THURSDAY, JUNE 28, 1917.

THE ELECTRIFICATION OF OUR RAILWAYS.

Electric Traction: A Treatise on the Application of Electric Power to Tramways and Railways. By A. T. Dover. Pp. xix + 667 + 5 folding plates. (London: Whittaker and Co., 1917.) Price 18*s.* net.

IN electric traction the questions that have to be discussed may be broadly classified under two headings—technical and financial. The author touches on the latter class incidentally, and then only because it is impossible to leave financial considerations out of account altogether. In the former class he has not included descriptions of generating stations and transmission lines. Even with these restrictions, however, it is only by the severest compression that he has managed in a single volume to give the necessary descriptions of the line, the rolling stock, the appliances and apparatus used in electric traction, and to touch on most of the technical and theoretical considerations involved. We congratulate the author on having succeeded in writing a treatise which engineers and advanced students will find most useful. He is evidently well read in the literature of the subject, most of which is published in the Proceedings of various engineering societies and technical journals, both in this country and abroad, and is therefore inaccessible to many.

In Britain railway electrification is mainly confined to large cities and their immediate neighbourhood. In most cases this traffic has been stimulated by the necessity of competing with tramcars and motor-omnibuses. Unless the railway companies are content to give up a large fraction of the suburban traffic, they must adopt the expedient of electrifying their lines. This expedient, although costly, has proved successful, and many people wonder why the English railways do not at once set about electrifying their main lines. They say that electrification is bound to come, and point out that morally it is wicked to go on burning coal extravagantly in locomotives, seeing that our coal resources will certainly not last for ever. It will be well, therefore, to point out some of the reasons which are making engineers hesitate.

On suburban lines the stations are close together and the trains are continually starting and stopping. Under these conditions an electric train, owing to its higher schedule speed, can carry a larger number of passengers in a given time than a steam train having equal seating accommodation. The number of signal and train movements required for an electric train entering and leaving a terminus is only one-quarter of the number required for a steam train, and for this reason a much larger traffic can be handled by the electric trains before the traffic in the station gets congested.

For main-line railways the problem is more difficult. The efficiency of a modern steam locomotive is very high, and when it has to haul a fast passenger train over a long distance on a level track it is working at its very highest efficiency. The cost of the electric locomotive that could replace it is very heavy, and when we take into account the interest on the great initial expense of electrifying the line, the saving effected, if any, is very small. If, however, there are heavy gradients on the line or long tunnels, electric traction may prove much the more economical. On a steep gradient the potential energy of an electric train can be converted into electrical energy and pumped back into the line. On the Giovi-Genoa line of the Italian State Railways, for instance, the energy recuperated on the down grade is from 60 to 80 per cent. of the energy consumption by the same train on the up journey. The results of tests on a train equipped with motors connected for "regenerative control" on the Metropolitan Railway in Paris show a saving of 20 per cent. of the energy consumption. In addition, the adoption of regenerative control effects appreciable economies in the maintenance costs of the brake shoes, wheel tyres, and rails. The saving in the rails is an especially important item.

Unfortunately, there are several different electrical systems for railways, of which the most important are the direct-current, the three-phase alternating-current, and the single-phase alternating-current systems. There are numerous able advocates of each of these systems, and they can instance in support of their contentions commercially successful electric railways. It is of vital importance to the future of a railway that it should choose the right system of electrification at the start, for the advantages of interchange of traffic between railways are obvious. In the interests of the country there is a pressing need for standardising an electric traction system as soon as possible, and so we hope that the usual costly period of waiting for the survival of the fittest will be brief. For this reason we welcome books of this type, which will enable railway engineers to appreciate the relative advantages and disadvantages of the various systems and so help them to come to a decision.

The author starts with a short and accurate introduction to the mechanics of train movement. It is an excellent example of one of the practical uses of the theory of dynamics taught in all our schools. We next come to chapters discussing in an instructive way various kinds of direct- and alternating-current motors. The modern methods of testing and controlling them are given. Halfway through the book we come to chapters describing the rolling stock for tramways and railways, electric locomotives, and track and overhead construction for tramways and railways. The last two chapters are on feeding and distributing systems and on substation converting machinery respectively. In addition, numerous examination questions are set, the answers being

given to the numerical ones, and references to the text in the case of the descriptive ones. We have satisfactorily checked some of the calculations, and the book is laudably free from misprints. There is little original matter in the work, but the author shows good judgment and no little knowledge in his selection and treatment of the various branches of this important subject.

We are sorry that the author was compelled by considerations of space to devote little more than half a page to the important subject of lightning arresters. He divides them (p. 279) into (1) the aluminium cell arrester, (2) the spark-gap arrester, and (3) the non-arcing arrester. We usually divide them into (1) the electrolytic, (2) the intermittent, and (3) the continuous types of arrester. Engineers are probably familiar with the devices mentioned, but the non-technical reader will have to look up the references given at the bottom of the page. The numerous references form a useful feature of the book.

A. RUSSELL.

COTTON CULTIVATION IN THE UNITED STATES.

Field Crops for the Cotton-Belt. By Prof. J. O. Morgan. Pp. xxvi+456. (New York: The Macmillan Co.; London: Macmillan and Co., Ltd., 1917.) Price 7*s.* 6*d.* net.

THE "Rural Text-book Series" has furnished the agricultural students of the United States of America with several very useful volumes. Prof. Oscar Morgan's contribution now before us worthily upholds the reputation of the series, and is likely to be accepted as having a value considerably beyond the sphere of usefulness very possibly contemplated for it by its author.

Coming from an expert resident in Texas (the most important of the cotton-producing States), the book will be appreciated by cotton-growers throughout the world. In that light it is perhaps unfortunate that so much elementary science was thought necessary. The first principles of the physiology and chemistry of plant life might have been left to the lower school text-book. A glossary of terms would have got over any difficulty presumed to exist and might, at the same time, have been made useful to the general reader not familiar with American agricultural terms and expressions. For example, it is somewhat amusing to find the expression "Irish potato"; tobacco a stimulant; buckwheat a cereal; the "cotton square"; the "Corn-Belt"; the silking of corn, etc.

Setting these minor considerations on one side, there are numerous features of the work of great merit. It is a considered and practical exemplification of the actual conditions and experience of cotton production of the States, framed primarily for use in schools and colleges.

Limitations of space will not permit of a detailed analysis, but it may suffice if we indicate one comparative aspect, namely, between the States and India, as illustrative of the numerous practical bearings of the book. Prof. Morgan describes very fully ten of the associated crops in the Cotton-Belt. The first and most important is corn, or, as in Europe it is more generally called, Indian-corn (*Zea Mays*). This, it would seem, occupies 38 per cent. of the belt, while cotton takes 39 per cent.; then follow (but far behind in point of area) oats, 3·7; wheat, 3·5; kafir and milo, 1·4; pea-nut, 0·9; rice, 0·8; sugar-cane, 0·6; while sweet sorghum, rye and barley show still smaller percentages. Practically all the cotton, sugar-cane, rice and pea-nuts grown in the United States come from the Cotton-Belt.

It may now be useful to exhibit a parallel assortment of the crops associated with cotton in India. Indian-corn, sugar-cane, rice, pea-nuts are not recognised as important crops in, and the Indian supplies of these are not drawn from, the cotton-producing districts. Oats and rye (except on the hills) can scarcely be said to be grown in India. Barley and wheat only occasionally accompany cotton, the former, as a rule, being mainly produced outside the cotton districts. On the other hand, Sorghum (*juar*), Pennisetum (*bajra*), Cajanus (pigeon-pea), Sessamum (*til* seed), Linum (linseed), and *Hibiscus cannabinus* (Deccan hemp) are very closely associated with the Indian cotton.

The Indian crops associated with cotton might be described as a slightly more tropical set than the American, and they denote at the same time differences in soil, climate, seasons of growth, tillage, manuring, and stock—differences that collectively account very possibly for the lower grade of the staple in India as compared with that of the United States. And perhaps the most vital aspect of these differences is the fact that the Indian cotton associates can scarcely be spoken of as rotated with it.

The Indian rotation, such as it is, is usually within the year, not after the lapse of one or more years. That is to say, two crops are taken off the same field every twelve months, one being cotton and the other the alternate crop. Interplanting is also largely followed, more especially with pigeon-pea (Cajanus), or with *juar* (sorghum, but only rarely the sweet sorghum), the balance in the soil being thereby to some extent preserved. Thus, while in India cotton is often grown year after year on the same field, our author tells us that in the States a three- or four-year rotation is universally accepted as essential. Thus: 1, cotton; 2, corn; 3, oats and wheat; and 4, cow-peas.

A study of the book leaves the conviction of its practical utility so deeply impressed that one is constrained to recommend improvement of existing supplies (especially Indian) on the lines set forth by our author as a more rational procedure than the discovery of new areas of production.

The book may be commended to all persons interested in cotton or the associated crops of cotton.

GENERAL CHEMISTRY.

General Chemistry for Colleges. By Prof. A. Smith. Pp. x+662. Second edition. (London: G. Bell and Sons, Ltd., 1916.) Price 6*s.* 6*d.* net.

THE second edition of Prof. Smith's "General Chemistry for Colleges" has been entirely rewritten. It now covers nearly 700 pages, and might easily be mistaken for a new edition of the author's well-known "General Inorganic Chemistry." Regarded from this point of view, the book is excellent: a very careful scrutiny would be needed to discover anything of real value or importance that has been sacrificed in the smaller as compared with the larger book, and the student has good reason to be pleased with a condensation which, after eliminating more than a hundred pages of text, has left him with a book that still covers everything that was essential in the original syllabus.

As the title implies, the book is primarily one for first-year college students, and not for schools. A clever schoolboy could, of course, master its contents; but so many "advanced" subjects are referred to, in an abbreviated form, that he would lose much of the benefit of the change of atmosphere which should take place on passing from school to college. The introduction is, however, so much superior in its method of treatment to that of the larger volume that the reader is left with a desire to see it expanded and used as part of a simple introductory text-book.

The author is a whole-hearted ionist and makes the fullest possible use of the theory of electrolytic dissociation. In a footnote on p. 217 he promises that "the objection that separate atoms of sodium could not remain free in water will be disposed of later"; but it is doubtful whether the ghosts of the separate sodium atoms can be finally laid to rest by the somewhat unconvincing incantation on pp. 234-35, which does not differ essentially from that used ten years ago in the larger book. This was based, then as now, upon the original recommendation of Ostwald that the ghost should be laid by an incessant chanting of the blessed word "allotropy." The objection is, however, a real one, and is not met by the mere assertion that "metallic sodium and ionic sodium are, simply, different substances," or the implication that sodium and chlorine ions become or remain separate in aqueous solutions in virtue of the fact that the atoms are provided with equal and opposite electrical charges. The more active part now assigned to the solvent will, no doubt, make it easier in future editions to meet the objections put forward by the student, or occasionally by the conscience of the teacher.

The whole volume bears the impress of the wide range of knowledge and the gift of clear exposition which belong to the author, and it will be widely used and read both by teachers and by students of chemistry.

T. M. L.

OUR BOOKSHELF.

Diderot's Early Philosophical Works. Translated and edited by Margaret Jourdain. Pp. v+246. (Chicago and London: The Open Court Publishing Co., 1916.) Price 4*s.* 6*d.* net.

ALL who are interested in the movement of thought which found its expression in the great French Encyclopédie will welcome this translation of some of Diderot's minor philosophical writings. It can scarcely be said that they show much profundity or definiteness of purpose. They were rather "works of occasion"—short pieces thrown off at short notice—mainly with the purpose of filling the author's purse when money, as happened so often, was running short with him. Nevertheless, they give us a pleasing insight into Diderot's eager and inquiring spirit, and his impatience with the religious bigotry which was the deadly foe of all free and honest inquiry. The main philosophical point treated in the volume is the relation between mental development and sensuous endowment, a point on which some diversity of opinion is still maintained. His conclusion is that "the state of our organs and our senses has a great influence upon our metaphysics and our morality"; and he shows in some detail in what directions this influence is exerted. To most modern psychologists Diderot's principle will seem so manifestly true as scarcely to admit of discussion. Nevertheless, the principle has been called into question recently by the New Realists, who argue that the human mind is in immediate contact with objective truth. For the confutation of such views Diderot's acute observations upon a blind man and a deaf-mute of his acquaintance are not without value at the present time.

Elementary Physics for Engineers: An Elementary Text Book for First Year Students taking an Engineering Course in a Technical Institution. By J. Paley Yorke. Pp. viii+165. (Cambridge: At the University Press, 1916.) Price 4*s.* net.

THE ground covered by this text-book comprises the fundamental properties of solids, liquids, and gases; force, work, and energy; and the elementary principles of heat, including a chapter on the mechanical equivalent of heat and the fundamentals of the heat engine. The author in his preface states that he has "attempted to present some essential facts of elementary physics as briefly and straightforwardly as possible, without any pedantry or insistence on details of no practical importance." While the book contains nothing novel, the matter is readable and the statements are clear and concise. Formulæ and mathematical equations have been avoided to a large extent. There is little in the text to make it peculiarly applicable to engineering students, and compared with some introductory books of physics which have appeared in recent years, the treatment is somewhat sparse. A few chapters are provided with numerical exercises, but no answers are appended. The book is expensive considering the amount of matter it contains.

