THURSDAY, JUNE 8, 1916.

THE MOVING PICTURE AND ITS MECHANISM.

Hopwood's Living Pictures: Their History, Photo-Production, and Practical Working. By R. B. Foster. New edition, revised and enlarged. Pp. x+377. (London: The Hatton Press, Ltd., 1915.) Price 6*s*. net.

THE last twenty years have seen such amazing development, both technically and industrially, in all that pertains to moving-picture devices that it is difficult to realise how long ago observations were made and simple devices constructed which by slow degrees led to the position from which the present activity has sprung. The whole story is well told in the new edition of Hopwood's "Living Pictures." The reviser has the advantage not only of a good scientific education, but also of that special training required for members of the legal profession, and this is reflected throughout the book in the strictly accurate statements of the problems at every stage and lucid descriptions of the method of solution. Further, the classification of the numerous modes adopted by different inventors for arriving at the desired end is a help to the reader and avoids the confusion which a merely chronological treatment, for instance, would introduce. Two other features should be mentioned. The early history, beginning with the observation of Dr. Roget on the appearance of the spokes of a wheel seen through a fence, is interesting, in that we find how many of the best-known scientific workers made contributions to the general subject. The following is a list of some of these: Brewster, Wollaston, Babbage, Herschel, Plateau, Faraday, Savart, Wheatstone, Clerk Maxwell, Marey, Janssen.

The second feature for which we have to thank the reviser is the excellent account of the legal side of the question, not only with regard to the restrictions where public exhibitions are concerned, but also in respect of the patents bearing on the subject, of which there is a complete classified list. Unfortunately, owing to considerations of space, this only contains the date and number, but not the name of the patentee or the title. In addition there is a valuable exposition of the state of the law in relation to copyright. It appears to the writer that the inventor will find this book of great use, owing largely to the careful way in which the problems are dissected and classified under sub-subjects, so that whatever ideas he may have he will be able to compare with existing practice or proposals by reference to only a few pages.

The subject is so vast that it is impossible in a notice to discuss more than one or two parts of it. The author has, in the historical section, preserved an astonishing number of inventors' names for their instruments, derived mostly from the Greek. The greater number of these are now wholly forgotten, though Thaumatrope, Zoëtrope, and several others are still remembered. Later inventors, with their kinematographs vulgarised to sinnema and other -graphs and -scopes, have, however, not entirely succeeded in imposing this class of language upon the profession, who have adopted the short and simple expression "movies" as a general term for moving pictures.

In the earlier discussions it is natural that the question of persistence of vision should have claimed much attention. The accepted views have been revised from time to time when new demands were made upon this physiological limitation, as, for example, when three-colour moving pictures or stereoscopic moving pictures, in which the two eyes alternately see succeeding views, were first discussed. It is a question whether persistence of vision is an accurate expression in relation to moving pictures at all. It is exact where the eye blends a number of successive views of a stationary object, but where the successive views are obtained of a moving object persistence is exactly what is not present. That which the brain creates for the eye is a supposed seeing of the object in all the intermediate positions which it never really sees at all, giving the idea of equable movement. Those who are familiar with the old slipping magic-lantern slides, or remember the old Zoëtrope slides, will realise how much the brain or the imagination can do in this respect. The modern moving picture does not call for a fraction of this creative faculty, except that projected pictures, as distinct from illuminated pictures, seem to make much greater demands upon it. It is probable that the reason for this is that the really successful Zoëtrope slides were those in which the prominent feature was a large object moving slowly, and, perhaps, turning also, while those with many small moving parts were not a success. The modern moving picture must of necessity meet all cases as they arise, but, even so, there remains obvious the greater perfection of the view presented by large objects moving slowly, as, for instance, wave motion on water, as compared with smaller objects in quicker movement, such as the arms and legs of living creatures, while the spokes of a moving wheel which succeed one another about as often as the individual pictures in the series do remain hopelessly unmanageable.

Chap. iv., on "Film Machines and Intermittence Mechanisms," is one of special interest, and it well illustrates the excellence of the classification, for every known method of arresting the film for the necessary time, or of making it appear stationary by optical means, even though it is in reality moving continuously, is set out under a suitable heading, and the mechanical difficulties and limitations of the different methods are well explained. In the writer's opinion, the discussion of the Maltese Cross movement, a movement of the type of the Geneva stop mechanism of clocks and watches, is treated in an unnecessarily cumbrous manner. This is due to the use of trigonometrical expressions, which are not well adapted for the treatment of this class of movement. Some seven pages might be replaced by

one or two, in which the problem could be discussed with abundant accuracy simply by the use of the geometric principle enunciated in text-books in dealing with the forms of the teeth of wheels.

The development of the moving picture and its mechanism, like that of many other inventions, has had to wait for, and has stimulated invention in relation to, its own elements or adjuncts. For instance, the early workers in moving-picture photography were met first by the insufficient sensitiveness of the photographic plate. The wet plate, with its silver bath, was, of course, hopeless; but the dry plate, with all its advantages of easy manipulation, has steadily improved in its requirements of light to make a good picture, until this has ceased to be a serious difficulty in a good light. However, the glass plate itself limited the number of pictures in a sequence to those that could be arranged in a spiral on a disc, and so was wholly inconsistent with the modern moving picture exhibition. The film, and with it the series of devices for sensitising, developing, fixing, washing, and perforating, had to be created before the moving picture as now understood could exist.

Two other questions discussed are those of colour kinematography, and living and speaking pictures. The explanation of the two methods of obtaining the three-colour components, the one by addition and the other by subtraction, is exceedingly clear, and this makes the discussion of the methods of different inventors the more luminous. Some stress is laid, and rightly so, on the Urban-Smith two-colour method, patented in 1902, which is the basis of the popular kinemacolour. The author does not state that this patent was the subject of an action which was hotly contested as far as the House of Lords, when a judgment was delivered which is of the most drastic kind in relation to ambiguity and confusion of language in a specification. This judgment is now constantly quoted, and is one which was much needed in consequence of the improper use of English patent protection, made more especially by American and German patentees. While there was no dishonest intention of this kind exhibited in the specification in question, there is no doubt that our Patent Office has been induced to allow patent specifications to be issued which are designed to mean anything in emergency, to the great advantage of the big bully; and, thanks to a kinemacolour specification, we now have in a judgment a cure so drastic as possibly to be more dangerous to the honest inventor than the disease.

In the speaking picture not only is the moving picture projected, possibly in colour, but the sounds heard at the time at which it was taken are reproduced also. When it is remembered how quick the eye and ear are to perceive want of synchronism, it will be realised what the mechanical difficulties are that must be surmounted in producing a successful speaking picture. Those who had the good fortune to be present at the Royal Institution when the Gaumont speaking pictures were exhibited in 1913 will remember how perfectly every element separately, and the whole conjointly, were produced. Of the colour effects the most astonishing were those of butterflies, with those brilliant iridescent blues and purples which would seem to defy imitation. However, after the photograph of those butterflies mounted on clockwork stands so as to revolve slowly had been shown, the originals on their stands were set revolving on the table, and it was seen that as far as the memory would serve the succession of iridescent hues, caused by the changing aspect of the wings, was identical in the original and in its presentation on the screen, and it appeared that Clerk Maxwell's three-colour theory of colour vision could not have a better proof of its sufficiency. However, the butterflies did not speak. Other pictures, one of a cock crowing, another of lions in a cage being annoyed by a bar of iron which was allowed to drop on to the stone floor, were each achievements of so perfect an order that, so far as the experience of the present writer goes, no moving picture had been so equable and free from flicker; no colour picture, whether moving or not, projected on the screen had approached these in faithful accuracy of colour; no gramophone—except, perhaps, the Autexophone of Parsons—had given so faithful a sound record; and the combination of the whole and the exact synchronism were such not only that the motion of the cock agreed with his voice, but the clink and ring of the iron exactly agreed with the moment at which it was seen to strike and bounce from the floor, while the lions were keeping up a snarl in consonance with their features. Where so much was attempted a failure in any part, and above all in the synchronism, would have converted the feeling of amazement and delight experienced by the audience into one of disgust at the obvious sham of the whole thing.

In addition to the list of patents to which reference has already been made, there is a bibliography covering the period from 1825 (Roget) to 1914 (Hallberg), and a list of British and foreign periodicals devoted to the subject.

C. V. Boys.

MODERN ANALYSIS.

A Course of Modern Analysis. By ~~Prof.~~ E. T. Whittaker and ~~Prof.~~ G. N. Watson. Second edition, completely revised. Pp. 560. (Cambridge: At the University Press, 1915.) Price 18*s.* net.

