxvi. Pp. viii+468. (London: 42 Bloomsbury Square.) 15*s*. net.

British Flowering Plants. Illustrated from Drawings by Mrs. H. Perrin, with Detailed Descriptive Notes and an Introduction by Prof. Boulger. Vol. i. Pp. xlv+plates and notes. (London: B. Quaritch.) In 4 vols. 12 guineas net, or on and after March 28 15 guineas net.

South African College. The Annals of the Bolus Herbarium. Edited by Prof. H. H. W. Pearson. Vol. i., part 1. (Cambridge University Press.) 5*s*. net.

Henri Poincaré. L'œuvre Scientifique—L'œuvre Philosophique. By Profs. Volterra, Hadamard, Langevin, and Boutroux. Pp. 264. (Paris: F. Alcan.) 3.50 francs.

A Study of Education in Vermont. Prepared by the Carnegie Foundation for the Advancement of Teaching, at the request of the Vermont Educational Commission. Bulletin No. 7. Parts 1 and 2. Pp 214. (New York City.)

Jahresbericht der Hamburger Sternwarte in Bergedorf für das Jahr 1912. By Dr. R. Schorr. Pp. 33. (Hamburg.)

Astronomische Abhandlungen der Hamburger Sternwarte in Bergedorf. Band iii. No. 1. Die Ham

burgische Sonnen finsternis expedition nach Souk-Ahras (Algerien) im August, 1905. By Dr. R. Schorr. Zweiter Teil. Pp. 93+17 plates. (Hamburg.)

Die Entstehung der Pflanzengallen verursacht durch Hymenopteren. By Prof. W. Magnus. Pp. 160+iv plates. (Jena: G. Fischer.) 9 marks.

Annual Report of the Board of Scientific Advice for India for the Year 1912–13. Pp. 190. (Calcutta: Superintendent Government Printing, India.) 1*s.* 6*d.*

Progress of Education in India, 1907–12. By H. Sharp. Vol. ii. Pp. 292. (Calcutta: Superintendent Government Printing, India.) 3*s.*

Thirty-Fourth Annual Report of the Director of the U.S. Geological Survey to the Secretary of the Interior for the Fiscal Year ended June 30, 1913. Pp. 183. (Washington: Government Printing Office.)

The Diamond Fields of Southern Africa. By Dr. P. A. Wagner. Pp. xxv+347+xxxvi plates. (Johannesburg: The *Transvaal Leader*; London: The Technical Book-Shop.) 1*l.* 7*s.* 6*d.* net.

DIARY OF SOCIETIES.

THURSDAY, MARCH 19.

ROYAL SOCIETY, at 4.30.—*Discussion*: Constitution of the Atom. Opener: Sir E. Rutherford.

ROYAL INSTITUTION, at 3.—Heat and Cold: Prof. C. F. Jenkin.

CHILD STUDY SOCIETY, at 7.30.—The Dramatic Impulse in Children: Prof. J. J. Findlay.

INSTITUTION OF MINING AND METALLURGY, at 8.—Annual Meeting.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—Discussion on Electric Battery Vehicles.

ROYAL SOCIETY OF ARTS, at 4.30.—Indian Water Gardens; Mrs. Patrick Villiers-Stuart.

LINNEAN SOCIETY, at 8.—The Bearing of Chemical Facts on Genetical Constitution: Dr. E. F. Armstrong.

ROYAL GEOGRAPHICAL SOCIETY, at 5.—A Geographical Study of Portuguese East Africa, South of the Zambezi: E. O. Thiele.

FRIDAY, MARCH 20.

ROYAL INSTITUTION, at 9.—Fluid Motions: Lord Rayleigh.

INSTITUTION OF MECHANICAL ENGINEERS, at 8.—The Chemical and Mechanical Relations of Iron, Tungsten and Carbon, and of Iron, Nickel, and Carbon: Prof. J. O. Arnold and Prof. A. A. Read.

JUNIOR INSTITUTION OF ENGINEERS, at 8.—Aeroplanes as Engineering Structures: W. H. Sayers.

SATURDAY, MARCH 21.

ROYAL INSTITUTION, at 3.—Recent Discoveries in Physical Science: Sir J. J. Thomson.

MONDAY, MARCH 23.

ROYAL GEOGRAPHICAL SOCIETY, at 8.30.—Lost Explorers of the Pacific: B. Thomson.

ROYAL SOCIETY OF ARTS, at 8.—Surface Combustion: Prof. W. A. Bone.