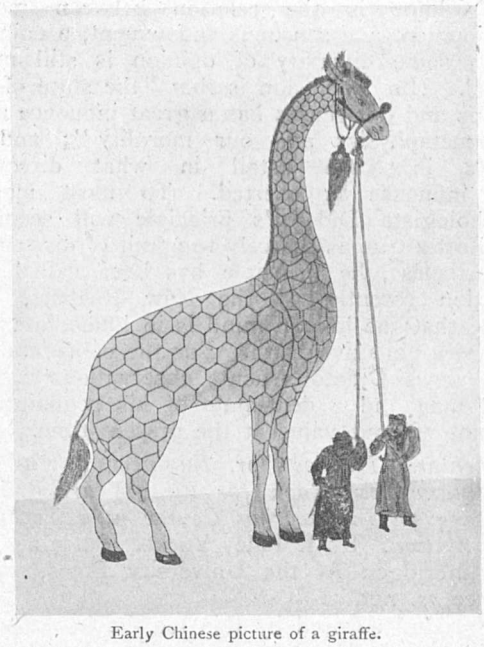
LETTERS TO THE EDITOR.

[*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.*]

Chinese and Persian Giraffe Paintings.

IN NATURE of February 18 and July 29, 1915, and in the American *Museum Journal* for last year, figures were published of ancient Egyptian and also of late fifteenth-century representations of the giraffe. To this series of olden-time drawings may now be added one from Chinese sources, dating probably from the early Ming period, a reproduction of which is shown in the accompanying illustration.

The original is a large unsigned painting in dull colours on silk, executed with considerable firmness of style and finish, the trappings and figures of the attendants receiving especial attention. The general



Early Chinese picture of a giraffe.

style of the painting and the state of preservation of the fabric and colouring would seem to indicate an antiquity of at least three or four hundred years. In the opinion of the owner, Mr. A. W. Bahr, a dealer in Chinese works of art in New York, the painting is still older.

Through the kindness of Miss Greene, in charge of the private library of Mr. J. P. Morgan in this city, the writer has had the privilege of examining a number of old manuscripts containing animal paintings, among them being one which is probably the earliest known English bestiary. Another is an extremely interesting Persian bestiary of the thirteenth century, which has been briefly noticed by M. Claude Anet in the *Burlington Magazine* for 1913 (vol. xxiii., No. 24).

Among the admirably drawn coloured figures of this Persian MS. is one of the giraffe, which is strikingly like the Chinese painting already referred to. It might almost be said that one has served as a model or general design for the other, and undoubtedly the Persian is the more ancient. The inference appears warranted, therefore, that pictures of the giraffe and other Western animals were introduced into Persia through trade routes so early as the thirteenth century, and thence found their way into China, where they were copied by native artists.

C. R. EASTMAN.

American Museum of Natural History, New York.

The Nature of Renal Activity.

MAY I be permitted to explain what seems to me to be a misunderstanding of Prof. Cushny's position contained in the review of his monograph in NATURE of June 14?

No physiologist at the present time can hold that the kidney is a "mere machine," if by that it is meant that such simple physical and chemical forces as those of diffusion and osmosis are sufficient to give a complete solution of its activity. The fact that the fluid which leaves the kidney has a much higher osmotic pressure than that of the blood from which the fluid was formed shows at once that work has been done by the cells of the organ. In our present ignorance we say that this is by means of the "vital" activities of the protoplasmic mechanism, which transforms chemical energy derived from oxidation of food material into osmotic energy. In using the word "vital," most of us have no intention of begging the question as to whether or not these activities involve more than forces present in the non-living world, acting in a special complex system, however much we may feel that further investigations will show that there is no necessity for the assumption of a form of energy peculiar to living beings.

Where Prof. Cushny's position, as I understand it, is an advance lies in the simplification which it introduces into many aspects of the problem. To put it very briefly, it is this:—In the glomerulus, fluid is filtered from the blood by means of the arterial pressure. This fluid consists of all the constituents of the blood *minus* the colloids, the latter, of course, including the blood corpuscles. It contains all that the final urine contains, but in very dilute solution. So far, this is the view put forward by Prof. Starling, but the further development diverges from that given by Prof. Starling. There are two possible ways in which this dilute glomerular filtrate might be made more concentrated—one by removal of water, the other by the addition of solutes contributed by the secretory activity of the cells of the tubules.

Now Prof. Cushny, after a careful examination of the evidence that has been brought forward in support of the second view, comes to the conclusion that none of this withstands criticism, so that the first method must be the one accepted. But, while previous theories regarded reabsorption of water and that of certain of the solutes as separate processes, the new point of view is that the fluid reabsorbed has the composition and concentration of the diffusible substances contained in the blood, with the omission of certain excretory products, such as urea. As Prof. Cushny puts it, "Locke's fluid" is reabsorbed. Naturally, some reason has yet to be found why urea fails to be absorbed, while sodium chloride, glucose, and amino-acids are, but the whole of the phenomena met with can be satisfactorily explained on this "modern view." For example, sulphates are foreign to the blood, and are not reabsorbed. Whatever is present in blood in true solution is present in the glomerular filtrate, but only the constituents of Locke's fluid (*plus* amino-acids) are reabsorbed and in the concentration present in that solution. Doubtless we shall be able in the future to say why the cells behave in this way. The process may be called "selective discrimination," if any comfort is obtained from doing so, but so may the behaviour of parchment paper towards gelatin and

salts. The point is, as Prof. Cushny shows, that the tubule cells *always* absorb a fluid of the composition referred to, whatever may be the needs of the body at the time. They have no power of choice.

The new view must be welcome to those who wish for simplification. It will probably not appeal to those who hold that this is no advantage to a theory, at all events in biology. W. M. BAYLISS.

University College, London, June 16.

THE expression "mere machine" is Prof. Cushny's, not mine. One is glad to learn from Prof. Bayliss that this is not to be interpreted too literally. We all look forward to the time when the expression "vital energy" can be expunged from our vocabulary, but whether the "modern theory" helps us to the realisation of this ideal renewed research alone can show. That Prof. Cushny's theory is in the direction of simplification is a matter of opinion.

THE REVIEWER.

The Origin of Flint.

SIR E. RAY LANKESTER (NATURE, June 7) does not say what form of carbon he refers to as the colouring matter of black flints. If it be carbon, why is the coloration not extended to the white cortex? The blackest flint nodules I have seen occur in a chalk-pit near Faversham, but the apparently black silica becomes white when powdered, showing it to be merely an optical effect. I believe that Judd was the first to point this out, more than thirty years ago. I refer to the flints obtained direct from the chalk and not to those which, having become dissociated from the parent mass, have been afterwards subjected to the influence of various solutions.

The white zone on the exterior of a flint does not necessarily indicate decomposition. In flints taken direct from the chalk it is due to the fact that the rock contiguous to the nodule has not been wholly silicified. Sometimes nodules in the chalk are white throughout, being formed entirely of soft, crypto-crystalline silica, the spaces between the quartz not being filled with colloid silica. I have found these near Corfe. There is no evidence of decomposition, and I regard them as representing an early stage in the forming of a flint nodule.

Some decomposed flint pebbles found at Southbourne-on-Sea, described by me in NATURE at the time (May 1, 1890), are very similar in appearance, but these results are due to deformation.

Many facts seem to prove that flint has been formed since the chalk became indurated and elevated. The naturally repaired fractured flints found near faults, etc., and the remarkable compound flints which I recently exhibited at the meeting of the Geol. Physics Society, are instances. In some of the latter specimens there are as many as four thick deposits of flint surrounding the original nodule, and as there appears to be little, if any, molecular continuity between the layers, the growth of the compound nodule must have been arrested from time to time during its development in the solid chalk. CECIL CARUS-WILSON.

THE suggestion of Dr. R. M. Caven (p. 306), that the black colour of flint is due to ferrosoferric oxide, is supported by the fact that flints which have been for some time in contact with gas-lime (as when a mixture of these materials is used for road-metal) become stained of a deep blue colour, which has been shown by analysis to be due to ferric ferrocyanide. A discussion on this subject appeared in NATURE in 1904 (vol. lxxi., pp. 83, 126, 176). F. J. ALLEN.

Cambridge, June 24.

A Note on Chaffinches and Cuckoos.

ONE day recently I went to look at a chaffinch's nest which I had known of for some time. I had just begun to climb up the hawthorn-tree in which the nest was placed when I heard the "pink, pink" of an alarmed chaffinch, and immediately about five cock chaffinches and more than half a dozen hens and young ones appeared from what seemed to me nowhere. These chaffinches flew all round the tree in a most agitated manner, and one cock actually got on top of my head and pulled my hair vigorously, while a hen, which appeared with the other chaffinches, and I think was the mate of my assailant, flew on to the nest and pecked at me every time I tried to touch it. Their attack induced me to get down; and not until I was more than fifty paces from the tree did the other chaffinches go away.

Not very long after this I was in the garden when I saw two cuckoos which were flying very low, and I could clearly perceive that one of them was carrying an egg in its beak, while the other was crying "cuckoo, cuckoo." I know that there has been much dispute as to whether cuckoos do or do not carry their eggs; but in this instance I can personally testify that a cuckoo was carrying what was obviously an egg.

HONOR M. M. PERRYCOSTE.

Higher Shute Cottage, Polperro, Cornwall, June 14.

Jupiter's Satellites and the Velocity of Light.

I SHOULD be grateful to any readers of NATURE who can find time to send me two postcards, one *via* Siberia and the other *via* U.S. America, telling me what is the most trustworthy interval of time between the eclipses of Jupiter's first satellite (sidereal revolution 1d. 18h. 28m.) when the earth and that planet are in conjunction and in opposition. Watson, on p. 503 of "A Text-book of Physics," fourth edition, gives $T-T'=1992$ sec., and Everett, on p. 82 of "C.G.S. System of Units," gives as the best determination of the mean distance of the earth from the sun $1{\cdot}49465(10)^{13}$ cm. If these figures are to be trusted, Römer's method of determining the velocity of light ranks second to none, as it yields the figure $3{\cdot}0012(10)^{10}$ cm. per sec. A. W. WARRINGTON.

Chengtu Fu, W. China, March 3.

Arcs of Halos.

THE phenomenon described by Dr. Ellison (NATURE, June 14, p. 312) is clearly the upper contact arc of the 46° halo, and is not very uncommon, even in the absence of the halo itself.

The Meteorological Office "Observer's Handbook" states:—

"The arcs of upper contact appear with their convex sides turned towards the sun. . . . The colour effects are often brilliant, red being turned towards the sun, *i.e.* on the convex edge of the halo. The coloration of the arc of upper contact of the halo of 46° is frequently exceedingly brilliant."

Meteorological memories are proverbially short, and town-dwellers miss many optical phenomena too common in the country to excite comment.

WALTER W. BRYANT.

Royal Observatory, Greenwich, June 26.

HORSE-BREEDING AND HORSE-RACING.

THE history of the English racehorse is a chequered one. During the Wars of the Roses many studs were dispersed, but owing to the re-importation of horses from the Continent during the reign of Henry VIII. the thoroughbred breed was re-established. Later, owing to the importation of numerous Oriental and other alien stallions and mares, the English breed of racehorses was for years in the melting-pot. In 1649 the Royal Tutbury Stud was handed over to Parliament, but a few years later Cromwell, though himself an owner of racehorses, found it necessary "for political reasons" to stop racing. History has been repeating itself. A valuable stud has recently been handed over to the Government, and racing has once again been virtually suspended. Further, some people not unduly biased by the objectionable features of race-meetings are asking, "Is racing necessary to maintain the pre-eminence of the English racehorse?" while others, including Sir H. H. Johnston, want to know "whether the type of horse that is evolved from horse-racing is of any use nowadays?"

It is well to bear in mind that the racehorse industry is a large and important one, and that the large sums received for horses exported help to pay for the raw material required for our cotton and other factories. But there is a more cogent reason than the economic one for preserving the racehorse. Unless we intend to retire once more to the fool's paradise we found so comfortable up to August, 1914, it is essential that we not only preserve the thoroughbred, but also, by more scientific breeding, add greatly to its value for military and other purposes. Light as well as heavy horses have played an important part in the present war, and, notwithstanding mechanical traction, they may play a still more important part in future wars. Horses for military purposes should have the vigour, staying power, and tenacity of mules combined with the cross-country instincts of hunters. Such horses can be obtained only by cross-breeding. It would be difficult to create and maintain a breed of hunters, and still more difficult to create breeds of the old pack-horse type suitable for military purposes. This being the case, it will continue to be impossible to provide Army horses without the help of the thoroughbred. The modern English racehorse is said to be "more remarkable for speed than stamina"; nevertheless, crosses having a large infusion of thoroughbred blood have often as much staying power, intelligence, and courage as Arabs.