THE treatise now under notice, which appears as a second edition of a former treatise by one of the authors, is in all essential respects a new work. Its scope has been extended in many directions, and very recent developments, of which a substantial number are due to the authors, receive a fair share of attention. The volume now gives a somewhat exhaustive account of the various ramifications of the subject, which are set out in an attractive manner. An unusually complete set of references is included, and the book should become indispensable, not only as a text-book for advanced students, but as a work of reference to those whose aim is to extend our knowledge of analysis. The references to original

memoirs are conveniently arranged at the ends of the chapters.

Part i. is concerned with the processes of analysis. After an introduction to complex numbers, continuous functions, and the more fundamental theory of convergence and uniformity, the reader passes to the theory of Riemann integration. Analytic functions are then introduced, and an account of Cauchy's theory of residues is followed by the theory of the development of functions in various forms of infinite series. The chapter on asymptotic expansions and summable series is very compact, and in the ensuing chapter, on Fourier series, the authors have taken the bold course of treating these series by the elegant means of Cesàro's theory of summable series, instead of by Dirichlet's method. But as the theory of these series only appeals to the pure mathematician, who finds Dirichlet's method equally difficult, this course appears to be justified. Part i. concludes with a valuable chapter on integral equations, which, like those on the theory of integration and linear differential equations, is new.

Part ii. is devoted to the theory of the special transcendental functions, and commences with a very complete account of the Gamma function. The statement that this function was defined by Euler as an integral is slightly misleading; he obtained a limit of a product by interpolation from factorials, proved it equal to a Beta integral, and thence derived the Gamma integral. Possibly, however, the writers do not regard the product as being suitable for a definition, for it is not of Weierstrass's canonical form, and, indeed, it is difficult to show that it represents an analytic function. A sketch of the theory of the Zeta function of Riemann, from the point of view of analytic functions, is given, although an account of its applications to prime numbers seems to have been considered beyond the scope of the book. The work of Mellin and Barnes, which has appeared since the first edition, has enabled the authors to give a more brief and systematic account of the hypergeometric function and of its "confluent" form. As particular cases of these functions, the harmonics of the parabolic cylinder, and, of course, the Bessel functions, are considered in some detail. A chapter is devoted to the differential equations of mathematical physics, and a pleasing novelty is introduced into their treatment. The authors are successful in reducing to a minimum the labour inherent in a discussion of Mathieu's elliptic cylinder functions. The book concludes with three long and interesting chapters on elliptic functions, and it is pleasant to observe that Jacobi's notation for the Theta functions has been retained on account of its historical interest. Moreover, it is actually the most convenient of those in existence.

In matters of general arrangement the book is excellent throughout. Peano's system of paragraphing is adopted, and the reviewer can only express the hope that the system may become more universal. An appendix gives the essentials of the more elementary theory of simpler functions, and the index is noticeably complete. The examples are numerous and well selected from the point of view of the student who wishes to pursue the subject. But perhaps the most characteristic feature of the book is its success in giving rigorous proofs of theorems without relapsing into the dullness too often associated with rigour. In every respect it is worthy of the traditions of the Cambridge University Press.

DOCILITY AND OTHER DISEASES.

(1) *The Nemesis of Docility: A Study of German Character.* By E. Holmes. Pp. vii+264. (London: Constable and Co., Ltd., 1916.) Price 4*s.* 6*d.* net.

(2) *La Guerre et la Pensée Médicale.* By Prof. Ricardo Jorge. Pp. 63. (Lisbon, 1916.)

(1) BY docility the author means "readiness to obey for the sake of obeying, avidity for commands and instructions, reluctance to accept responsibility or exercise initiative, inability to react against the pressure of autocratic authority"; and this is what is wrong with Germany, where a slavishly docile majority is as wax in the hands of a dogmatic and domineering minority. The Germans lost their early domestic freedom in becoming feudalised, and they failed to recover it because of the disruptive influences of tribalism. The ultra-docility has grown and is obvious to-day alike in the Army, with its "serf-like rank-and-file" and its "arrogant, overbearing caste of officers," and in "an almost serf-like people," which bows to the despotism of the Kaiser, the Junker, and the lords of commerce and finance "as to the gracious rule of a divinely instituted 'State.'"

Having been Prussianised themselves, the Germans have sought solace in the dream of "forcibly Prussianising a greater Germany which would expand at last into a world-wide empire." They have also sought to make their dream come true. "The aggressive egoism of an over-docile people is the torch which has set the world ablaze." The blaze has given the world a glimpse of the pernicious way in which over-docility may deaden and brutalise a people. We wish it had left them less effective! That it will eventually betray Germany in the field is evidently the author's expectation, which we cannot but share. We wish again, however, that the symptoms of material Nemesis were a little more convincing than they are as yet, for the temporary success of the thoroughness of the ultra-docility which Mr. Holmes so vigorously damns remains as the active cause of incalculable wastage and misery, and as a terribly disquieting menace to civilisation.

While we are inclined to regard the author's survey as one-sided, and his interpretation in terms of the "ultra-docility" formula over-strained, we feel that he has powerfully presented part of the truth, and driven home the salutary moral: *Fas est et ab hoste doceri.*

(2) This is a beautifully printed lecture on "The War and Medical Thought," delivered in December, 1914, as a presidential address to the

Lisbon Society of Medical Sciences by Prof. Ricardo Jorge. By the wish of the society it has been published in French as well as in Portuguese, and we appreciate this convenience.

The first part of the address traverses familiar ground in contrasting the present-day army medical service with that of former times, emphasising such modern features as prophylactic inoculation and conservative surgery. A deeper note is struck in the author's admission that war in itself—as a biological phenomenon—is directly antithetic to the ideal of medicine, which is the increase of wholesomeness of life. Refusing to be led astray by any apology based on the pervasiveness of the struggle for existence in Nature, Prof. Jorge asks eloquently and passionately how it has come about that the nations have been led into the disastrous anachronism which the war implies. The answer he feels compelled to give is that the controllers of German policy are the victims of a "collective paranoia engendered and sustained by a mental and sentimental intoxication of progressive acuteness—panteutomania." He does not maintain that other countries have not, from time to time, exhibited analogous aberrations, but his contention is that we are confronted with the most terrible "psychodemic" in history. It has invaded even the temple of science, as is shown by the names of many of the 93 signatories to the famous "Appeal to Civilised Nations."

Admitting a profound admiration for the achievements of German science, and for Virchow in particular (from whom some noble-minded sayings are quoted), the author holds to the thesis that there has been in Germany a terrible outbreak of social pathology, a "pandemia vesanica." In spite of these learned terms, which are rather question-begging, and references to Le Bon and other students of the psychology of the crowd, we suspect that Prof. Jorge's theory is largely verbal and metaphorical. The address seems to have been first published in *Medicina Contemporanea*, and a lurid German review by Prof. C. Mense is answered in a manner suggestive of high explosives.

OUR BOOKSHELF.

Spiritualism: A Historical and Critical Sketch. By Rev. Canon Edmund McClure. Pp. viii + 56. (London: Society for Promoting Christian Knowledge, 1916.) Price 6*d*. net.

THIS is an enlarged version of an address to a small clerical society, one member of which had been caused "distinct anxiety" by the growth of spiritualism. Canon McClure touches on the *Odyssey*, Saul and the Witch of Endor, St. Augustine and St. Thomas Aquinas on demons, Porphyry, Swedenborg (whose "so-called" visions were due to a disappointment in love, acting on a nervous system of "unbalanced character"), Dr. A. Russel Wallace (who is treated with respect and extreme brevity), Mrs. Piper (untruly said to be afflicted with hysteria, like "all mediums"), and Dr. T. J. Hudson, whose insufficiently supported theories are too lightly accepted. The Society for Psychical Research, though often referred to, is not once correctly named, nor is the Dialectical Society; the names Schiaparelli and Blavatsky are wrongly spelt, and an American "Colonel Sinnett" is mentioned who seems to be a blend of Mr. A. P. Sinnett and Colonel Olcott. These and other mistakes will lead scientific readers to distrust the author, who, moreover, has apparently no first-hand knowledge of the subject. The Archdeacon of Bristol, in his preface, seriously recommends those who desire further knowledge to read Monsignor Benson's novel "The Necromancers"! Both writers have apparently decided that the alleged phenomena are due to fraud, hysteria, or the Devil.

Canon McClure says (p. 50) that hysteria plays an important part in the functions of all mediums, "and notably, according to Prof. Richet, in Mrs. Piper." The present reviewer, through the kind offices of a friend, communicated this statement to Prof. Richet, whose reply is just received, after the foregoing was in type. He emphatically denies ever having said anything of the kind. J. A. H.