TUESDAY, MARCH 24.

ROYAL INSTITUTION, at 3.—Landscape and Natural Objects in Classical Art. I. Early Greece and its Precursors: A. H. Smith.

VICTORIA INSTITUTE, at 4.30.—The Number of the Stars: Dr. S. Chapman.

ROYAL ANTHROPOLOGICAL INSTITUTE, at 8.15.—Bellingshausen's Visit to Ono-i-Lau: Sir Everard im Thurn.

INSTITUTION OF CIVIL ENGINEERS, at 8.—Some Recent Developments in Commercial Motor-vehicles: T. Clarkson.—Comparative Economics of Tramways and Railless Electric Traction: T. G. Gribble.

WEDNESDAY, MARCH 25.

GEOLOGICAL SOCIETY, at 8.—The Geology of Rockall: Prof. J. W. Judd.—The Composition of Rockallite: Dr. H. S. Washington.

THURSDAY, MARCH 26.

ROYAL SOCIETY, at 4.30.—*Probable Papers*: The Nature of the Tubes in Marsupial Enamel and its Bearing upon Enamel Development: J. H. Mummery. Oxidation of Thiosulphate by Certain Bacteria in Pure Culture: W. T. Lockett.—The Production of Anthocyanins and Anthocyanidins: A. E. Everest.—Variations in the Growth of Adult Mammalian Tissue in Autogenous and Homogeneous Plasma: A. J. Walton.—(1) The Decomposition of Formates by *B. coli communis*; (2) The Enzymes which are Concerned in the Decomposition of Glucose and Mannitol by *B. coli communis*: E. C. Grey.—Description of a Strain of *Trypanosoma brucei* from Zululand. I: Morphology. II: Susceptibility of Animals: Surg.-General Sir D. Bruce, Major A. E. Hamerton, Captain D. P. Watson, and Lady Bruce.

ROYAL INSTITUTION, at 3.—The Progress of Modern Eugenics. I: The First Decade, 1904–1914: Dr. C. W. Saleeby.

CONCRETE INSTITUTE, at 7.30.—Discussion on Reports of the Science and Reinforced Concrete Practice Standing Committees on: (1) A Standard Specification for Reinforced Work; (2) Advice to Superintendents of Concrete Work; (3) Standard Connections and Joints in Reinforced Concrete.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—Current Limiting Reactances on Large Power Systems: K. M. Faye-Hansen and J. S. Peck.

INSTITUTE OF CHEMISTRY, at 8.—Explosives: W. Macnab.

FRIDAY, MARCH 27.

ROYAL INSTITUTION, at 9.—Improvements in Long Distance Telephony: Prof. J. A. Fleming.

JUNIOR INSTITUTION OF ENGINEERS, at 8.—Harmonigraph as Applied to Advertising: A. Forbes.

FARADAY SOCIETY, at 5.—Discussion on Optical Rotatory Power.—Introductory Address: Prof. H. E. Armstrong.—Some Contributions to the Knowledge of the Influence of Certain Groups on Rotatory Power: Prof. H. Rupe.—New Studies in the Rotatory Dispersion of Tartaric Acid and Malic Acid: Prof. H. Grossman.—The Existence of Racemic Tartaric Acid in Solution: Dr. E. Darmois.—Anomalous Rotatory Dispersion: Prof. L. Tschugaeff.—Normal and Anomalous Rotatory Disperston: Dr. T. M. Lowry and T. W. Dickson. At 8.15.—An Enclosed Cadmium Arc for Use with Polarimeter: Dr. T. M. Lowry and H. H. Abram.—The Relations between the Rotatory Powers of the Members of Homologous Series: Dr. R. H. Pickard and J. Kenyon.—The General Behaviour of Optically Active Compounds as Regards the Dependence of Rotation on Temperature Dilution, Nature of Solvent, and Wave Length of Light: Dr. T. S. Patterson.

PHYSICAL SOCIETY, at 5.—A New Type of Thermogalvanometer: F. W. Jordan.—An Instrument for Recording Pressure Variations due to Explosions in Tubes: J. D. Morgan.—The Direct Measurement of the Naperian Base: R. Appleyard.—An Experiment with an Incandescent Lamp: C. W. S. Crawley.

SATURDAY, MARCH 28.

ROYAL INSTITUTION, at 3.—Recent Discoveries in Physical Science: Sir J. J. Thomson.

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