Hitherto, while Continental Powers have been spending annually large sums in breeding, or providing facilities for breeding, military horses, our Army Remount Department has looked to thoroughbred and other breeders to provide them with all the different types of service horses required, has, in fact, trusted to meet the demands of the Army by misfits obtained at a price which scarcely paid for their upbringing.

Many who realise the national importance of maintaining the English and Irish racehorses have some difficulty in realising that racehorse breeding implies racing. They admit that it is impossible to create and maintain herds of "1000-gallon cows" without keeping milk records, and that unless records are kept it is impossible to have strains of "200-egg hens," but they fail to appreciate the importance of having continuous records giving the performance of racehorses. It is impossible by looking at or handling a cow to say whether or not her offspring will prove as good milkers as her pedigree suggests, for everything depends on the contents of the germ-cells, and the only way to obtain information about the composition of the germ-cells is to test the milking powers of the offspring. When a thoroughbred stallion has a distinguished racing record there is a probability that he will prove a successful sire, but the only sure test is the performance of his offspring. As thoroughbreds are an unstable blend of several distinct types they rarely breed true, hence breeders in selecting stallions should be guided mainly by the racing records of their offspring. Sometimes indifferent performers acquire great distinction at the stud. "Stockwell" is said to have achieved at the stud "the most brilliant success of any sire of all time," and he is often referred to as the Emperor of Stallions. The sire of "Stockwell" ("The Baron") was the son of the very unattractive, fiddle-headed mare "Echidna," who was never saddled; "Stockwell's" dam ("Pocahontas") was a bad roarer and an indifferent performer on the Turf and deficient in quality, yet "Pocahontas," through "Stockwell," "Rataplan," "King Tom," and others who inherited her immense vitality, did much to increase the stamina of the modern English racehorse. But for the racing test the value of the "Pocahontas" and "Echidna" blood would never have been realised.

The necessity of testing the speed, endurance, etc., of possible sires was first realised about the beginning of the seventeenth century, but the importance of directing more attention to the performance of the offspring than to that of either sire or dam is not yet sufficiently recognised. During a considerable part of last century the practice of considering almost exclusively the records of the sire did little harm, because (as Osborne points out in his "Horse-breeders' Handbook") in former times one out of every three horses bred could win a race, but since the 'eighties it is doubtful if more than one in twenty of the horses bred has won a race. That a change has taken place since it became the fashion to have large sales of yearlings is supported by Sir Walter Gilbey, who, in 1898, pointed out that twenty-two yearlings, sold in 1895 for 46,200 guineas, only won three races in 1897 worth 108*l*., and that twenty-two, sold for 34,850 guineas as yearlings in 1894, had failed, when their racing career was nearly over, to earn one-half of what they originally cost. Obviously, if only about 5 per cent. of the racehorses bred have the speed and endurance required to win a race, it is important that facilities should be provided for systematically testing young horses as soon as their training is sufficiently advanced. Breeding racehorses with-

out applying racing tests is bound to lead to deterioration. For this reason the continuance of such racing as may be required to test the value of the stallions and mares now at stud is essential. J. C. EWART.

THE DESTRUCTION OF HOUSE-SPARROWS.

THE question whether or not a particular species of wild bird is injurious or beneficial is one that is difficult to answer, but it is manifestly unfair to complicate the matter further by raising issues that are foreign to the subject, or by the publication of random statements which are not substantiated by actual facts.

Recently in the *Times* a correspondent recorded "a plague of caterpillars such as are taken by the sparrows to feed their young," and deplores the action of the Board of Agriculture in issuing an Order for the destruction of the house-sparrow. Unfortunately, the correspondent does not mention the species to which this caterpillar belongs; presumably it is the larva of the Winter Moth (*Cheimatobia brumata*, L.), upon which the house-sparrow feeds its young during the nestling period, but only to a limited extent. For years past we have had plagues of caterpillars when house-sparrows were free to breed and multiply, and careful inquiry has shown that such outbreaks are almost universally due to the omission of grease-banding of the fruit trees, or, in the case of other species, to the absence of the spraying machine. Owing to the present scarcity of labour, either of these reasons may account for the plague of caterpillars, so that the demand for "the immediate reversal of the orders given" by the Board of Agriculture is unjustifiable. In view of the above and similar statements now appearing in the Press, it may be well once more to state the economic position of the house-sparrow as related to agriculture and horticulture.

First, the writer would like to state that he is in full agreement with the action of the Board of Agriculture, believing from long experience and close study of the food and feeding habits of the house-sparrow that, as a result of its recommendation, great benefit will accrue to both the agriculturist and the horticulturist.

Gurney, who investigated the food of this species in 1885, stated that "fully 75 per cent. of an adult sparrow's food during its life is corn of some kind. In young sparrows not more than 40 per cent. is corn, while about 40 per cent. consists of caterpillars and 10 per cent. of small beetles. This is up to the age of sixteen days." This statement was founded upon an examination of 694 dissections. In 1910 the writer commenced to work upon this species, and by June, 1914, had examined 404 adults and 329 nestlings, obtained from fruit-growing, agricultural, and suburban districts. Since then the work has been continued, so that up to the present time upwards of 750 adults and 470 nestlings have been investigated, and the results clearly show:—

(i) That the house-sparrow is far too plentiful, and in agricultural and suburban districts it still requires very drastic reduction.

(ii) That, to a less extent, perhaps, it requires reducing in number in fruit-growing districts, and were this carefully carried out annually, after the nesting period, the good done during that season might probably compensate for the harm occasioned during the remainder of the year.

(iii) That in agricultural districts the food of 75 per cent. of the sparrows consists of corn.

(iv) That, apart from the nesting season, the house-sparrow does far more harm than good; indeed, its depredations on cereal crops alone entail a most serious loss to the farmer and the country in general.

As a result of the numbers of house-sparrows that are now, very wisely, being destroyed, we shall, in all probability, see a marked increase in the number of truly insectivorous birds, which are invaluable to the fruit-grower.

As to the continuance of the present Order, all must depend upon the number of birds destroyed in fruit-growing districts; but there is little fear, in the writer's opinion, of their extermination in agricultural or suburban districts, and there the Order might be wisely continued.

From the above recorded observations and those previously published, no unprejudiced mind will doubt the wisdom of a drastic reduction of this species. Enthusiasts and humanitarians may continue to write upon the value of this bird to the farmer, etc.; but the futility of such statements must be apparent to the most casual observer, unless they are supported by trustworthy and carefully obtained facts as to the precise nature and quantity of the food, while such investigations as have been conducted entirely fail to support the popular view that the insects destroyed during the nesting season compensate for the wide destruction occasioned by the species generally during the remainder of the year.

There is a very general, but entirely mistaken, opinion that the house-sparrow feeds largely upon insects. During the nesting season the food fed to the young birds, and in all probability most of that taken by the parents, consists mainly of insects, worms, and slugs; but during the remainder of the year it is mainly grain of some kind.

No thinking individual wishes or advocates the destruction of truly beneficial species of wild birds; on the contrary, every encouragement should be offered them, provided that they are not permitted to increase to such an extent that a change in their feeding habits is forced upon them by reason of their numbers.

Whilst the majority of species of wild birds are undoubtedly beneficial, no increase in their numbers will ever lead to the extermination of any of our common orchard pests. That they aid in the control of such pests is perfectly true, but so long as artificial conditions prevail—*i.e.* the association in a given area of a large number of trees of a particular species—so long will it be necessary to spray, grease-band, and carry out clean cultivation. If the house-sparrow is the

potent factor that some writers claim, then with the countless hordes that have devastated the country during the past ten or fifteen years there should be scarcely a caterpillar left; but, as I stated in 1913, this bird "has been allowed to increase to such an extent that it has become one of the worst pests we have," and "at present the attitude of all farmers must be one of extermination." Finally, I think we may leave the reputation of the Board of Agriculture to take care of itself, for it is a gross exaggeration, unsupported by facts, to say that "it is clear to every naturalist and observer that a great mistake has been made."

WALTER E. COLLINGE.

THE PUBLICATION OF THE "KEW BULLETIN."

WE are glad to see that the order suspending the publication of the *Kew Bulletin*, to which reference was made in NATURE of May 24, is likely to be withdrawn. Replying to a question asked by Mr. Peto in the House of Commons on June 18, Sir R. Winfrey said: "The *Kew Bulletin* was suspended by the Stationery Office in consultation with the Board of Agriculture and Fisheries. The whole matter is, however, at present under reconsideration, and I hope it will be found possible to arrange for the continuation of the publication."

After the appearance of the article in NATURE deploring the action of the Controller of H.M. Stationery Office in suspending the publication of the *Kew Bulletin*, the subject was taken up by the *Times*, which, in an article entitled "False Economy," also regretted the Controller's decision. The British Science Guild took prompt steps to direct attention to the matter; and in the House of Commons on June 11 Sir William Phipson Beale, a member of the Executive Committee, asked the Secretary to the Treasury

on whose advice the decision of the Controller of H.M. Stationery Office was taken to suspend the printing and publication of the *Kew Bulletin*; whether his attention was called to the importance of that publication for the spread of valuable information throughout the Empire relating to plant culture and the supply of fibre, timber, and plant products; if he can give the names of any experts concerned in the scientific and commercial development of Colonial industries connected with plant culture who were consulted in the matter; whether the editor was consulted; and whether any estimate was made of the consumption of paper involved in the continuance of the *Kew Bulletin* as compared with the consumption of paper for dramatic, sporting, pictorial, and other fashionable papers which have no practical value for the development of the resources of the Empire either during or after the war.

The reply given by Mr. Stanley Baldwin was as follows:—

In reply to the first part of the hon. member's question, it is understood that the Secretary of the Board of Agriculture and the chairman of the Select Committee on Publications were consulted by the Controller of the Stationery Office prior to the suspension of the *Bulletin*; and that the Controller's decision was acquiesced in by the Director of the Royal Botanic Gardens. The editor of the paper was, I am informed, consulted by the Controller before any action was taken. The answer to the second part of the question is in the affirmative, and that to the third part in the negative. The consumption of paper for dramatic, sporting, pictorial, and other fashionable papers is not within the jurisdiction of the Controller of the Stationery Office.

It will be noticed that this reply does not cover the points raised by Sir William Beale, and we believe that Mr. Baldwin was not in the possession of the full facts when he suggested that suspension was decided upon after consultation with suitable advisers and with the consent of the Director of the Royal Botanic Gardens, who is the editor of the *Bulletin*. We are confident that everyone who is competent to pass a judgment upon the case would express the opinion that the discontinuance of the *Kew Bulletin* upon the ground that it was "not essential" could not be justified for a moment. The subjoined memorandum, signed by members of the Executive Committee of the British Science Guild and sent to the Secretary of the Treasury on June 9, affords in itself sufficient reason for the continuance of the publication of the *Bulletin*, which Sir R. Winfrey hopes will be possible. If that end is attained, the Guild is to be congratulated upon the part it has played in bringing about the abrogation of an unfortunate and ill-considered decision.

The British Science Guild learns with much astonishment that the Controller, H.M. Stationery Office, has decided that the *Kew Bulletin of Miscellaneous Information* is not essential, and has therefore suspended its publication until more normal times are reached. The Guild is strongly of opinion that such action should not have been taken without referring the question of the value of the *Bulletin* to competent scientific authorities; and it protests against the suspension of publication at a time when every effort should be made to promote the development of the plant resources of the Empire. The part which Kew has played in the collection and distribution of cinchona, india-rubber, and many other plant products, including timbers, should have preserved the *Bulletin* from any restriction on account of the great benefits it has been the means of conferring, not only upon the Empire, but also upon humanity at large.

The *Kew Bulletin* was first issued in January, 1887, in response to the demand for the prompt publication for general use of any information likely to be of service to those engaged in science, cultivation, or commerce connected with the plant and agricultural resources of the Overseas Dominions. The prefatory note to the first number says:—

"It is hoped that while these notes will serve the purpose of an expeditious mode of communication to the numerous correspondents of Kew in distant parts of the Empire, they may also be of service to members of the general public interested in planting or agricultural business in India and the Colonies."

The *Bulletin* was started at the desire of Parliament, upon the recommendation of the First Commissioner of H.M. Works and Public Buildings (Mr. Plunket). It has been the vehicle for the publication of a vast amount of information of various kinds, some on purely scientific, but mostly on economic, subjects. The "miscellaneous information" supplied by the *Bulletin* has ever been welcome to botanists and to those concerned with the utilisation of vegetable products; and it has provided a valuable record of Kew work in all its varying aspects.

The *Bulletin* is sent out to all botanic and agricultural departments in correspondence with Kew, and much of its contents is usually reprinted in local journals. It affords the best evidence of the many activities of the Royal Gardens, in advising upon the possible development of the natural resources of our Colonies and Dependencies. Almost every issue contains a number of plain statements of attempts made to introduce new and commercially profitable plants in suitable districts, of improved methods of cultivation, and of work that men trained at Kew are doing in the various parts of the world to which they have gone from the Royal Gardens. By suspending the publication of the *Bulletin*, the link connecting Kew with the whole of the botanic stations of the Empire is broken, and the means of communicating information to them all is removed at a time when the information afforded is no less valuable than in pre-war periods.