Manuring for Higher Crop Production. By Dr. E. J. Russell. Pp. vii + 69. (Cambridge: At the University Press, 1916.) Price 3*s*. net.

THE problem of increasing the food output of British farms is no new one, but has been rendered vastly more acute by the stern necessities of war-time. The solution of the problem lies obviously along one or both of two lines: either the farmer must increase his area under cultivation, or he must obtain more from the existing area. To the layman the former alternative may appear to promise the larger results, but its practical application in war-time is beset with grave difficulties, which tend only to increase with the prolongation of the war. The efforts of the farmer must thus be concentrated more and more in the direction of the second alternative, endeavouring by improved cultivation, readjusted crossing, and more liberal and rational feeding of his crops to utilise to the fullest extent the capabilities of his soil.

It is to assist him in the pursuance of this object that Dr. Russell has epitomised in this small volume the essential information now available on manures and soil management, with special reference to British experience, and the results of numerous field trials made at Rothamsted and elsewhere in this country. His aim throughout is to state the facts in simple and plain language, with sufficient illustrative data from experimental results to enable the individual farmer to draw his own conclusions as to the probable requirements of his own soil. There are no simple formulæ for increasing crop production. Local conditions must exercise a dominating influence. The skill and judgment of the farmer in appraising these and in adapting his practice to them must be decisive, but with intelligent application of the facts set out so clearly by Dr. Russell he will be but an incompetent farmer who fails to achieve some measure of success in increased crop and enhanced returns.

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.*]

Molecular Attractions in Solutions.

THE following is, so far as I know, a new method of attacking this problem. I have been working at the experiments for some time, but on account of the war progress in the matter has come almost to a standstill. It seems desirable to publish this brief preliminary note now.

Let A and B be two pure liquids miscible (completely miscible would be better still) over a large range of concentrations. Let the densities and compressibilities of the liquids and their mixtures be known. Then, taking the simplest case (*i.e.* one in which there is no association either in the mixture or in the pure liquids), we may postulate that if there be a change in volume on mixing, this change is caused by the algebraic sum of the alterations in the attractions of A to A and B to B, together with the added effect of the new attractions of A to B.

The sum of these three effects can be calculated with considerable plausibility. Consider any definite mixture, the coefficient of compressibility of this mixture being supposed known over a wide range of pressure. As we know the coefficient for the separate pure liquids, we could calculate the theoretical coefficient of the combination. From these data we can get an approximate value for the mean coefficient of compressibility of the mixture while passing, so to speak, from the theoretical combined state to that which ultimately prevails. Then the change in volume divided by this mean coefficient gives the change of internal pressure on mixing. Now, if this method be followed by a number of different concentrations, a series of different changes in internal pressures will result.

If it is desired to disentangle the various internal attractions from one another, this can only be done by trial and error. The following development of Laplace's method may be tried. Assume that the attractions are proportional to the mass of the operative particles, then, calling the changes of pressure P_1, P_2, etc., and referring the concentrations to a gram-mol. of liquid A, let V be the volume of the mixture which contains 1 gram-mol. of A, and n the accompanying mass of component B.

The change of attraction of A to A in mixture (1) will be proportionate to α/V_1^2.

The change of attraction of B to B in mixture (1) will be proportionate to $\beta n_1^2/V_1^2$.

The change of attraction of A to B in mixture (1) will be proportionate to $n_1\gamma/V_1^2$.

From these quantities we get a set of equations:—

$$P_1=(\alpha+n_1\gamma+\beta n_1^2)/V_1^2,$$
$$P_2=(\alpha+n_2\gamma+\beta n_2^2)/V_2^2, \text{ etc.,}$$

where α, β, and γ are algebraic quantities.

There are some reasons for supposing that γ may be equal to $(\alpha\beta)^{\frac{1}{2}}$; if so, α and β can be calculated from any two of the equations, when P_1, n_1, etc., are known, and hence the validity of the assumption may be tested over any range of concentrations. Obviously a formula of this type would not meet the case in which the two liquids can mix in all proportions without change of volume; but it is possible that although the total pressure now remains constant, yet there may have been a redistribution of pressure among the constituents.

It may be mentioned that even an empirical formula giving approximate values for the separate internal pressures would be of considerable help in deducing a correct equation of state for the osmotic pressures of solutions.

BERKELEY.

Foxcombe, May 24.

Meteorological Conditions of a Blizzard.

As used to signify a certain type of snowstorm primarily characterised by fine, dry, powdery, or sand-like snow driven before a gale of wind, the temperature of which is extremely low (say 20° below zero F.), the term "blizzard" is, of course, wholly inapplicable in the British Isles; and it is, moreover, ridiculous to apply the name to every little occurrence of sleet after the manner of the daily Press, referred to by Mr. Dines. But there is another type of severe snowstorm peculiar to damp, stormy, and relatively warm winter climates like our own, the natural breeding-grounds of which are the wild tracts of bleak, elevated moorland which cover so much of the north of England and Scotland; and I fail to see why "blizzard," which, after all, comes from the same root as "blast," should not be as expressive of a British moorland snow gale, with its relatively large damp flakes, as it is of the fine dry crystals of North America or the polar regions, produced by meteorological conditions practically unknown in this country. The huge falls of snow swept by heavy gales which isolated many high-lying districts of Great Britain for weeks together in February and March of the present year (see *Symons's Meteorological Magazine* for April), bringing in a few weeks an aggregate depth of some 10 ft. to the Black Mountains in South Wales, were, it seems to me, not inappropriately described as "blizzards"; but for the sake of distinction it might be advisable to restrict the use of the term to the American type of storm.

Mr. Dines refers to January 18, 1881, as affording the nearest approach to an American blizzard in the S.E. of England; but possibly an even better approximation was the great storm of March 9–13, 1891, in the S.W. of England. In Devon and Cornwall the "great blizzard" of that spring is now a household word, and I do not think that anyone who either experienced that west-country visitation or has read the vivid narratives regarding its effects will feel inclined to quarrel with the designation.

L. C. W. BONACINA.

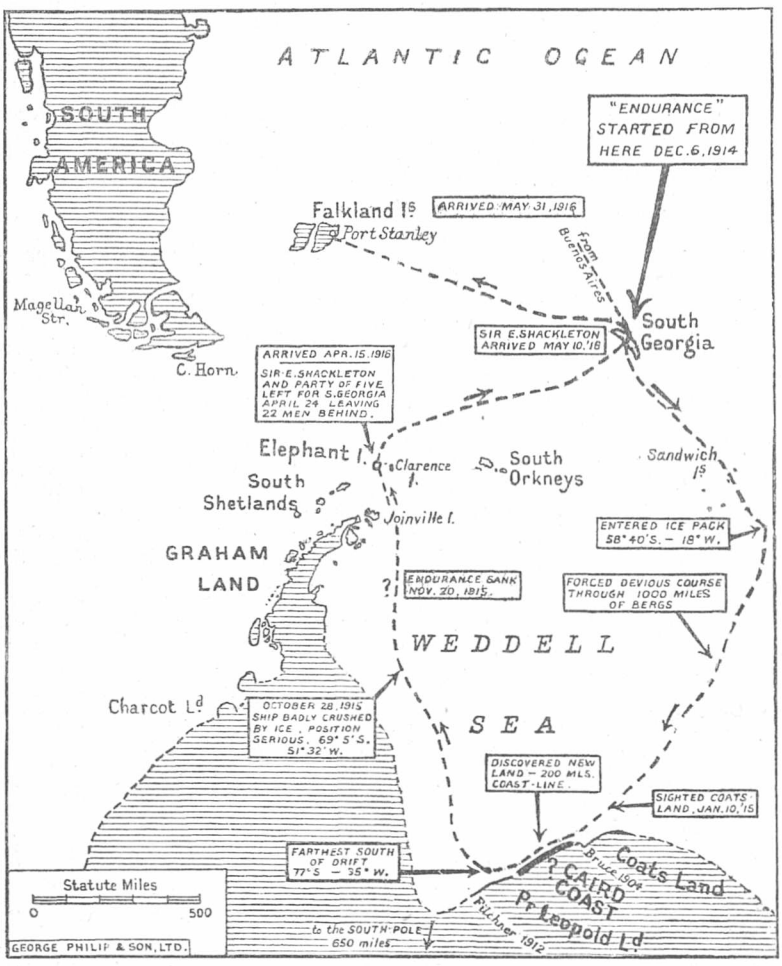
Hampstead, N.W., June 2.

SIR ERNEST SHACKLETON'S ANTARCTIC EXPEDITION.

SIR ERNEST SHACKLETON has fully justified the faith of those who were confident that if he did not cross Antarctica his expedition would make valuable additions to the geography of the little-known area of the Weddell Sea and that he would act with the combined daring and sound judgment necessary to success in what was admittedly almost a geographical forlorn hope. He is to be congratulated on his return after one of the most adventurous of Polar expeditions; for its voyage on the ice-floes has been only equalled in perils by that of the Hansa Expedition; his heroic passage in search of help across the stormy seas south-east of Cape Horn during an Antarctic winter will rank among the finest examples of seamanship achieved in an ordinary ship's boat; and, having landed on

the uninhabited side of South Georgia, he has achieved the fine mountaineering feat of the first traverse of that rugged ice-capped island.

The narrative of Sir Ernest Shackleton in the *Daily Chronicle* of June 2 confirms the expectation that the *Endurance* had come to grief in the heavy ice of the Weddell Sea. She left South Georgia on December 6, 1914, and sailed to the south-east, entering the pack at 58° 40′ S., 18° W. After a passage of 1000 miles through crowded ice-floes Coats Land was sighted on January 10, 1915. The expedition, continuing westward, discovered 200 miles of new land, the Caird Coast, which appears to fill the gap between Coats Land and Filchner's Prince Leopold Land, and thus to prove that they are part of the Antarctic continent and not off-lying islands. The *Endurance* was, however, unable to reach the hoped-for base. From the latitude of 77°, her furthest south, she was carried northward, the direction of drift being apparently controlled by land to the west. This land does not, however, extend as far east as was thought. Capt. Benjamin Morrell, an American sealer, claimed to have discovered land, which he called New South Greenland, in 1823. Morrell was generally dismissed as the Munchausen of the Antarctic until Dr. Bruce accepted his records, largely on the ground that his other record of new land was supported by Ross's observation of apparent land at 75° S., 44° W. If those two records had been confirmed, the land to the west of Weddell Sea would project north-westward in two great peninsulas, Grahamland to the north-west, and Morrell's New South Greenland to the south-east. The axes of these lands would have been concentric with one another, and also with the line, further to the north-west, of the South Shetlands and South Orkneys.



Map of Sir Ernest Shackleton's route. Reproduced by permission of the *Daily Chronicle*.

Sir Ernest Shackleton has found 1900 fathoms of water over the site of New South Greenland. He has therefore restored to the Weddell Sea its great extension westward and modified the possible interpretation of the structure of the Grahamland region. Morrell may have mistaken ice for land or may have been merely wrong in his longitude—a very excusable mistake at that date; and that an extensive land exists not far west of the course of the *Endurance* is suggested by the exceptionally heavy ice pressures by which she was wrecked; but the supposed peninsula to the south-east of Grahamland and Ross's apparent land are definitely disproved.

The *Endurance* was crushed on October 28, and sank on November 20 as the ice opened during the drift further to the north. The expedition camped on the floes, and passed in sight of Joinville Island, off the north-eastern end of Grahamland, but it was inaccessible. The expedition endeavoured to reach Deception Island, where there are huts and stores of food; but it was unable to force a way to the western end of the South Shetlands and landed, on April 15, on Elephant Island, one of its north-eastern members. It is a rugged, cliff-bound island rising to the height of 3500 feet, and though there are fair anchorages, landing appears to be difficult. As the food supply was low Sir Ernest Shackleton left twenty-two of his men camped in an excavation in the ice and started, on April 24, with Capt. Worsley and three others, in one of the ship's boats for South Georgia. The Falkland Islands are nearer; but South Georgia offered an easier course and the attraction that one of its whalers might be available for the immediate rescue of the party on Elephant Island.

Shackleton reached the western coast of South Georgia and climbed over the Allardyce Range to the whaling station at Stromness Bay. The fact that the island had not been crossed before gives some indication of the difficulty of this feat, which can also be realised from the map and photographs published in Mr. Ferguson's recent memoir on the island (Transactions Roy. Soc. Edinburgh, vol. l., part iv., 1915). A relief expedition was at once despatched to Elephant Island, but only an eighty-ton vessel was available, and the ice was too thick for her to force a passage to the land.

The Government has already promised the funds for the larger rescue expedition which had appeared necessary. The problem is now much simplified, as the work to be done is definitely known. Elephant Island—in 61° 10′ S., about the latitude of the Shetlands—though sometimes surrounded by drift ice, can apparently be reached by a suitable vessel at any season of the year. Relief is obviously wanted urgently. The party on April 24 had only five weeks' provisions, which it can doubtless supplement by penguins and perhaps seals. The name Elephant Island refers to the once-abundant sea-elephants; but as the island is easily accessible they have been practically exterminated there; and Sir Ernest Shackleton's account of the locality where his comrades are camped suggests that it may be a very difficult hunting-ground.

The larger South Georgia whalers are probably now on their way to Europe, and unless a suitable steamer can be obtained in Argentina or at the Falkland Islands it is to be hoped that the whaler nearest to South Georgia can be promptly intercepted and sent back there, *en route* for Elephant Island.

RETURN CURRENTS AND ELECTROLYTIC CORROSION.[1]

THE two memoirs referred to below are part of the series of valuable contributions which are being issued by that admirable institution, the U.S. Bureau of Standards, under the able directorship of Dr. Stratton.

The publications before us relate to the troubles which arise from the electric return currents that leak through the soil from electric tramways and railways, in consequence of their setting up electrolytic corrosion in buried pipes or other metallic objects in the neighbourhood of the tramway or railway lines. This was an acute question in Great Britain as well as in North America some twenty years ago when electric traction was a novelty. But, so far as England is concerned, it long ago ceased to be acute in consequence of the prompt action of the Board of Trade. That often abused body framed a regulation that the maximum allowable voltage drop between any two points of the earthed return-system, near which underground metallic structures are laid, should be limited to seven volts. This limitation, though not an absolute safeguard against stray currents, has practically solved the difficulty; and we never, or seldom, hear any suggestion of electrolytic corrosion. Were any considerable difference of potential between two points of an earthed return system to be allowed to subsist, that difference of potential would have the result of forcing a fraction of the current to leave the return rails at some point of higher potential and to find its way through the soil or other available path, to re-enter the return rails at some point of lower potential, presumably nearer the generating station or sub-station. If such stray or vagabond currents merely traverse moist soil in widespread paths they do no damage; but if a waterpipe, or other metallic object, lie along their course, some of the current will find a readier path along such conductor; and wherever the current emerges from the metallic conductor into moist surroundings, electrolytic action will ensue, corroding and pitting the metal surface—sometimes with disastrous effects. Various palliatives, such as the better bonding of the return rail tracks, the use of return feeders, the careful connecting of the negative side of the system to the metallic pipes or other objects by metal connectors, have been used, including the employment of appliances called negative boosters.

The first-named of the monographs before us is devoted to a discussion of the electric conductivity of various kinds of soils under various conditions of moisture, pressure, and temperature, and the effects of these factors on the electrolytic corrosion question. Methods of measuring the resistivities of soils *in situ*, as well as in the laboratory, are discussed. The soil of cities appears to be more highly conductive than that of country districts by reason of absorption of drainage and sewage. The presence of refuse in "made" land is distinctly promotive of conductivity, and therefore of electrolytic corrosion. The authors of the monograph, Messrs. McCollum and Logan, have done their work thoroughly, and have added statistical tables, which, in countries like the United States, where legislation has not intervened to stay the damage, must be very valuable.

The second memoir, by Messrs. Rosa and McCollum, is a lengthy discussion, as an engineering problem, of the mitigation of electrolytic corrosion, or as they rather unfortunately describe it, of "electrolysis." They deal with corrosion in reinforced concrete; with attempts to prevent corrosion by protective coatings of paint; with the use of insulating joints in pipes; with electrical means of combating or compensating the tendency to stray currents; with summaries of the various legal regulations in use in different countries. It appears that the Bureau of Standards has issued eight different publications on this subject. The present memoir alone extends to more than 143 pages.

[1] "U.S. Department of Commerce. Technologic Papers of the Bureau of Standards (Washington)." No. 26, Earth Resistance and its Relation to Electrolysis, etc. No. 52, Electrolysis and its Mitigation. (Washington: Government Printing Office, 1915.)

SCIENCE AND GOVERNMENT.

THERE have been many signs lately of awakened interest in the national significance of scientific method and work, and not the least encouraging among them is the action taken by scientific workers, individually and collectively. Until the war compelled attention to be given to all matters affecting national efficiency, both in the present and the future, little heed was paid to the warnings of those who discerned clearly the consequences of the neglect of science by the State. For this indifference men of science must themselves accept a share of the responsibility. With a few notable exceptions, they did nothing to enlighten the community as to the close relation between scientific work and modern progress, or to promote reforms by organised effort. It is not surprising, therefore, that the place of science in national polity is not understood by the general public, and that the activities of even such representative bodies as the Royal Society and the British Association are commonly regarded as of little practical importance.