Without knowledge of the functions fulfilled by the *Bulletin*, and an intimate acquaintance with what it has accomplished in providing information not accessible in any other form in regard to the capabilities of the various parts of the Empire for the cultivation of plants of economic importance, no Government official is capable of deciding justly whether the *Bulletin* is an essential publication or not. The British Science Guild urges, therefore, in the interests of Imperial development, that the decision be submitted to a competent tribunal, which will take into consideration, not only the shortage of paper, but also the value of what is printed upon it. It is confident that the result of such an inquiry would be a judgment in favour of the continued publication of the *Bulletin*.

SYDENHAM (President, British Science Guild).
NORMAN LOCKYER (Chairman of Committees).
BOVERTON REDWOOD (Deputy-Chairman, Executive Committee).
WM. P. BEALE, W. MATHER (Vice-Presidents).
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J. S. YOUNG

(Other members of the Executive Committee).

PROF. KR. BIRKELAND.

WE regret to learn from the *Morning Post* that Prof. Kr. Birkeland, of Christiania, died in Tokyo on June 18. He was one of the few speculative physicists of the day the value of whose work would be generally admitted in commercial circles. He was the co-inventor with Mr. Sam Eyde of the Birkeland-Eyde direct process for the manufacture of calcium nitrate by the extraction of nitrogen from the atmosphere. In the Journal of the Royal Society of Arts, May, 1912, Mr. E. Kilburn Scott records how, starting with a 25-h.p. experimental plant in 1903, the company controlling the Birkeland-Eyde patents had 200,000 h.p. at work in 1912, and was likely to add a further 300,000 h.p. before the end of 1916. This was by no means the only successful patent in which Prof. Birkeland was interested.

As a theorist Prof. Birkeland was extraordinarily bold in his speculations. He had theories on the internal constitution of the sun and the nature of sunspots, on the sun as a magnet and as a source of electricity, on the origin of the planets and their satellites, on the nature of various celestial phenomena, especially the zodiacal light, on the production of aurora and magnetic storms, and on the past geological history of the earth. The wealth acquired by his practical gifts enabled Prof. Birkeland to experiment and arrange for solar and magnetic observations on a large scale. He made many striking experiments with an artificially magnetised terella in a high vacuum, directing towards it electrical discharges, intended to represent the discharge of corpuscles from the sun. In some of his experiments the vacuum chamber had a capacity of 70 litres, and the supply of electrical energy required a 6-h.p. engine. He obtained phenomena closely resembling various forms of aurora, which he believed to represent the conditions under which magnetic storms appear on the earth.

Prof. Birkeland was largely responsible for the institution of special magnetic observatories in Arctic regions in 1900, in 1902-3, and again during the last few years. His two large volumes in English, "The Norwegian Aurora Polaris Expedition, 1902-3," besides much speculation as to the causes of magnetic storms, contain much important information as to the simultaneous progress of magnetic disturbance at different parts of the earth. Since 1910 he had lived a good deal abroad for observational purposes, and numerous communications to the *Comptes rendus* of the French Academy of Sciences describe his various conclusions and speculations. In one dated July, 1914, he expressed his intention of devoting the next three years to the study of the zodiacal light in Natal, at Helwan, and in Uganda, and he was working in Egypt in 1915 and 1916. Presumably the continuation of his quest had taken him to the Far East. At the time of his death Prof. Birkeland was only about fifty years of age; but when last in England, in 1913, he had aged considerably in appearance and become very deaf. He was, however, as animated as ever when discussing his theories.

C. CHREE.

NOTES.

ON June 20 Lord Montagu of Beaulieu gave an interesting lecture before the Aeronautical Society of Great Britain on the world's air routes and their regulation. He pointed out how favourably placed the British Empire was in this matter, inasmuch as its many possessions were so scattered about the globe that suitable landing and halting places could be provided without the necessity of asking for concessions from other nations. Lord Montagu based his calculations upon an assumed speed of 120 miles an hour,

and showed that with two five-hour periods per day the journey to India could be accomplished in four days. Under the stage which aeroplanes have now reached, the carriage of mails and passengers to India seems quite a feasible proposition; the meteorological conditions along the tracks that might be followed, except at the British end in the winter, are quite good. Crossing the Atlantic is another matter, especially from Europe to America; the shortest track, from Ireland to Newfoundland, is in the winter a region of gales, mostly from some westerly point, and if the more favourable weather that prevails further south is sought, the distance is about doubled. Lord Montagu's suggestion is that certain levels should be assigned to certain types of traffic, but it has been estimated that at any given time one-half of the earth is covered with clouds, and a pilot above a sheet of clouds cannot keep his course, as there is nothing to tell him the strength and direction of the air drift to which he is exposed. It follows therefore that a pilot aiming at a definite place must fly low enough to see the earth at frequent intervals; in or above a cloud sheet he would have no horizon and could not rely on astronomical observations for his position. Thus the traffic to which the highest levels were assigned would be at a great disadvantage.

THE Executive Committee of the Conjoint Board of Scientific Societies presented its report on the work of the last six months at the fourth meeting of the Board, held at the Royal Society on June 13, Sir Joseph J. Thomson in the chair. The report indicates that a number of important questions of scientific and industrial importance has occupied the attention of the Board. Various bodies are at present interested in the formation of a census of the mineral resources of the Empire. It was agreed to enter into communication with these bodies and to make suggestions with a view to the publication of information in a form useful to the general community. Interim reports were received and approved on the necessity for an anthropological survey of the British people, on the best methods for carrying on the International Catalogue of Scientific Literature, and on an inquiry into the desirability or otherwise of the adoption of the metric system throughout the British Isles. The sub-committee on National Instruction in Technical Optics reported that a scheme approved by the Board of Education had now come into operation (see NATURE of May 24 and June 14). A sub-committee, having considered special cases of magnetic disturbances revealed by a magnetic survey of the British Isles, and their possible connection with the occurrence of iron ores, recommended a detailed investigation of two test areas, in order to ascertain how far, under the conditions of the British iron ores, the magnetic survey was likely to prove of economic value. Arrangements for carrying out the investigation are in progress. An agricultural sub-committee, with the Earl of Portsmouth as chairman, reported that it is at present devoting itself mainly to engineering questions. It is engaged in collecting information with regard to the transport of raw materials to farms and agricultural products from them, to the power required for this purpose, and for seasonal operations on the land, with the view of comparing the relative advantages and costs of steam or internal-combustion engines and electrically operated machines. A sub-committee was appointed to report on what is at present being done to ascertain the amount and distribution of water power in the British Empire. A complete report of the first year's work of the Board will be published in due course.

WE notice with regret the announcement of the death on June 19 of Dr. Robert Bell, F.R.S., formerly chief geologist of the Geological Survey of Canada.

THE King has been pleased to award the Edward Medal of the First Class to the representatives of Mr. Andrea Angel and Mr. George Wenborne, who lost their lives in endeavouring to save the lives of others on the occasion of a fire which broke out at the Silvertown Chemical Works on January 19 last.

IN order to celebrate the centenary of the birth of Henry D. Thoreau, the Humanitarian League (53 Chancery Lane, W.C.2) has arranged a meeting to be held in the Caxton Hall, Westminster, on the evening of July 12. The chair will be taken at 8 p.m. by Sir John L. Otter, J.P., and short addresses will be given by various speakers. Admirers of Thoreau's writings are invited to be present.

IN a recent issue (June 14, p. 312) we directed attention to a report that the Prime Minister and others were awakened by the sound of the explosions at Messines on June 7. The evidence in favour of the sound having been heard in and near London is, however, insufficient, and information since received from Flanders throws doubt on the statement. An officer of the Royal Engineers, who was only a mile from the largest mine when it was fired, describes the noise as "not so very great"; while another, who was at a distance of eight miles, saw the flash, waited for the noise, and heard only a slight "phit." A contrary wind might, of course, have tilted the sound-waves over the latter observer, but the wind seems to have come from the direction of the front, for the air at the time on the west side was charged with lachrymatory gases. Moreover, a well-prepared explosion is seldom noisy.

THE governors of the West of Scotland Agricultural College have recently issued, in the form of a bulletin (No. 81), a summary by Principal W. G. R. Paterson of certain schemes for the training and employment, particularly in rural occupations, of discharged disabled sailors and soldiers. The three schemes dealt with were selected from eight submitted in response to an offer of prizes placed at the disposal of the governors through the generosity of an anonymous donor. Each scheme is outlined and critically discussed by Mr. Paterson, who contributes also a comprehensive memorandum drafted independently for the consideration of the governors of the college. It is not possible within the compass of a short note to indicate adequately even the essential features of the different schemes, and it must suffice to commend their suggestiveness as to the useful part that may be played in the solution of the problem by the regeneration of our villages, the establishing of colonies of smallholders, the setting up of isolated holdings, and the revival of a number of subsidiary rural industries, as well as the development of new industries.

La Nature (No. 2279, June 2, 1917) devotes a special article to the question of the method of choosing an employé. It is a plea for a more scientific treatment of the problem of adjusting the work to the worker, so that the right person is put to the work for which he is naturally adapted, and also that the work itself should be analysed, with the object of discovering what particular qualities, both mental and physical, it will demand, and, having discovered these, to train the worker along those lines. The writer quotes with approval the attempts made in America in the direction of scientific management of labour. He describes various tests, such as tests of manual

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dexterity, of comprehension, of judgment, etc., which he suggests might be advantageously used by employers of labour when selecting workmen. It is, however, necessary to issue a warning to those enthusiasts who are tempted to accept "tests" uncritically, viz. that one is not entitled to assume that, because a person does well in any given test, he will necessarily be willing to do well in work demanding that same quality for an employer. That he *can* do it is not equivalent to that he *will* do it. Again, it is necessary to be on one's guard against believing in some one test as a test of a particular capacity. It is possible to have, *e.g.*, an excellent memory in a given line of interest, and a very weak one in some other direction. The article is interesting and timely, but much yet remains to be done by trained scientific workers before the method of tests can be generally applied.

WE have received a copy of a pamphlet published by the justice to the Mountain Committee in Tacoma, Washington, and containing the appeal submitted to the United States Geographic Board urging that the mountain now officially known as Mount Rainier should in future be called Mount Tacoma. The request is supported by the House of Representatives of the State of Washington, the Federation of North-West American Indians, and public opinion generally in Seattle and Tacoma. The mountain, which lies about fifty miles east of Puget Sound, in the Cascade range, was discovered in 1792 by Vancouver, and named by him after Rear-Admiral Rainier, R.N. Rainier had certainly no connection with that coast, but the arguments adduced against the use of his name for the mountain do not seem to us to be very convincing. On the other hand, a great deal is to be said for the use of the name Tacoma, which is the modern version of the old Indian name, and the one by which the mountain is generally known in the district. And, after all, the local residents must be the arbiters in the matter, and no decision of the United States Geographic Board can alter local usage. The committee has gone to a great deal of trouble in collecting evidence as to written and oral usage, and has made out a good case for the use of Tacoma in preference to Rainier.

WE have received the report of the bacteriologist (Mr. Ward Giltner) of the Agricultural Experiment Station, East Lansing, Mich., U.S.A., for the year ending June 30, 1916. Much research has been carried out on contagious abortion of the cow. Attempts have been made to render animals insusceptible to infection with this disease, which is caused by *Bacillus abortus*, by vaccination with living and dead cultures, but with little success. Details are also given of the routine work carried out at the station.

THE number of cases of paralysis following gunshot injury of nerves in the present war has given prominence to the subject of electrical testing of nerve and muscle, and the value to be attached to results of such testing for diagnosis and prognosis. The methods of testing commonly applied are by means of condenser discharges or by the faradic or the galvanic current, but it is doubtful if the reactions of the *muscles* induced thereby give information of the state of the nerve supplying them when once reaction of degeneration has developed. In a paper in the *Archives of Radiology and Electrotherapy* for May (No. 202) Dr. Adrian has applied to the human subject a method that was employed by Keith Lucas at Cambridge. A galvanic current of known and variable strength and duration is used. Dr. Adrian makes use of a time-constant known as the *chronaxie*. It is remarkably constant for muscle with undamaged nerve, and has a short duration; for denervated muscle it is very much longer. The method promises to be a useful one.

THE *Geographical Journal* for May (vol. xlix., No. 5) includes a singularly interesting paper by Mrs. Scoresby Routledge describing the results of the expedition to Easter Island under the leadership of her husband and herself. We probably now possess all the information which local investigation can secure about the strange buildings and statues which have so long been a problem for anthropologists. The reading of this suggestive paper at a recent meeting of the Royal Geographical Society was followed by a discussion in which Sir Hercules Read, Sir H. Howorth, and Messrs. T. A. Joyce, A. P. Maudslay, Basil Thomson, and Henry Balfour took part. A most interesting suggestion was made by Mr. Joyce that on the basis of skull measurements the earlier Easter Island natives displayed Melanesian affinities. Mr. Balfour added that for affinities with their culture we must look rather to the West than to the East, the New World influence being practically ruled out. In his opinion the statues appear to show a relation to Melanesian art. This is the latest phase of this long-protracted controversy, and though the results are still to some extent uncertain, the problem has now decidedly advanced towards a definite solution.