The neglect of science by the public has, indeed, been due largely to the neglect of the public by science. The only body which has seriously endeavoured to show the bearing of science and scientific method upon public affairs of every kind is the British Science Guild; yet until recently its objects, and the work of its various committees, were disregarded by a large part of the scientific world. It is a satisfaction to know, however, that the pioneers of the movement for a fuller recognition of science by the State have exerted a sub-conscious influence upon the minds of scientific men, as evidenced by the manifestoes lately issued, and the meetings held, upon the subject of the co-ordination of science with industry, education, and administration, which the Guild has been urging for the last ten years. The Royal Society has formed a conjoint committee of members of scientific societies; a Reorganisation Committee has been constituted to deal with science in the public schools, at Oxford and Cambridge, and in examinations for the public services; an Education Reform Council, having upon it representatives of science, industry, and commerce, as well as of education, has been brought into being by the Teachers' Guild; and suggestions for reforms have been issued, or are being deliberated, by all these bodies.

The latest expression of scientific opinion is contained in the memorial, reprinted on p. 305, from the professorial staff of the Imperial College of Science and Technology, to Lord Crewe, the chairman of the governors. The memorial was presented to Lord Crewe by the Right Hon. A. H. D. Acland, chairman of the executive committee of the governors; Sir J. W. Wolfe-Barry, chairman of the delegacy, City and Guilds (Engineering) College; and Sir Alfred Keogh, Rector of the Imperial College; and it was signed by the twenty-one professors whose names appear at the end.

To those who are acquainted with such utterances as are contained in Huxley's essays on "Science and Education," Sir William Huggins's Royal Society addresses on "Science in the State and in the Schools," Prof. Perry's "England's Neglect of Science," and Sir Norman Lockyer's presidential address to the British Association in 1903, contained in his "Education and National Progress," most of the educational points raised in the memorial will be familiar; nevertheless, it is well that they should be impressed again upon the public mind. The war is arousing the nation to a sense of the need for the adoption of new measures to enable it to compete successfully in the struggles before it; and scientific men have now an opportunity of exerting strong influence upon the schemes of reconstruction which are being put forward. Sporadic memorials are worthy enough in intention, but their effect will be ephemeral unless the signatories to them unite to form a strong and active body of opinion which will guide the country aright. The British Science Guild provides the machinery by which this end may be reached; and it is the obvious duty of all who believe in the application of scientific method to national affairs to give their practical support to an organisation which exists solely for that purpose.

Dissatisfaction with existing means of school preparation for the strenuous conditions of modern life is being expressed on all sides, and it is evident that the country would welcome a practical programme in which scientific principles occupied a prominent place. Most progressive people are now convinced that radical reforms are needed in teaching and outlook, and they are looking to representatives of science and other branches of modern learning to state exactly what should be done. In the absence of a constructive scheme in which all advocates of reform will co-operate, the citadels of traditional studies will stand unshaken, and the vested interests in them will remain untouched, be memorials never so numerous. Our educational and scientific deficiencies have been revealed by the war, and the nation is anxious to see them remedied without further delay. A letter published in the *Times* of June 5, and reprinted on p. 306, is a characteristic statement of this feeling, and we believe it will receive wide support from the parents of the public school to whom it is an appeal.

It is unlikely that the Headmasters' Conference, the members of which are practically all classical men, will be moved by this demand for less classics and more science in the public schools, but if they continue to obstruct advance action should be taken by the Government to compel them to stand aside. Not a single sound argument can be put forward for the waste of effort in schools and universities caused by the existence of the traditional curriculum of classical studies, and the sooner it is superseded by courses more in touch with the actual needs of the times, the better will be the prospects of increased national efficiency.

(1) SCIENCE IN NATIONAL EDUCATION.

We, the undersigned, submitted to you in March last a brief memorandum in support of a memorial which had then recently appeared on "The Neglect of Science." We believe that you will welcome a further statement from us as to what, in our opinion, the Government could do in regard to this important subject, and we have, therefore, tried to indicate some of the ways in which, in our opinion, the Government might render a service to the nation on this matter.

We assume it to be accepted that it would be an advantage to the country if more trained men of science could be found in our public services, and that it is desirable that a larger proportion of boys and young men than at present shall have instruction of the best kind in science, as an essential part of their education. It is needless to say that we do not underrate the importance of the teaching of languages and other subjects as part of a good educational curriculum, nor do we believe that an education which includes good teaching of science need be a narrow education.

What seems to be primarily needed is that at this critical time in our history the Government, through some of its leading members, shall speak plainly to the country on the question of national education, and shall guide and instruct the public in a matter where there is still so much lethargy, misconception, and ignorance. There have been many reports by associations and societies, and advisory bodies, and departmental committees, and Royal Commissions. A strong lead from the Government itself, or a Ministerial Committee announcing a policy and offering guidance, would now be of the highest value. We do not pretend to indicate what that policy or that guidance should be, but we wish to mention some matters which appear to demand early attention.

A large body of opinion at Oxford and Cambridge, and in the country generally, is in favour of altering the conditions of entrance to these universities. It has been clear for a long time that to effect reform in this and other matters an alteration in the method of their government is required. And yet generation follows generation and nothing is done. Is it not desirable that, at any rate immediately after the war, the legislative changes which are desirable shall be introduced into Parliament by the Government? The influence of the old universities through their endowments and their examinations upon the schools is very far-reaching. For this reason the question is of real importance. No reasonable person can think that the study of languages, including the ancient languages, by those who are most able to profit by them will really suffer by reform in this direction.

As regards those public schools where classical education occupies an important or preponderating position, information is needed as to the extent to which school scholarships on entrance to the schools and later are given for successes in which knowledge of Latin and Greek plays a predominating part. It would appear desirable that the boys with brains should be attracted to the modern as much as to the classical side of the schools, as far as the use of the endowments is concerned. At the present time, however, it is the fact that many of the best boys at the public schools are practically forced to the classical side, and it is often only in exceptional cases, as where a far-seeing parent has intervened, that a clever boy has been allowed seriously to study science. If the Government has not full power to obtain the necessary information on the above-mentioned and other relevant matters, it seems desirable that the requisite power should be obtained.

In the past a considerable proportion of the cleverest boys in these schools, and in the preparatory schools which lead to them, have been taught classics from an early age, and because many boys with brains who succeed in after life have been educated in this way, it has been assumed that a classical education is more likely to make a man successful in the public service and in other branches of life than is a modern or scientific education. We believe this assumption to be quite unfounded. The important matter is to allot to boys an education according to their capacity. There is no doubt at all that an enormous amount of time is at present wasted in trying to teach certain types of boys Greek. The effort in these cases is not only of very little value, but, in our opinion, is positively detrimental. In any event a knowledge of Greek literature or culture is notoriously not obtained by merely acquiring an enforced smattering of the Greek language, and the time thus wasted might well be turned to better purpose. Many boys, to whom Greek, and often Latin, too, are completely distasteful, might find in the more practical training of the laboratory and the workshop (which should be coupled with thorough instruction in English subjects, mathematics, and a modern language) an outlet for faculties which an education of a predominantly literary character will never effectively develop.

There is no doubt that at some of the public schools careful attention is given to the provision of teaching of science. The difficulty that often arises is that, in a school where classical teaching predominates, conflicting claims, which cannot be met, are made by parents or by outside examinations on what is called the modern side, and confusion of aim results. The excellent training of our officers in the Navy at Osborne and Dartmouth offers an example of concentration of aim which is worthy of careful attention.

If a Government Committee could report exactly how matters stand in these respects at our public schools, even without any power whatever to make a change, we believe it would have a considerable effect on public opinion.

We viewed with great satisfaction the appointment last summer of a Special Committee of the Privy Council (of which you are chairman) to aid Industrial Research with the help of an Advisory Council, and of other committees which contain men of eminence in science and industry. We hope that the grant of money in Parliament for this purpose will not be stinted, and that the sum of 40,000*l.* allotted for this year will be considerably increased, for our own experience in connection with both science and technology shows how much has yet to be done by the nation in this direction.

We desire to lay very great stress upon the importance of immediately devising means for sending a larger supply of able young men who have been thoroughly educated in science as part of a well-considered curriculum to our universities and colleges. This would provide among men of business, or men in public careers, a larger proportion of individuals trained in scientific methods, which is generally recognised as of great importance. In our own experience, now that many leaders of industry are realising the value of science, we have found, when asked by them to supply the young and promising men that they require, that it has been sometimes impossible to answer their call simply because of a shortage of properly trained men.