THE Proceedings of the Yorkshire Geological Society, new series, vol. xix., part iii., March, 1917 (Hull: A. Brown and Sons, Ltd.; price 7*s.* 6*d.* net) is devoted to a paper by Mr. T. Sheppard, entitled "William Smith: His Maps and Memoirs." No serious student of geology can fail to be interested in the life of William Smith, whose stupendous labours laid a sure foundation for the science of stratigraphy. Several memoirs of his life and work are in existence, and Mr. Sheppard has now said what may be presumed will be the last word on this subject. The paper is naturally concerned with Smith's work in Yorkshire as lecturer and geological explorer, but much space is given to full details of the publication of his maps, sections, and memoirs, and this information will be of great value to librarians and others. Reference is also made to the efforts of earlier writers to understand and explain geological features, and in this connection the ideas of George Owen, Martin Lister, John Strachey, John Woodward, Nicolas Desmarest, Christopher Packe, John Michel, John Whitehurst, John Smeaton, Prof. Jamieson, and James Parkinson have been briefly summarised. The paper is illustrated by numerous plates and figures in the text, and concludes with a bibliography.

MESSRS. RICARD AND BARRAL have recently communicated to the Société Médico-Chirurgicale Militaire de la XIVe Région a very simple method of ascertaining rapidly and easily whether water has been poisoned. It consists in placing a few fish—blay, gudgeon, etc.—in a jar filled with the water to be tested. Two drops of nicotine per litre kill the fish in less than a minute; two drops of conicine paralyse them in six minutes and kill them in eight; one decigram of solanine kills in one and a half hours, the same quantity of cocaine in one hour, and the same quantity of stovaine in ten minutes. One milligram of aconite kills in three and a half hours; twenty drops of aniline in one and three-quarter hours; seven milligrams of digitalin only take effect in four hours. Veratrine does not appear to have any effect; one decigram of potassium cyanide kills the fish in two minutes; two decigrams of corrosive sublimate in ten to twelve minutes; two grams of lead acetate in five hours; five grams of zinc sulphate in two hours; two grams of copper sulphate in forty-five minutes; and thirty-five centi-

grams of picric acid in five hours. On the other hand, the fish do not appear to be inconvenienced by morphine, cantharidine, atropine, pilocarpine, hyoscyamine, scopolamine, or arsenical salts. Water in which fish die in less than four hours should therefore be considered as dangerous.

THE Journal of the East Africa and Uganda Natural History Society (vol. vi., No. 11) contains a number of extremely interesting papers. Not the least of these is that by Mr. R. L. Harger on the desiccation of Africa. Reviewing the records on this theme of pioneers like Livingstone, Harris, and Selous, the author adds much valuable matter of his own, covering a vast extent of country from Tanganyika southward and westward. That the diminution of the chain of the great lakes and the river systems feeding them is proceeding at a most disconcerting rate there can be no question, but the author makes no suggestion as to the causes to which this shrinkage is due. Natural history notes from British East Africa, by Mr. A. Loveridge, afford one a vivid insight into the wealth and variety of the fauna of this part of Africa, for the habits and haunts of many of the smaller creatures unnoticed by the big-game hunter are vivaciously described.

OWING to the war the completion of the reports on the collections of zoological and botanical specimens obtained by the ill-fated British Antarctic (*Terra Nova*) Expedition, 1910, has been seriously delayed. Some of them we have already noticed in these columns. The trustees of the British Museum have now issued Dr. W. T. Calman's report on the Crustacea, and two reports on the marine and fresh-water Algæ, and these sustain the high standard of their predecessors. Four very diverse groups of Crustacea are represented in this collection, and of these two only, belonging respectively to the Cumacea and the Phyllocardia, were taken in Antarctic waters. Two species of Cumacea new to science were taken off the extreme north of New Zealand, and one new species of Stomatopod was taken off the Brazilian coast. Of these Dr. Calman gives admirable descriptions and some very beautiful figures. The marine Algæ have been worked out by Mr. and Mrs. Antony Gepp, and the Melobesieæ by Mme. Paul Lemoine. Only two species of marine Algæ were taken in Antarctic waters, and these are not new. The only specimens of Melobesieæ collected proved, on examination, to represent two species new to science; one of these was taken off New Zealand, the other off Trinidad. Very beautiful figures of both are given. All the fresh-water Algæ collected were Antarctic. They were entrusted to Prof. F. E. Fritsch for investigation, and proved to contain two new species. From the material collected Prof. Fritsch has been enabled to describe the cell-division of *Pleurococcus antarcticus*, which was hitherto unknown.

THE annual report for 1916 of the Horticulture Branch of the Board of Agriculture and Fisheries contains, amongst other matters of interest, a summary of the work accomplished in connection with the investigation and control of various plant diseases and insect pests. Of the notifiable diseases a distinct improvement is recorded in the case of American gooseberry mildew, but a much less satisfactory position with regard to wart disease of potatoes. The latter disease has not only spread throughout areas known previously to be infected, but has also made a sporadic appearance in several new places. Glamorgan, South Lancashire, and Durham are mentioned as areas in which the disease is very prevalent. It is gratifying to note, however, that in areas previously notified as infected very satisfactory results have been obtained by the action of the Board in securing the use of resistant varieties. It is reported that the long and elaborate inquiry into the parasitism of the large larch sawfly has been concluded, but the results have not yet been tabulated. With reference to plant diseases not caused by scheduled pests, special mention is made of the "capsid bug" disease of apples and apple mildew, both of which have been the subject of investigation by the officers of the branch. An interesting summary is also given of the present position with regard to Isle of Wight bee disease, the supervision of which is included among the duties of the branch. The report this year is not issued separately, but appears in the form of an article in the *Journal of the Board of Agriculture* for May.

MEMOIR 92 of the Canadian Geological Survey, by Mr. J. A. Dresser, indicates the excellent prospects of water-power in the Lake St. John district, north of the city of Quebec, and includes an opportune review, by Prof. A. Stansfield, of the smelting of iron-ores rich in titanium. This article, with its references to recent work, will be of service in mineral development elsewhere, and possibly in Ireland.

THE Bulletin of the Hawaiian Volcano Observatory for January, 1917, is of more than usual interest from its record of experiments with Seeger cones enclosed in iron pipes some 40 ft. long, which were thrust into grottoes of glowing lava. It is shown that in a distance of 20 ft. the temperature may vary from 850° C. to 1150° C., and there is some indication that the incandescent upper layers of the lava, emitting gases, may be of higher temperature than the more viscous mass below.

MR. J. C. H. MINGAYE describes several meteorites in the Records of the Geological Survey of New South Wales, vol. ix., part iii., 1916. The Government printer may be congratulated on the beautiful coloured plate showing the various types of olivine in the pallasite of Molong. Mr. Mingaye's detailed analyses of two australites (obsidianites) in the same part serve to emphasise the difference between these bodies and ordinary meteorites.

PROF. C. SCHUCHERT, in discussing the correlation of strata on the basis of palæogeography (Bull. Geol. Soc. America, vol. xxvii., p. 491, 1916), provides an interesting series of maps showing the prevalent conditions in the west of North America during successive Mesozoic periods, and a still more valuable conception of the relations of land and water in early Permian time, in the form of a map of the world, on which the areas are marked where evidences of Permo-Carboniferous glaciation have been found. Teachers of geology may like to enlarge this map into a diagram. The author supports the theory of the permanence of oceanic and continental areas, which seems to many geologists to be based partly on our ignorance of what underlies the oceans, and partly on the definition of oceanic water.

IN the Transactions of the Royal Society of South Africa (vol. vi., part i.) Mr. S. H. Haughton, assistant director, South African Museum, describes ancient human remains found during the excavation of a drain at Kolonies Plaats, Boskop, in the Potchefstroom district of the Transvaal, in 1913. The remains found consist of a large portion of a calvaria, the horizontal part of the left ramus of the mandible, the major portion of a temporal bone, and some fragmentary limb-bones. The distinctive feature of the

skull is that at the level of the posterior part of the parietal there is a decided flattening, which continues on to the superior part of the occipital bone. The occipital projects strongly, and has a thick ridge bifurcating downwards. The flattening of the skull is not paralleled by any skull in the South African Museum, although, according to Mr. Boule, it has been seen on some negro skulls and also upon a Namaqua skull now in the Paris Museum. The paper gives a full account, with photographs, of this interesting specimen. Prof. G. Elliot Smith thus sums up the question: "Whatever the date of the Boskop remains may be, the evidence now in our possession suggests that this early inhabitant of the Transvaal represents the type of the immediate ancestors of the men of the Upper Palæolithic (or, as I prefer to call it, the Neanthropic) age, possibly somewhat modified in the course of his southern migration. It probably represents the earliest (not necessarily in actual age) known phase of *Homo sapiens* in the course of his transformation from a condition analogous to that of Neanderthal man to that of Cro-Magnon."

Two very important palæontological papers by Mr. R. Bullen Newton have recently been published. The first, "On the Conchological Features of the Lenham Sandstones of Kent and their Stratigraphical Importance," forms the subject of his presidential address to the Conchological Society of Great Britain and Ireland (Journ. Conch. Soc., vol. xv., pp. 56–149, four plates). The work on these puzzling deposits begun by Prestwich, Wood, Lyell, and other noted geologists, was well advanced by the late Mr. Clement Reid (NATURE, vol. xxxiv., 1886, pp. 341–43, and in his "Pliocene Deposits of Britain," Mem. Geol. Surv., 1890), who regarded the beds as of Coralline Crag age, and equivalent to the Diestian of Belgium. Mr. Newton has now very carefully gone over Mr. Reid's material in the Museum of Practical Geology with the Graham Wallas and other collections in the British Museum (Natural History), and here discusses most fully each fossil species and its occurrence in time and space, illustrating photographically all the more important forms. The conclusions he comes to will certainly surprise our older geologists, for he terminates the Pliocene with the Red Crag, and refers to the Upper Miocene, in descending order, (*a*) the Coralline Crag; (*b*) the Diestian of Belgium; (*c*) St. Erth beds; (*d*) Lenham Sandstones; (*e*) Anversian of Belgium; and (*f*) the Upper Miocene of Germany; whilst he refers the "Box Stones" to the Middle Miocene. These important and seemingly well-based conclusions deserve a wider notoriety than the pages in which they appear are likely to obtain for them. The second paper describes an interesting mass of "Fossiliferous Limestone from the North Sea" (Quart. Journ. Geol. Soc., vol. lxxii., 1917, pp. 7–22, one plate). After a painstaking investigation of its fossil contents, Mr. Newton decides that it represents a submarine exposure of beds belonging to the lower portion of the Coralline Crag. The accompanying plate is worthy of attention, since the process adopted is the best yet employed in this country for depicting shells.

Science for May 18 contains an address by Prof. R. D. Carmichael on the provision made by mathematics for the needs of science. While very properly defending the study of mathematics for its own sake, he points out that many of its most interesting problems have been suggested by natural phenomena, while, conversely, this debt has been amply repaid by the application of mathematics to astronomy, physics, and chemistry, not to mention other sciences. Prof. Carmichael is one of a group who are now working at a new development of the theory of difference equations, and he expresses a hope that this may have some direct application to theoretical physics. As he says, our latest physical hypotheses seem to be tending towards an atomic, discrete, or statistical form, so that differential equations are not always the most appropriate tools to be employed. Not impossibly we may have a Boscovitchian interlude, after which a deeper insight may bring us back to a flux-theory again. In any case, it is satisfactory to find that mathematics is still growing with remarkable vigour, and providing new methods of attacking a new set of problems.

A RECENT technological publication (No. 82) of the Bureau of Standards, Washington, describes an experimental investigation recently made of the causes of failure of a number of articles, particularly bolts, of wrought brass of the type 60 copper, 40 zinc, with special reference to the presence of initial stress. The work was taken up in connection with tests, made for the New York Board of Water Supply, of failed brass bolts which had been in service in the construction of the new Catskill Aqueduct, which is to supply water to the city from the watersheds of the Catskill Mountains. In view of the fact that most of the equipment and materials used in this construction would be subjected to the corroding action of both water and the atmosphere, a substitute was sought for steel, which would ordinarily be used, and it was considered possible to find a brass which would have mechanical properties comparable with those of steel and yet be practically incorrodible. As such a substitute the so-called manganese bronze was chosen. In the course of the investigation the physical properties, micro-structure, and initial stress distribution have been studied in failed and sound materials, not only from the Catskill Aqueduct construction, but also from the filtration plant of the city of Minneapolis, the Navy Department, and the Panama Canal, and in new material from a number of manufacturers. Failure has occurred (1) as a result of faulty practice in forging bolt-heads, flanging plates, etc.; (2) as a result of the presence of initial stress; and (3) as a result of service overstress due to drawing up bolts too tightly. This investigation shows that an average initial stress of 5000 lb./sq. in. (350 kg./cm.^{2}) is to be regarded as a safe limit for rods and bolts of this type of material under ordinary service conditions, in which the service load itself is not greater than from 5000 to 10,000 lb./sq. in. Experiments have also been made to ascertain under what conditions of annealing initial stresses could best be removed, and have shown that temperatures of from 300° to 400° C. are sufficient to reduce in from one to seven hours the initial stresses to a safe value.