There are a large number of boys and young men of real ability to be found in our State-aided secondary schools, our technical schools and classes, and our evening schools. What is needed is that these shall have better opportunities of being well taught, and

better chances of coming on to the universities and colleges of university rank. For this purpose we need in these schools, above all, teachers with better pay and better prospects. It is impossible to get the best results as long as many of the teachers in these schools are badly paid, and have not as yet, like so many other teachers, even any prospects of a pension. The whole scale of salaries for teachers of all subjects, especially in the upper departments of most of these schools, must be lifted.

The effect of existing examinations upon secondary schools of all kinds, including State-aided schools, which is sometimes very injurious, is a matter of importance. We are glad that the Board of Education have had this question under consideration, and hope that remedies will be found for some of the more obvious evils that arise, at an early date. Among the rest, the Civil Service Examinations need careful consideration.

In order to bring to the universities the best boys, so many of whom now leave the State-aided secondary schools at sixteen, tempted by offers of salaries into business and industry, an adequate number of bursaries for those of from sixteen to eighteen years of age ought to be provided tenable at these schools. These should be followed by the offer of a large number of Government scholarships, adequate in value, and tenable at the universities and at colleges of university rank. For the above-mentioned purposes, probably half a million a year could be wisely spent with results to the nation of the most valuable kind. Since ours is the only college in England at which the few Government scholarships in science that exist are held, it may be desirable to state that in our experience the excellent capacity and diligence of the great majority of these scholars fully warrant the opinion that a large increase in their number for universities generally would be of great national value, and this would be especially the case if the range of selection were widened. The universities and colleges have sent a very large proportion of their students to the front, and are now greatly depleted. It is of the utmost importance that the Government should exercise immediate foresight in order that the demand for trained scientific men that must inevitably arise on the return of peace conditions may be sufficiently met. By a scheme of bursaries and scholarships it will be possible now to retain at some of the State-aided schools the best boys of the younger generation, who, after further training at the colleges, will be available for the furtherance of the skilled industries of the country—industries which are coming vitally to depend on scientific knowledge and research for their existence among us.

As to the universities and colleges themselves, no doubt part of the money for industrial research, which is administered by your Privy Council Committee, will be of real service to them. But much has to be done to put the teaching of science and technology on a proper footing at these institutions. The salaries of the junior staff are often much too low. Money, which is greatly needed for buildings, for equipment, and for research, is not forthcoming. New departments should be founded as the demands from industry increase, and a considerable number of research fellowships are required. It is estimated that the State grants to universities in Germany are about a million and a half a year, whilst in England they amount to less than a quarter of a million a year. Another quarter of a million a year could be advantageously expended by Parliament in this direction.

The Government, therefore, can, in our opinion, do great service to national education in ensuring a more adequate position for science—

(1) By removing obstacles.

(2) By giving information and guidance which may be of service to parents and to the public at large.

(3) By recommending to Parliament considerable grants of public money in the directions we have indicated.

We have ventured to lay these considerations before you because we know that, as our chairman, you are interested in these matters. Your position, too, as chairman of the Privy Council Committee on Industrial Research brings you in contact with many of these questions, the high national import of which we feel sure you appreciate. We earnestly hope that the Government may give early attention to them, for there is a general agreement that never were they of more vital importance to the nation than now.

H. B. Baker, F.R.S. . .	(Chemistry).
V. H. Blackman, F.R.S. .	(Plant Physiology and Pathology).
W. A. Bone, F.R.S. .	(Chemical Technology—Fuel and Refractory Materials).
H. L. Callendar, F.R.S. .	(Physics).
H. C. H. Carpenter . . .	(Metallurgy).
C. Gilbert Cullis. . . .	(Economic Mineralogy).
W. E. Dalby, F.R.S. . .	(Mechanical and Motive Power Engineering).
S. Dixon	(Civil Engineering).
J. Bretland Farmer, F.R.S.	(Botany).
A. R. Forsyth, F.R.S. .	(Mathematics).
A. Fowler, F.R.S. . . .	(Astrophysics).
W. Frecheville	(Mining).
Percy Groom	(Technology of Woods and Fibres).
E. W. MacBride, F.R.S.	(Zoology).
T. Mather, F.R.S. . . .	(Electrical Engineering).
J. C. Philip	(Physical Chemistry).
H. G. Plimmer, F.R.S. .	(Comparative Pathology).
R. J. Strutt, F.R.S. . .	(Physics).
Jocelyn Thorpe, F.R.S. .	(Organic Chemistry).
W. W. Watts, F.R.S. .	(Geology).
A. N. Whitehead, F.R.S.	(Applied Mathematics).

(2) PUBLIC SCHOOL REFORM.

In view of the grave crisis through which we are passing, we venture to ask you to join us in a demand that boys at the public schools should be properly trained in subjects essential for our national life. We consider a mastery of science and of modern languages is necessary to fit our sons to take their proper places in modern life, whether in science, commerce, or the Forces of the Crown.

A grave warning has lately been issued, signed by the most eminent scientific professors, pointing out the immediate necessity for a proper education in science; for both in the Services and in every branch of commerce is involved the use of scientific data and a sound knowledge of scientific processes, and it constitutes a grave national danger that this subject is so inadequately taught in our public schools. Few boys leave the public schools able to converse freely in modern languages; the presence of so many interpreters in the British Army is absolute evidence on this point. It is clearly seen how immensely important are these two subjects for our sons, whatever may be their future professions. The wonderful efficiency of the Germans, both in science and languages, points to the fact that their schools and universities answer these two vital requirements better than do ours. We consider that a sound knowledge of our own language and literature, modern geography, English and European history should be

taught in our public schools far more thoroughly than is done at present.

We wish to point out that the classical training in public schools is for the average boy a deplorable waste of most valuable time, and though a small minority doubtless derive advantages from the study of the classics, yet we deprecate most strongly the amount of time spent on them, and the prevalent specialisation in them on antiquated lines, with an adherence to conditions that no longer exist, while real essentials for our national success are dangerously neglected. As it is, the public-school boy, who is doing so splendidly, both as a man and a soldier, in the great ordeal through which we are passing, suffers a severe and unnecessary handicap, both in the military and commercial professions, compared with our present enemies and permanent trade competitors.

It is intended to form a deputation to approach the Conference of Headmasters, to ensure that our wishes may be carried out. Kindly state if you are in sympathy with this letter, and if you approve of such deputation. This letter has been sent to the *Times* and the parents of boys at one of the leading public schools, the headmaster of which is in favour of receiving the deputation.

AVEBURY. ARTHUR LEETHAM.
DESBOROUGH. J. E. THORNYCROFT.
CLAUD J. HAMILTON. CHARLES WALPOLE.
JN. JELLICOE, Admiral. PHILIP H. WATERLOW.

NOTES.

THE tragic news that Lord Kitchener, the Secretary of State for War, had been drowned off the Orkneys, in the sinking, either by a mine or torpedo, of the cruiser *Hampshire*, in which he was travelling with a party on a special mission to the Emperor of Russia, was received by the nation on Tuesday with deep emotion. Lord Kitchener was born on June 24, 1850, entered the Royal Military Academy at Woolwich in 1868, and obtained a commission in the Royal Engineers in 1871. In the early years of his professional career he did notable surveying work for the Palestine Exploration Fund. He was engaged from 1874 to 1878 in mapping 1600 square miles of Judah and Philistia, and in surveying part of western Palestine. Later, he did similar work for the construction of a map of Cyprus, and also took part in the survey of the Sinai Peninsula. In all the offices occupied by Lord Kitchener, and enterprises undertaken by him, he was strong with the strength of organised knowledge; and that was the secret of his success. While British Agent and Consul-General in Egypt, a post to which he was appointed in 1911, he had the Department of Agriculture transformed into a Ministry, and promoted many movements to improve the agricultural position of the country. He was also chiefly responsible for the establishment of the fine Gordon Memorial College at Khartum. His life was devoted to the service of the State, and in that service it has been lost at a time when the nation can ill afford to be deprived of genius for organised administration in every department. Two members of Lord Kitchener's party, who were lost with him, were Sir H. F. Donaldson and Mr. L. S. Robertson. Sir Frederick Donaldson was formerly Chief Superintendent of the Royal Ordnance Factories, and resigned that post in September last to become chief technical adviser to the Ministry of Munitions. He was president of the Institution of Mechanical Engineers in 1913. Mr. Leslie S. Robertson, assistant to the director of production in the Ministry of Munitions, was secretary of the Engineering Standards Committee.

THE list of honours conferred in celebration of the King's birthday includes five new peerages, seven Privy Councillorships, twelve baronetcies, thirty-one knighthoods, and a number of other promotions and appointments. Among the names of men either distinguished by their scientific work or associated closely with it, we notice the following:—*Knights*: Dr. G. T. Beilby, F.R.S.; Dr. M. A. Ruffer, C.M.G., formerly professor of bacteriology at Cairo Medical School; Dr. J. J. H. Teall, F.R.S., late director of the Geological Survey of Great Britain; Mr. R. F. Stupart, director of the Meteorological Service of Canada; and Dr. N. Tirard, medical editor of the "British Pharmacopœia" (1914), and for twenty years' secretary of the Pharmaceutical Committee of the General Medical Council. *K.C.M.G.*: Dr. W. Baldwin Spencer, C.M.G., F.R.S., professor of biology in the University of Melbourne. *Privy Councillor*: Dr. Christopher Addison, Parliamentary Secretary to the Ministry of Munitions, and late professor of anatomy in the University of Sheffield. *K.C.B.*: Mr. R. H. Rew, C.B., assistant secretary, Board of Agriculture. *C.B.*: Col. C. F. Close, Director-General, Ordnance Survey; Col. A. P. Blenkinsop, Assistant Director-General, Army Medical Service; Major P. S. Lelean, assistant professor, Royal Army Medical College; Col. C. E. Nuthall, Deputy Director-General, Army Veterinary Service. *M.V.O.*: Dr. N. D. Bardswell, medical superintendent, King Edward VII.'s Sanatorium, Midhurst, Sussex; Dr. F. S. Hewett, Surgeon Apothecary to his Majesty the King. *Companion of the Imperial Service Order*: Mr. Edmund Burke, professor of surgery, Punjab Veterinary College, Lahore, Punjab. *C.I.E.*: Mr. C. S. Middlemiss, superintendent of the Geological Survey of India.

AN important question was asked by Mr. W. H. Cowan in the House of Commons on May 23, and an unsatisfactory answer was given to it. Mr. Cowan asked the Secretary of State for the Colonies "whether his attention has been called to a communication received by the Colonial Office from the British Science Guild, dated March 12, 1915, representing that it would be proper and advisable for all departments of the Imperial Government, or of municipalities within the Empire, to make it their invariable rule and practice to pay scientific experts of all kinds for assistance rendered by them, either at committees, or by letter, or in any other way, such payments to include not only refunds for travelling expenses or other out-of-pocket expenses or maintenance, but also a proper fee for the professional assistance rendered; and whether he will appoint a committee to consider and report upon these proposals of the British Science Guild with a view to an equitable settlement of the matter." The answer of the Colonial Secretary was:—"I have seen the communication in question, and, so far as the Colonial Office is concerned, I agree with my predecessor in thinking that there is no sufficient ground for modifying existing arrangements. The second part of the question does not, therefore, arise." What we should like to know now is why the principle of gratuitous service is not applied to legal as well as to scientific experts. The only reason we can suggest is that men of science have been willing to place their knowledge at the disposal of Government departments without asking for fees, whereas members of the legal and other professions require payment for their opinions. The action of the Government in making no provision for the payment of scientific men appointed to serve on committees, or otherwise called upon for advice, influences the attitude of municipal councils and other public bodies throughout the country, and is thus largely responsible for the common view that science has no commercial value. What can be obtained for

nothing is lightly prized by the British mind, which measures the importance of advice by the amount paid for it. If science were a lucrative profession, it could command high fees for national services; but as it is not, scientific men commonly permit themselves to be exploited, and are expected to find their own reward in the interest of their work.

THE adjourned extraordinary general meeting of the fellows of the Chemical Society to consider the question of the removal of the names of nine alien enemies from the list of honorary and foreign members of the society will be held on Wednesday, June 21, at 8 p.m., in the theatre of the Civil Service Commission, Burlington House, W.

THE Paris correspondent of the *Times*, in a message dated June 4, states that the Committee of the French Senate appointed to consider the Daylight Saving Bill has, after hearing a statement submitted by M. Painlevé, adopted a resolution which empowers Parliament to advance legal time by one hour until October 1, and not for the duration of the war. The Rome correspondent of the *Times* reports that the new Summer Time came into operation throughout Italy at midnight on June 4.

THE second Japanese Supplement of the *Times*, issued on June 3, contains contributions from eminent Japanese and European authorities on Japan, among them some of scientific interest. Prof. F. Omori describes the work carried out in recent years in the investigation of volcanic and seismic phenomena in Japan. In reference to the Sakurajima eruption, in January, 1914, he notes that the total amount of ejecta from the volcano, which is only 3700 ft. in height, was sufficient to have buried the entire city of Tokyo, 31 square miles in area, to a depth of about 103 ft. An article by Mr. Robertson Scott, on enthusiasm for rural instruction, refers to the Japanese zeal for education and progress, which finds expression in the Young Men's Associations. These associations, a feature of every village, have for their object the intelligent organisation of local resources. Technical instruction is very thorough. On the subject of rice-growing, for example, Japanese authorities know not only all the East knows, but all that is known in the rice tracts of Italy and Texas. The rapid development in the past few years in the application of electricity to mechanical power, lighting, and locomotion in Japan is another illustration of the same spirit, and is dealt with by Prof. Abe, of Waseda University, writing on municipal problems. Baron Kikuchi writes in favour of the adoption of *Romaji*, or Roman letters, in place of the Chinese characters with which Japanese is now written. This reform is rendered difficult by the fact that the language is developing along ideographic, rather than phonetic, lines. New words are formed wholesale by the simple juxtaposition of Chinese characters with reference to their pictorial or symbolic meanings, and regardless of their sounds. The resulting homonymy in the literary language is the focus of the problem.

DR. J. E. SWEET, whose death is reported at the age of eighty-five, was president of the American Society of Mechanical Engineers in 1883, and was the first president of the Engine Builders' Association of the United States. From 1873 to 1879 he occupied the chair of practical mechanics at Cornell University.

MR. W. STANLEY, known by his work on long-distance light and power transmission by alternating currents, has died at his home at Great Barrington, Mass., at the age of fifty-seven. He was successively chief engineer of the Westinghouse Electric Co., the Stanley Electric Manufacturing Co., and the Stanley Instrument Co. He had been vice-president of the American Institute of Electrical Engineers.

THE death is announced, in his seventy-sixth year, of Mr. E. L. Corthell, president of the American Society of Civil Engineers, and of the American Institute of Consulting Engineers. He had been connected with some of the most important engineering enterprises, not only in the United States, but in Latin America. He was formerly consulting engineer of the Department of Public Works in the Argentine Government. One of his most conspicuous achievements was the designing of the harbour works at Tampico, which raised that port to the first rank in Mexico. As a trustee of the University of Chicago, Mr. Corthell played an important part in the foundation of the school of engineering and architecture at that institution.

THE ninety-eighth annual meeting of the Société Helvétique des Sciences naturelles will be held on August 6–9 at Tarasp-Schuls-Vulpera, in the Lower Engadine, north-east of St. Moritz, in order to facilitate visits to the Swiss National Park. There will be the following sections, as well as several general conferences:—Mathematics and astronomy; physics; geophysics and meteorology; geology and mineralogy; chemistry; botany; zoology; entomology; anthropology and ethnography; physiology and medicine. Persons proposing to communicate papers to any of the sections should write, before July 1, to the president, M. le Dr. Chr. Tarnuzzer, Chur, Switzerland.

SIR OLIVER LODGE has sent to the *Times* a translation of the letter sent by Prof. Max Planck, of the University of Berlin, to Prof. H. A. Lorentz, of the University of Leyden, in March last upon the subject of the manifesto signed by ninety-three German scholars and artists, published in August, 1914. Prof. Planck says that the terms in which the appeal was drawn up "led to mistaken conceptions as to the attitude of the signatories, as I have repeatedly discovered to my regret." As the letter has been published in Holland, it is of interest to place a full translation on record. The substance of the letter appeared, however, in the *Daily Chronicle* of April 24, and was given in NATURE of April 27 (p. 186).

MISS E. G. EVEREST, of Chippens Bank, Hever, Kent, whose bequests for a home of rest and a bird sanctuary are announced in the *Times* of June 5, was a daughter of the late Col. Sir George Everest, C.B., F.R.S., Surveyor-General of India, in honour of whom Mount Everest was named in 1856. From the terms of the will we learn that Miss Everest left her house to the National Trust to be used as a home of rest for tired brain-workers, particularly writers and artists. The land round the house has also been bequeathed to the National Trust to be used as a public park for the use of the nation, and as a bird sanctuary, where bird-life shall be encouraged, together with 8000*l.* for the maintenance of the estate. Miss Everest also left the residue of her estate, after providing for some legacies to relatives and others, for the formation and maintenance of a college in India, on lines approved by the natives, for the education of natives by natives.