MESSRS. ROSS, LTD., have purchased from the Controller appointed by the Board of Trade the Zeiss Optical Works at Mill Hill, including all machinery and tools therein; also their business premises at 13 and 14 Great Castle Street, W.1., including the stock-in-trade, etc.

OUR ASTRONOMICAL COLUMN.

ORBIT OF COMET 1915*a* (MELLISH).—The orbit of this comet, which was discovered by Mellish on February 10, 1915, and afterwards became a naked-eye object, has been investigated by L. Rosenbaum (*Ast. Iaktt. Stockholms Obs.*, vol. x., No. 5). The comet traversed a heliocentric arc of 205° during the eleven months of its visibility. After taking account of per-

turbations, the following hyperbolic elements were derived :—

Osculation 1915 *February* 10·0.

$T = 1915$ July $17{\cdot}18869 \pm 0{\cdot}00159$ Berlin M.T.
$\omega = 247^\circ\ 46'\ 5{\cdot}6'' \pm 3{\cdot}41''$
$\Omega = 72^\circ\ 16'\ 24{\cdot}1'' \pm 3\ 66''$
$i = 54^\circ\ 27'\ 22{\cdot}1'' \pm 5{\cdot}11''$
$q = 1{\cdot}005338 \pm 0{\cdot}000006$
$e = 1{\cdot}000235 \pm 0{\cdot}000061$

The residual errors are probably to be attributed to the division of the nucleus into two parts, which was observed about two months before perihelion passage, and before it can be considered certain that the true orbit was hyperbolic it will be necessary to discuss separately the observations before and after the change in the nucleus.

THE SOLAR PHYSICS OBSERVATORY.—The activities of the Solar Physics Observatory, Cambridge, appear to have been seriously curtailed through the absence of members of the staff on war service. From the fourth annual report, recently issued by the director, we gather that apart from some unfruitful attempts to photograph the spectrum of Venus with high dispersion, no observations other than those made with the spectroheliograph were undertaken. The sun's disc was photographed in calcium light on 117 days, and prominences at the limb on 104 days. These provide records for sixteen out of the thirty-seven days for which there were gaps in the Kodaikanal series, and the combined results account for 345 days during the year 1916. Laboratory experiments on the spectra of carbon and its compounds were continued, and further investigations of atmospheric electricity were carried on by Mr. C. T. R. Wilson.

THE SPECTRA OF NEBULÆ.—Some interesting results which have recently been obtained at the Lick Observatory with a new quartz spectrograph are described by Dr. W. H. Wright in Lick Observatory Bulletin No. 291. The optical parts are two 60° quartz prisms of the Cornu type, with lenses of about 11 in. focal length and 2 in. effective aperture. The instrument can be used either with or without slit, the collimator in the latter case being replaced by a concave lens of equivalent focal length, and the whole instrument so adjusted with respect to the mirror of the Crossley reflector that parallel light falls on the prisms. It has been very successfully employed as a slitless spectrograph in a study of the distribution in planetary nebulæ of the various radiations which make up their spectra, an image of the nebula being produced by each line of the spectrum. The monochromatic images thus obtained have been found to exhibit a great variety of forms for the same object. If there be a nucleus, it is usually represented by a streak of continuous spectrum threading the centres, giving the appearance of beads on a string. A number of strong nebular lines which have previously escaped notice have been detected in these photographs, among them being 3313, 3342, and 3444 A. Another interesting fact brought to light is that most of the planetary nebulæ show a faint continuous spectrum which begins abruptly at about 3652 A, near the termination of the hydrogen series, and extends with great uniformity far into the ultra-violet. A similar appearance has been noted in the spectra of solar prominences, and a corresponding absorption effect has been observed in the spectra of such stars as Vega and Sirius. There is reason to suppose that the continuous spectrum in question is associated with the Balmer hydrogen series, and that its production is in some way involved in the mechanics of line series radiation. Further laboratory investigations in this connection are suggested.

ANNUAL CONGRESS OF THE SOUTH-EASTERN UNION OF SCIENTIFIC SOCIETIES.

THE union held its annual congress at the Linnean Society's rooms in Burlington House on June 6–9, which was well attended by delegates from all parts of the union's area. This was the first occasion of its meeting in central London, and was an undoubted success. The address by the president, Dr. W. Martin, dealt with "Science and the Industries," and traced the lines on which, by halting steps, the Government had in the past encouraged the study of science. It called on the nation to insist that its leaders shall give due recognition to the truth that the country's future is bound up with giving the fullest encouragement to workers in all branches of science, and urged the union to take its place as an organisation of value and power in the strenuous times before the country when the war is over.

Amid the upheavals to which industries have been subjected during the beating of ploughshares and pruning-hooks into implements of war, it may be that the country has already proceeded apace towards greater triumphs. Old machinery has been scrapped, antiquated custom flung away, and resources have been adapted to the stern demands of a people under arms. With new measures, new men have arisen. Unity, organisation, co-ordination, and precision are the weapons with which without misgiving the future may be faced. May we not fitly anticipate the time when from the ashes of an otiose past and an age of neglect a rejuvenated nation will have arisen among whom lethargy and indifference shall be as aliens? At such a time we shall regard the period before the shock of war was upon us as the ultimate remnant of the Dark Ages, and shall fail to understand that mental attitude which considered science a luxury and its application to the industries in need of advocacy.

Dr. A. Smith Woodward, in addition to lecturing on the mammalian remains which have from time to time been found in superficial deposits of London, showed members the human remains which were dug up at Piltdown by the late Mr. Dawson and himself, including the recently found fragments which have proved the existence of at least one other human being of the Piltdown race. This was followed by an address by Mr. E. A. Martin, giving a general summary of what is known of the early types of man and their implements. Prof. MacBride raised a burning question in his paper, "Are Acquired Characters Inherited?" and dealt to some extent with the experiments of Kammerer on newts and salamanders, claiming that as a result the question asked in the title of his paper could be answered in the affirmative. In the discussion it was pointed out by Dr. Boulenger that some doubt had been thrown upon Kammerer's work.

A paper was read by Dr. J. S. Haldane on "Abnormal Atmospheres and the Means of Combating Them," followed by a visit to Messrs. Siebe, Gorman and Co.'s works at Westminster, under his guidance. Here William Walker, the diver who a few years ago so successfully laid foundations under peat and water for the then threatened Winchester Cathedral, gave an exhibition of the diver's work under water, in the great tank on the premises, where many a modern diver has been initiated into the art. A number of the guests, in Dr. Haldane's company, were then immured in a chamber while the pressure was raised to nearly two atmospheres, while another party entered a second chamber in which the pressure was reduced to nearly half an atmosphere.

On June 8 a party of seventy persons enjoyed a visit to a large munitions factory in the East of London, employing 2700 men and 800 women, where the manufacture of shells proceeds with a possible output of 16,000 a week. Here the whole of the making of a shell was seen, except the filling, from the time that the steel billet is put into the furnace to the time when it is passed into the hands of those who test them to detect faults in completed shells. The accuracy observed in the making is so fine that those cast out are but a small fraction of one per cent. Another party accompanied Prof. G. S. Boulger to the Chelsea Physic Garden, and listened to a paper read by the guide, whilst Dr. Boulenger entertained a large number at the Zoological Gardens with a paper on "Reptiles in Captivity," followed by a perambulation of the gardens. Variety was afforded by a paper on "Tokens of London," by Mr. W. Dale, and a lecture by Dr. Daydon Jackson, the secretary of the Linnean Society, on "Famous Trees and Gardens of London." At the delegates' final meeting Sir Daniel Morris, K.C.M.G., was chosen to be president for 1918–19, but the place of meeting has not yet been decided upon.

THE FUTURE OF THE X-RAY INDUSTRY.

THE future of the British X-ray industry will depend upon the ability of the British manufacturers to hold their own against those of other countries. The world's markets will be captured by that country which can combine the largest capital with the greatest initiative and fertility of invention. British manufacturers in other directions in the past have been able to hold their own; there is no reason why the British X-ray industry, if sufficiently capitalised and guided by the best skill in the country, should not be able to do the same in open competition with other countries.

American manufacturers have already advanced to the stage of amalgamation and pooling of interests. The capital invested amounts to a considerable sum—250,000*l.*, or thereabouts. This means active propaganda in the future and severe competition in all markets. On the Continent the industry has been fostered by several large electrical firms, which by virtue of their resources and capital have been able to initiate research and perfect the technical details of the apparatus.

In England up to the present such methods have been conspicuous by their absence; the trade has been in the hands of a number of small firms, the combined capital of which would form only a fraction of that invested in the American amalgamation. It would appear, then, that if British firms are to hold their own and command a share in the world's markets, a determined effort must be made now to reorganise the industry. Co-operation is urgently needed; financial aid must be forthcoming either in the form of a Government subsidy or by private endeavour. Another important step would be the formation of an advisory committee consisting of physicists, medical men, and technical experts. The duties of this committee would be to advise on new apparatus and the best methods to employ for its production. Such a committee might also act in an advisory capacity to hospitals and medical men on technical and other points.

We welcome the announcement of the formation of a section of the British Electrical and Allied Manufacturers' Association as a step towards this end. "Already the section has been able to co-operate with the Government in research work connected with the improvement of essential instruments, and it is hoped that this will only be a preliminary to wider investigations." The field is a wide and an ever-increasing one, and well worthy of the consideration of financiers as a profitable investment for capital.

The keynote to success is efficiency, and none but the very best technical apparatus can hope to hold its own in the world's markets. Initiative in the organisation of the industry and the production of new types of apparatus would be the first step towards the recovery of a place in the world's markets. Publicity is another step towards that end; this must be secured by collaboration with the radiologists, who by attracting workers from all parts of the world would direct their attention to the apparatus used in the clinics and teaching centres throughout the country. Side by side would arise an active British School of Radiology and a large industry devoted to the perfecting of the apparatus used in the various departments of its activity.

THE ARGENTINE SOCIETY OF NATURAL SCIENCES.

THE Argentine Society of Natural Sciences, founded on the plan of the British Association and kindred societies, held its first general meeting in Tucuman at the end of last November, and at the same time celebrated the centenary of the foundation of the Argentine Republic. The society began its activities five years ago by the publication of an excellent small journal, *Physis*, which we have several times noticed; and it intends in future to hold a biennial congress, by which the aims and progress of science may be made more widely known to the people. Its founders realise that hitherto scientific studies in the Argentine Republic have been prosecuted chiefly by foreign travellers and by foreigners temporarily resident in the country; and they hope, by a more systematic organisation of university teaching, and by rousing the federal and provincial Governments to a more sympathetic attitude towards scientific research, to follow up this pioneer work at home. We appreciate their ambition, and wish the society all success.

The congress in Tucuman was welcomed by the Governor of the Province in an appropriate speech, and its scientific session was opened by the address of the president, Dr. Angel Gallardo, director of the National Museum, Buenos Aires. Dr. Gallardo, as a distinguished biologist, referred to the studies to which he has devoted his life, and explained in a popular manner the fundamental importance of biological research to modern man, especially in such an environment as that of tropical and sub-tropical South America. He briefly reviewed the methods to be followed, and incidentally alluded to the manner in which Darwin's work on the pampas aided him in propounding his theory of evolution. He also mentioned with natural pride the important researches of the late Dr. Florentino Ameghino on the fossil mammals of Argentina, which made known a new world of life and led to speculations of great interest.

The technical work of the congress was arranged under eight sections: I. Geology, geography, and geophysics, presided over by Dr. E. Hermitte, who spoke of the economic applications of geology; II. Palæontology, with Dr. Carlos Ameghino as president; III. Botany, presided over by Dr. C. M. Hicken, who referred to some features in the flora of Tucuman; IV. Zoology, with Dr. E. L. Holmberg as president; V. Anthropology, ethnology, and archæology, with

Dr. J. B. Ambrosetti as president; VI. Physics and chemistry, under the presidency of Dr. E. H. Ducloux, who discussed the chemistry of chlorophyll; VII. Applied science, presided over by Dr. T. Amadeo, who urged the importance of a well-organised national institute for agricultural research; and VIII. Teaching and history of natural science, presided over by Prof. V. Mercanti, who discussed the teaching in the national colleges and normal schools. Papers were numerous, especially in reference to Tucuman, and among the evening lectures was a valuable discourse by Dr. Hermitte on the petroleum worked at Comodoro Rivadavia.

The next congress is to be held at Mendoza, and it is hoped meanwhile to establish in all the provincial capitals institutes or societies to work in association with the Argentine society.

EDUCATIONAL RECONSTRUCTION.

THE appreciation of the urgent need for an immediate improvement and extension of the supply of educational facilities for all sections of the population is common alike to administrators of education and to teachers of all grades. During recent months special meetings of associations of educational workers of many types have been held, at which reports and resolutions have been adopted, which summarise the experience gained in various localities and in all kinds of educational institutions.

One of the latest competent authorities to issue a report on educational reform is the Association of Education Committees. Since June of last year the executive committee of this association has been considering important educational questions, with the object of contributing help to our administrators in the task of educational reconstruction to which they are committed. It is impossible here to enumerate all the recommendations included in the comprehensive report recently issued by the association, but attention is directed to the importance attached in the report to the necessity for an adequate provision of instruction in science. The general tenor of the replies to a question on the subject from education committees throughout the country is that in the elementary schools the rudiments only of science can with advantage be taught, between the ages of twelve and fourteen, and that it is not desirable to extend the range of the science teaching given in these schools much, if any, further than at present. In secondary schools, however, there is a large majority in favour of an increase of science teaching. With this view the executive committee concurs, but thinks that the science teaching to be given in elementary schools should be made general, and should proceed upon much more definite and systematic lines than it does now. In many schools science is the last subject considered in framing the time-table, and any kind of equipment, or none at all, is often considered adequate, while the training of teachers, other than specialists, for giving good lessons in science is often very defective. The committee desires to record its emphatic opinion that it is essential in the best interests of the nation that much more attention should be given to the teaching of physical science in every type of school. It should be made impossible for any child to leave school without having had a full opportunity of learning at least the basic principles of science. In elementary schools the teaching can only be elementary, but, even so, it must be adequate. In secondary schools science should be the basis of the teaching on the "modern side," and that side should be of equal standing with any other. The mistaken view which puts science in antagonism to the older features of a liberal education should be vigorously combated.

So far as continuation classes are concerned, the report reveals some diversity of opinion. Of the one hundred and two education committees which replied to the question on the desirability of compelling children who have left school to attend classes for further education, only twelve were opposed to the introduction of compulsion. Of the remainder, a few would carry on the further education only to the age of sixteen or seventeen, while sixty-five were in favour of compulsion up to eighteen. On the important point whether such education should be given in the daytime, or in the evening as now, only eight committees out of one hundred and six were in favour of a continuance of entire evening teaching, though some others thought that a part of it might be given in the evening.

The Association of Directors and Secretaries for Education, which includes the chief administrative officers for counties and county boroughs throughout England and Wales, has issued a series of resolutions dealing with important educational questions requiring legislative or administrative action. Among the resolutions of particular interest are the following:—In the interests of the State no child or young person should be debarred by lack of means from the highest education of which it is capable. The upper limit of compulsory full-time attendance at the elementary school should be raised universally to fourteen years. The power of local education authorities to supply or aid the supply of education other than elementary, as provided by the Education Act, 1902, should remain unimpaired. It should be the duty of local education authorities to make adequate provision of such forms of higher education as are needed for their areas. The limitation of the amount which may be raised by rate under the Education Act, 1902, section 2 (1), should be removed. It is desirable in the interests of educational efficiency as well as of economy that the Board of Education should resume its statutory powers with regard to agricultural education and should provide itself with the necessary expert staff. A system of compulsory day continuation schools should be established, with a minimum of eight hours' instruction per week, or at least 320 hours per year, between the ages of fourteen and eighteen years, the instruction to be given between the hours of 8 a.m. and 6 p.m. An obligation should be laid (1) on all employers to allow full time for instruction, including time for travelling, without deduction of wages; (2) on parents and pupils as to attendance; and (3) on local education authorities to make the necessary provision. The total hours of labour and of school attendance during the continuation-school period should not exceed forty-eight per week. The possession of an approved certificate testifying to the completion of a satisfactory course in a secondary school ending not earlier than sixteen years of age should entitle the holder to exemption from compulsory continuation-school attendance between sixteen and eighteen years of age. Adequate provision of scholarships from elementary schools to secondary and technical schools, and from secondary schools to places of higher education of university rank, should be an integral part of each authority's scheme.

The Association of Technical Institutions also has drawn up a programme of educational reform, with special reference to technical instruction, which should assist the Board of Education in its important task of extending and completing our system of national education.

A special committee was appointed by the association consisting of the council and six representatives

of institutions outside the council. This committee has formulated a series of resolutions, which are now issued with the general approval of the members of the association, and among them the following may be noted:—

That the Government be asked to prevent any child leaving school before the end of the term in which the child attains its fourteenth birthday; that the State should make adequate grants for the maintenance of free scholars proceeding from primary schools to secondary and junior technical schools; that there shall be instituted compulsory attendance at continuation classes up to the age of eighteen years, such attendance to be made in the daytime, and the period of instruction to be not less than eight hours per week, such hours to be within the normal hours of employment; that the conditions for admission to universities should be reconsidered and rendered more uniform as between different universities, and less uniform as between different faculties and different honours schools in the same university, and that in the interest of candidates of mature age and of other candidates approaching the university otherwise than through the normal avenue of the secondary school, university entrance tests should be distinguished from secondary-school examinations; that it is desirable that there should be a large increase in the number of scholarships with adequate maintenance grants to enable candidates to proceed to day technical colleges; that teachers in technical departments of universities and technical colleges be encouraged to undertake research on behalf of, and in co-operation with, manufacturing firms: that in view of the national importance of technical education the State should bear a much larger proportion of its cost than is now the case; that Government grants in aid of technical research should be largely increased; that it is essential that the chief officials of the Technological Branch of the Board of Education should have had a scientific training; and that the examinations of the Civil Service and for other Government appointments, when not directly on the subjects of the service, should include such science subjects and syllabuses, and should be so marked as will give the student with a scientific training an equal chance with a student who has had a literary training.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

LONDON.—The Senate has elected Sir Cooper Perry, physician at, and superintendent of, Guy's Hospital, to the office of Vice-Chancellor for the year 1917–18, in succession to Sir Alfred Pearce Gould.

The thanks of the Senate have been accorded to the Right Hon. Lord Reay, K.T., for the gift of a portion of his library to the University for the University College libraries, and to Mr. George Hare for the gift of 50*l.* to found a zoology prize at King's College, in memory of his son, a medical student, who was killed at the battle of Gaza.

The following doctorates have been conferred:—*D.Sc. in Physiology*, Mr. S. W. Patterson, an internal student, of University College, for a thesis entitled "The Action of Carbon Dioxide and Adrenalin on the Heart"; *D.Sc.* (*Economics*), Mr. J. E. Holloway, an internal student, of the London School of Economics, for a thesis entitled "The Prelude to the Great Trek"; *D.Sc. in Zoology*, Mr. Cyril Crossland, an external student, for a thesis entitled "Desert and Water Gardens of the Red Sea," and other papers.

OXFORD.—Sir Napier Shaw, Director of the Meteorological Office, has been appointed Halley lecturer for 1918.

The School of Geography has published its arrangements for the ensuing Michaelmas term. These include lectures, tutorial instruction, and field work. Among the subjects announced are:—"Maps: their Construction and Interpretation"; "The Alps and Northern Italy," Mr. Beckit; "The British Isles," Miss MacMunn; "Eastern Australia and New Zealand," Mr. Spicer; "Geology," Prof. Sollas; and "Historical Geography of Great Britain," Mr. Grant Robertson.

A list of lectures and other courses of instruction for the forthcoming term has also been issued by the Department of Anthropology. In physical anthropology lectures will be given by Prof. Thomson and by Miss Czaplicka, the latter on ethnology. The geographical distribution of man will be dealt with by Mr. Beckit. Mr. H. Balfour, Prof. Sollas, and Mr. Griffith will lecture respectively on prehistoric archæology, on stages of human culture, and on ancient Egypt. Various topics of social anthropology will be taken in hand by Dr. Marett, Sir P. Vinogradoff, Prof. Macdonell, Mr. V. A. Smith, and Mr. Blunt. Prof. Wright will lecture on philology, and Prof. J. A. Smith on primitive language in its relation to thought.

MR. T. H. BICKERTON has been appointed lecturer on ophthalmology in the University of Liverpool in succession to Mr. E. A. Browne, who has resigned the position.

THE title of Emeritus professor has been conferred upon Col. de Burgh Birch, until lately professor of physiology and histology, and dean of the faculty of medicine, in the University of Leeds.

THE proceedings at the annual general meeting (March 29) of the Council of Education, Witwatersrand, published in a report just received from Johannesburg, show that we were right in our article of August 10 last year when we said that apparent grievances and jealousies would end in a unanimous effort to establish a real university for Witwatersrand. We wish we could hope that the present entrance examination for the diploma of the School of Mines might be regarded as sufficient for matriculation in the new university, at all events for undergraduates proceeding to science degrees.

AMONG the many problems connected with engineering upon which experience gained during the war has shed fresh light is that of the workshop training of apprentices. An article which appears in *Engineering* for June 22, by Mr. Neil J. Maclean, gives an interesting account of the system which has been in operation for twelve years at the works of Messrs. Barr and Stroud, Ltd., Glasgow. The author lays down six axioms which should be borne in mind in instituting any apprenticeship system. (1) The apprentice must be always busy, thus necessitating the time and attention of a skilled man. (2) The apprentice must be always learning; he must be taught to do a certain thing properly, and must then be moved on to a different kind of work. (3) Engineering is an exact science, and the apprentice must develop the scientific mind; to obtain the desired result, the training must involve an intimate mingling of practical and theoretical work, of shop experience and study, of things seen and done, things noted and written down. (4) The apprentice's course of training must not be determined by the shop foreman or manager responsible for output; in our opinion, the author touches a fruitful source of grievance here. A lad does well at a certain job, and the foreman keeps him at it in order to maintain output, regardless of the loss of experience to the apprentice and the ultimate loss to the firm.

(5) There cannot be too many highly trained apprentices. (6) Special training must be given to those apprentices who show marked ability. The article is very interesting to all concerned in the training of apprentices, and throws light on one reason for the success of the well-known firm mentioned.

PROF. IGNAZIO GALLI has an article, "Sulla questione della lingua internazionale," in a recent number of the *Atti della Pontificia Accademia Romana dei Nuovi Lincei*. Among arguments in favour of a common international language he lays stress on its convenience at scientific congresses. Those who attend such meetings must have noticed that when each member uses his own language the discussion often shows that a speaker has imperfectly understood much that has been said in a language foreign to him. As regards the choice of the international language, Prof. Galli finds that Volapük is too complicated and difficult to pronounce. Esperanto is easy to pronounce, since it gives to each letter of the alphabet only one sound. Prof. Galli thinks that the belief that Esperanto would become a universal language is steadily losing ground, and that this is due to its too artificial simplicity, which renders this language meagre and rather vague. We are told that Ido has a more rational selection of words than Esperanto, while Simplo, a language invented by Mario Ferranti, has about 5800 words, which are formed from roots common to Latin, Italian, French, and English. Finding none of these artificial languages to be sufficiently flexible to express all the ideas of modern science and philosophy, Prof. Galli strongly urges that instead of wasting energy in the creation of a new language, Latin should be adopted as a common language for international intercourse. He proposes that Latin should be taught in schools, not as a dead, but as a living, language. Men of all nations would then converse freely when they met, as the learned could in the days of Roger Bacon. In connection with Prof. Galli's suggestion, it is worth while to mention that Latin and Greek are both taught as living languages at the Perse School, Cambridge, with very successful results. A letter on "Latin as a Universal Language," by the late Sir Lauder Brunton, appeared in NATURE of February 10, 1916 (vol. xcvi., p. 649).

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, June 14.—Sir J. J. Thomson, president, in the chair.—Prof. T. H. **Havelock**: Some cases of wave motion due to a submerged obstacle. In this paper Prof. Lamb's solution for a submerged circular cylinder is carried a stage further in the approximation, and the wave resistance is calculated directly from the resultant fluid pressure on the cylinder. Similar methods are then applied to a three-dimensional problem, the waves produced by a submerged sphere.—Prof. L. V. **King**: The propagation of sound in the free atmosphere and the acoustic efficiency of fog-signal machinery.—H. J. **Shannon**, F. F. **Renwick**, and B. V. **Storr**: The behaviour of scattering media in fully diffused light. The paper deals with the relationships between the rejectance (proportion of incident light rejected), the obstruction (ratio of incident light to transmitted light), light capacity (ratio of accepted light to transmitted light) when a sheet of diffusing medium is illuminated on one side by diffuse light, and also the relative obstruction, and relative density, when, as in various instruments, the source of light is a first sheet of diffusing medium in contact with the sheet being examined. The experimental part of the paper discusses the method of using the theoretical equations obtained for determining the constants of a specimen of diffusing medium, certain requirements of the instrument used, and precautions to be taken. Examples are given showing the close agreement between observed and calculated values up to seven thicknesses of opal for both air and oil contact.—J. W. T. **Walsh**: The theory of decay in radio-active luminous compounds. The theory of destruction of "active centres" put forward by Rutherford to account for the decay of luminosity of radio-active luminous compounds leads to a simple exponential relation in the special case of a compound of constant activity. It has been found for radium zinc sulphide compounds that this relation expresses the observed results to a sufficient accuracy over short periods of less than 200 days, but that it fails to do so over longer periods, such as 500 days, the rate of decay of luminosity becoming gradually slower and slower, so that the brightness tends to a limiting value which is not zero. The paper is an attempt to find a luminosity time relation which will allow of the prediction of the ultimate behaviour of compounds of varying composition, and it assumes the operation of some factor acting in a direction opposite to that of the destruction of the active centres.

Physical Society, June 8.—Prof. C. V. Boys, president, in the chair.—T. **Parnell**: An alternating-current bridge method of comparing two fixed inductances at commercial frequencies. The paper describes a method of avoiding the troublesome double adjustment required in Maxwell's method of comparing inductances. A current detector, the deflections of which depend on the component of the current in quadrature with the E.M.F., is employed, which makes it possible to arrange that the condition for no deflection depends chiefly on either the inductances or the resistances. In series with the bridge is placed either a non-inductive resistance or a capacity. In the first case the balance depends chiefly on the inductances, and in the second case on the resistances. A few alternate repetitions of the two adjustments suffice to balance the bridge, both for resistances and inductances. As detector a sensitive moving-coil galvanometer in conjunction with a commutator, or a Sumpner electrodynamometer, may be employed; the latter proved more satisfactory.—Balth. **Van der Pol**, jun.: The wave-lengths and radiation of loaded antennæ. The paper consists of a mathematical treatment of the subject, the following being some of the conclusions arrived at:—The radiation resistance of a loaded antenna, and also the radiation from the antenna, are dependent not only on the wave-length, but also on the current values at the top and bottom. The radiation cannot, therefore, be written $\Sigma = AT^2l^2/\lambda^2$, where A is constant and T is the R.M.S. current at the base, as is done in most text-books. Rüdenberg's formula for flat-top or umbrella antennæ is valid only for very long wave-lengths, with a capacity at the top of the antenna very large compared with that of the vertical part, and Austin's table of radiation resistances up to ratios of $l/\lambda = 0{\cdot}4$ is based on an unjustifiable extrapolation of Rüdenberg's results. The paper also treats of the directions in which the energy is most strongly radiated under different conditions.—Dr. A. **Griffiths**: A method of preventing sparking at a rapid make-and-break, which incidentally produces colloidal platinum. The apparatus exhibited was described in the *Philosophical Magazine* for March, 1895, p. 232. The device consists of a series of electrolytic cells placed as a shunt across the spark-gap. The electrodes consist of platinum, and the electrolyte of strong sulphuric acid. The cells polarise, and on making the gap an E.M.F. is introduced opposed to the E.M.F. of the battery, so that the

current rapidly diminishes, decomposing the liquid and doing chemical work. The author made the following statements:—(1) The platinum cathodes disintegrate and a colloidal solution of platinum is formed. (2) The cathode on the negative side of the spark-gap generally disintegrates to the greatest extent; the next cathode disintegrates less, and so on, the least disintegration occurring in the cell at the positive side of the spark-gap. (3) The cathodes develop, to the naked eye, an appearance as if they were covered with platinum black. Certain plates examined under the microscope seemed covered with numerous craters. (4) The production of gas does not appear to be the same in each of the electrolytic cells in series; sometimes no gas at all appears to be evolved from the most negative cathode. (5) The rate of disintegration of a cathode appears to be small when the cathode is first placed in the sulphuric acid, and appears to increase to a maximum in course of time. (6) One specimen of platinum appears to behave differently from another.

Royal Meteorological Society, June 20.—Major H. G. Lyons, president, in the chair.—C. E. P. **Brooks**: The reduction of temperature observations to mean of twenty-four hours, and the elucidation of the diurnal variation in the continent of Africa. Mean temperatures obtained from various combinations of observations should be reduced to true mean or mean of twenty-four hours to make them comparable. This is generally done by interpolation, but interpolation is not possible in Africa. An alternative method is given by representing the diurnal variation of temperature by means of the first two terms of a Fourier series—$Th = a_0 + a_1 \sin(H + A_1) + a_2 \sin(2H + A_2)$. This gives six variables, and a_0 can be found if we have three observations a day and two of the constants. a_1 and a_2 can be calculated from mean maximum *minus* mean minimum, and the reduction of various combinations of hours to true mean is discussed on these principles, and the connection of the various constants with physical factors is also discussed.—F. J. W. **Whipple**: Autographic records of the air-wave from the East London explosion, January 19, 1917. The records which were made use of in this investigation were of two kinds, those from ordinary barographs and those from the recorders used for indicating the pressure in gas mains. The gas engineer measures the difference between the pressure in his mains and the pressure of the air so that his instruments show sudden changes in air-pressure, as well as the barographs, and on a much more open scale. As a large number of records were available in the neighbourhood of London, it was possible to map in some detail the intensity of the air-wave from the East London explosion. A measurable disturbance was shown as far to the north-west as Enfield, and as far south as Whyteleafe, but the range to the north-east was very restricted.—R. C. **Mossman**: Some aspects of the cold period, December, 1916, to April, 1917. In the course of his remarks the author said that the mean temperature of the British Isles during the period under notice, taking the mean of the twelve divisions used in the Monthly Weather Reports of the Meteorological Office, was 1·9° C. below the normal, the extremes ranging from −2·8° C. at Belvoir Castle, in Leicestershire, and −2·7° at Newquay, to −0·5° at Castle Bay, in the Hebrides. The cold, except in December, was general over Western Europe, the mean temperature of Sweden being 1·9°, of Holland 2·7°, and of Norway 1·5° below the average, whilst as far south as Gibraltar the mean was 1·1° under the average. It was shown that when the eastern portions of the British Isles had a mean temperature below the normal in each month from December to April, an event that had only occurred on five occasions in the last century and a half, there was then a pronounced tendency for the depression of temperature to continue without interruption until the end of the year. The only exception occurred in 1808, when a warm period covering the four months, May to August, was sandwiched between two cold spells. The frequent absence of historic frosts during long periods of uniform cold over the British Isles was also referred to.

EDINBURGH.

Royal Society, May 21.—Dr. J. Horne, president, in the chair.—Capt. **Miller** and Dr. H. **Rainy**: Observations on the blood in gas poisoning. From a study of fifty cases, they found that in all cases of any degree of severity there was a change in the relative proportions of the different kinds of white-blood corpuscle, the lymphocytes being proportionately much increased. This increase in any marked case is sufficiently striking to be of some importance when the medical officer is in doubt as to the trustworthiness to be placed upon the statements of men complaining of being gassed. The change is one which develops early, probably within a month of the gassing, and continues for a long time. It appears to be independent of the kind of gas, and is shown by patients exhibiting many varieties of symptoms. It is not clear what the change is due to; but it is probable that chronic inflammatory change in respiratory and gastric mucous membranes is at least a factor.—H. M. **Steven**: The Chermes of spruce and larch and their relation to forestry. For the development of the Chermes group of aphids two hosts are normally required and a period of two years. The one host is a species of spruce, and the other may be a species of larch, pine, or silver fir. A description was given of the biology of the species of the genera Chermes and Cnaphalodes, which occur on larch and spruce, and it was shown that there were separate and independent cycles on spruce only. The cumulative damage done on larch is frequently very severe. Experiments on the fumigation of coniferous nursery stock were now being carried out, and it was hoped to ensure that trees planted out on an area would be free from infection, and thus the further spread of the Chermes would be checked.—F. L. **Hitchcock**: The square root of a linear vector function. The purpose of this paper was to examine and classify the various cases in which a solution could be obtained of the functional equation first studied by Tait, namely, $\phi^2 = \psi$, where ψ is a given linear vector function and ϕ is to be found.

PARIS.

Academy of Sciences, June 11.—M. A. d'Arsonval in the chair.—A. **Carnot**: Ammonio-cobaltic molybdate, tungstate, and vanadate. The estimation and separation of cobalt.—C. E. **Guillaume**: Changes in the expansion of the alloys of iron and nickel under the action of various thermal and mechanical treatments. An account of the changes in the expansion of invar by varying thermal and mechanical treatment has been published already. The present paper gives results obtained with other nickel-iron alloys, containing from 27·5 to 69 per cent. of nickel.—G. **Charpy** and M. **Godchot**: The conditions of formation of coke. The quality of the coke in these experiments was defined by the resistance to compression, expressed in kilograms per square cm., and exact details are given of the method of preparing the test cylinders. The influence of temperature of coking on the strength of the coke was very marked.—M. Leclainche was elected a member of the section of rural economy in succession to the late M. A. Chauveau.—G. **Julia**: Indeterminate

conjugated biquadratic forms with integral coefficients.—J. **Renaud**: Points of identification, in times of fog, of the great French ports on the Atlantic Ocean.—P. **Chevenard**: A self-recording differential dilatometer. Two test pieces, one of a standard chrome nickel alloy ("*baros*") of known coefficient of expansion, are arranged to move an optical lever, the magnification being about 300. Curves are given for a ferro-nickel (59·2 per cent. nickel), electrolytic iron, and forged nickel.—J. **Repelin** and L. **Joleaud**: Limits of the marine Aquitanian in the Provençal region.—H. **Jumelle**: The palm-trees producing vegetable horsehair of Madagascar.—L. **Bordas**: The function of some Ichneumonides as auxiliaries in forestry. Two species of Pimplinæ—Rhyssa and Ephialtes—assist in the defence of forests against the attacks of Sirex and Callidium. The Ichneumons deposit their eggs in the larvæ of Sirex and other pests, and in consequence are of great service in the preservation of forest trees.—J. **Pavillard**: Some new or slightly known Protozoa of the Mediterranean plankton.

CAPE TOWN.

Royal Society of South Africa, April 18.—Dr. L. Péringuey, president, in the chair.—Sir Thomas **Muir**: Note on the expansion of the product of two oblong arrays. The form taken by Binet and Cauchy's well-known expansion of the year 1812 is that of a sum of products of pairs of determinants; the form of the expansion now given is that of an aggregate of single determinants. The relation between the two is explained and a historical remark added.—J. S. v. d. **Lingen**: Notes on radiation of crystals. (1) Radiation patterns of the transformation of magnesium hydroxide to magnesium oxide. The patterns show that the reflecting planes of the crystal are disturbed when water is driven off. The "spots" become drawn out into radial lines, and these radial lines reflect the intensity of the X-ray spectrum. (2) Diamond tests by radiation patterns. The following stones were examined:—"Macle," "spotted" stone, "spotted rejection" stone, and an "inferior brown block" with a spot in it. The patterns show that a "spot" in a stone causes a discontinuity in the intensity of individual spots of the patterns, and that a fracture of the lattice causes a discontinuity of the spots so that they now represent irregular markings on the plate. An ideal diamond's pattern shows a uniform intensity in all the spots. (3) Bultfontein apophyllite, (i) ideal, and (ii) showing a cleavage crack along a cleavage plane. The flaw causes the spots of the "flawed" crystal to present a nebular appearance, whereas the ideal stone shows a uniform distribution of intensity in the elliptic spots. This represents a case of discontinuity in the lattice normal to the incident rays. (4) Serpentine, malachite, and pseudomorph quartz. Serpentine shows a regular "radial line" pattern symmetrical to a line parallel to the threads of the crystal. This indicates that serpentine is not triclinic unless every specimen examined was a "twin." Malachite shows three "lines" parallel to the threads and some minor radial lines normal to the former deviating slightly from the normal. Crocidolite: A long exposure shows that it is microcrystalline and that the elementary units have a tendency to favour a direction parallel to the threads. (5) A square-plate of iodine showed, after an exposure of about an hour, a diffraction phenomenon similar to that described by Prof. Laub, of Buenos Aires. In this case the plate shows diagonal lines of zero intensity.—S. **Schönland**: A summary of the distribution of the genera of South African flowering plants (with special reference to the flora of the Uitenhage and Port Elizabeth divisions). This is to a large extent based on published data, checked and enlarged, however, by the author's personal knowledge. It was compiled in connection with a study of the flora of Uitenhage and Port Elizabeth, but it is hoped that it may be welcome to other botanists who desire to have readily available a summary showing the general trend of distribution of South African genera.—Prof. G. Elliot **Smith**: Note upon the endocranial cast obtained from the ancient calvaria found at Boskop, Transvaal (see p. 353).

BOOKS RECEIVED.

L'Œuf et les Facteurs de l'Ontogénèse. By Prof. A. Brachet. Pp. 349+xii. (Paris: O. Doin et Fils.) 6 francs.

The Organisation of Thought: Educational and Scientific. By Prof. A. N. Whitehead. Pp. vii+228. (London: Williams and Norgate.) 6*s*. net.

DIARY OF SOCIETIES.

THURSDAY, JUNE 28.

ROYAL SOCIETY, at 4.30.—Contribution to the Study of the Magnetic Properties of Manganese and of some Special Manganese Steels: Sir Robert Hadfield, Ch. Chéneveau, and Ch. Géneau.—Note on the Specific Heat of Water: W. R. Bousfield.—The Specific Heat of Aqueous Solutions, with Special Reference to Sodium and Potassium Chlorides: W. R. Bousfield and C. Elspeth Bousfield.—The Rankine Trochoidal Wave: Sir George Greenhill.—The Tribo-electric Series: Dr. P. E. Shaw.—And other Papers.

MONDAY, JULY 2.

ARISTOTELIAN SOCIETY, at 8.—Relation and Coherence: Miss L. S. Stebbing.

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