A PAMPHLET on the urgent necessity of establishing an Imperial School of Technical Optics in this country has recently been issued, with a foreword by the Minister of Munitions commending the scheme to the generous consideration of all patriotic citizens who can assist in providing the requisite funds. The scheme was originally submitted by the governing body of the Northampton Polytechnic to the Technical

Education Board of the London County Council in 1903, and has been under the consideration of committees and sub-committees of the Council ever since. Both the Council and the various Government departments which have been approached in the matter admit its urgency, but the sum of 40,000*l.* necessary for carrying out the scheme has not been provided by either authority. As the scheme, if carried out, would establish an institute in Clerkenwell which would benefit the optical industries, both locally and throughout the kingdom, there seem strong reasons for making the appeal for funds over a wide area.

AN article under the title of "Air Navies of the Future" appears in the *Fortnightly Review* for June. It consists mainly of a discussion as to the likely developments in our air services in the near future. As is usually the case in such articles, the discussion is highly imaginative, and belongs rather to the realm of speculation than to that of science. The scientific statements are indeed often incorrect, as, for example, the statement that the velocity of shrapnel bullets and pieces of steel falling from a height of 20,000 ft. will be very high, and that such fragments will be highly dangerous in consequence. As a matter of fact, the limiting velocity of such bodies will rarely exceed 500 ft. per second, and the velocity on reaching the earth will be very nearly the same for all heights above 5000 ft. The one point of real interest in the article concerns the practicability of building very large aeroplanes; the writer contemplates one of 240-ft. span. There is certainly nothing inherently impossible in the building of such a machine, but it opens up a whole series of new difficulties, both aerodynamic and constructional. It seems unlikely that such aeroplanes will be built for use in the present war. The great majority of present machines are less than two tons in weight, and the five-ton aeroplane has yet to become common. It would seem that the best course to pursue is to concentrate on the construction of moderately large machines, say about five tons total weight, before attempting anything approaching a Zeppelin in carrying capacity.

IN monograph vol. xii., No. 1 of the University of California Publications in American Archæology and Ethnology, Mr. E. W. Gifford discusses the composition and age of some Californian shell-mounds. More than half their contents consist of molluscan shells, the remainder being bones, charcoal, ash, and other substances. The presence of large quantities of oyster shell (*Ostrea lurida*) points to the similarity between the conditions at the time of their growth and those of modern times. The writer enters into an interesting discussion of the age of these mounds, based largely on the assumed numbers of the population during the period of their construction. The result is that the age of one mound, that of Emeryville, appears to be from 3700 to 3300 years. The puzzle of their age, he observes, "requires for its solution every scrap of information bearing on the mounds. A knowledge of shell-mound composition, of population, of artifacts, of skeletal remains, of environment, or of food alone will not solve the problem. The proper combination of all these is necessary to gain the end."

DR. GIUSEPPE DESPOTT, in the *Zoologist* for May, deplores the destruction of bird-life which has been taking place in Malta during the last few years. Five or six species are now in imminent danger of extermination. The number of both licensed and unlicensed sportsmen and fowlers is so large that very few chances of breeding are afforded to any of the resident species. Such a thing as a "close season" is unknown in Malta, yet, remarks the author, for some species at any rate, this is "a consummation devoutly to be wished."

THE *Scientific Australian* for March gives a brief account of the new Zoological Gardens in Sydney, which are now nearing completion. About sixty acres of land, lying between the main arms of Sydney Harbour, have been devoted to this purpose. The site secured is not only one of great natural beauty, it affords also peculiarly suitable conditions for its purpose, since it comprises rocky, sheltered slopes and gullies covered with natural trees, scrub, and undergrowth. The housing of the animals will be on a generous scale and in conformity with the most recent standards —that is to say, there will be no cages in the ordinary sense, bars being replaced by deep trenches. The birds, of course, are an exception to this rule, but since the aviaries provided allow of full powers of flight, and reproduce the natural conditions of the occupants, so far as is possible, this exception is of no moment. A number of photographs afford an insight into what has been done. One of these, the elephant-house, is distinctly disappointing, the outdoor area being but a concrete yard provided with a bath in the form of a huge tub placed in the surrounding trench, and having its rim studded with spikes. This is, to say the least, inartistic.

DRS. WATKINS-PITCHFORD, A. J. Orenstein, and W. Steuart have conducted a preliminary inquiry into the prevalence of pulmonary tuberculosis among the natives working in the mines of South Africa. The conclusions arrived at are:—(*a*) That the disease in its open, or communicable, stage is far less prevalent amongst natives actually working on the mines than has been hitherto supposed; only one case, out of 400 examined, has been detected. (*b*) That the problem of the control of the disease is not so formidable as has been anticipated, and that its total eradication from the mines, therefore, appears to be a feasible proposition. (*c*) That although 107 natives were examined whose term of employment underground exceeded two years only one was found with marked X-ray signs of silicosis apparently uncomplicated by tuberculosis; it seems, therefore, fair to surmise that marked silicosis is at least not more prevalent than pulmonary tuberculosis. Various recommendations are made for the prevention of the disease (*Medical Journal of South Africa*, 1916).

THE fossil remains discovered at Piltdown are being closely studied and debated by American anatomists. Dr. Smith Woodward recognised that anthropoid characters were very clearly marked in the mandible, which he ascribed to Eoanthropus. Prof. Waterston (NATURE, November 13, 1913, p. 319) directed attention to the close resemblance of the skiagram of the Piltdown mandible to that of a chimpanzee, and regarded it as incompatible with the skull. That also is the opinion which Mr. Gerrit Miller, jun., has formed (Smithsonian Misc. Coll., 1915, vol. lxv., No. 12) after a systematic comparison of casts of the Piltdown fossils with corresponding bones of men and anthropoid apes contained in the National Museum of the United States. Mr. Miller regards the mandible as that of a chimpanzee which had its habitat in England during the Pleistocene epoch, and makes it the type specimen of a new chimpanzee species which he names *Pan vetus*, a procedure which has been already questioned by Dr. Chalmers Mitchell (NATURE, December 30, 1915, p. 480). Dr. Wm. King Gregory, of the American Museum of Natural History (*Amer. Mus. Journal*, 1914, vol. xiv., p. 189), regards the canine tooth, not as a right lower, but as a left upper member of the dental series, an opinion accepted by Mr. Miller. At a recent meeting (January 24, 1916) of the Odontological Section of the Royal Society of Medicine, Mr. W. Courtney Lyne made an elaborate analysis of the canine tooth, and gave as his opinion

that the canine tooth was "incongruous in this [Piltdown] mandible." We are of opinion that future discovery will show that all three specimens are, as Dr. Smith Woodward inferred, parts of one individual, or at least of individuals of one species. A closer acquaintance with the anatomy of anthropoid apes will reveal many similar incongruities in their structure. If mankind has been evolved from an anthropoid stock the occurrence of a combination of human and anthropoid characteristics in earlier or dawn human forms, such as occur in Eoanthropus, is just what we ought to find.

THE coast-section of Monte Hermoso, near Bahia Blanca, Argentina, has been relied on by authors who assign a high antiquity to man in South America (see NATURE, vol. xcii., p. 144). Mr. Ricardo Wichmann, however, contributes to *Physis* (tomo ii., 1916, p. 131) an account of the present condition of the exposure, and remarks that F. Ameghino must have compiled his sequence of formations from observations made at various localities. The surface of the Hermosean beds now exposed passes beneath the Puelchean without any appearance of unconformity, and the author was unable to satisfy himself that the angular fragments of quartzite, regarded by Ameghino as human implements, belong with certainty to the Puelchean horizon.

THE famous intermittent spring at Rajapur, in the Bombay Presidency, is the subject of a short paper by the Rev. Dr. A. Steichen, S.J. (Bulletin No. 14, Indian Association for the Cultivation of Science). A careful record of the flow of the spring, kept since 1883, shows that the flow lasts for sixteen to sixty-eight days, followed by a dry period of 291 to 1189 days. Dr. Steichen has compared these periods with the records of rainfall, and finds that there is no obvious correspondence between the two. This makes it unlikely that the intermittency of the spring depends on a simple siphon-like arrangement of channels connected with an underground reservoir. Dr. Steichen supposes that the channels have this arrangement, but that they become choked with deposits of lime, which stops the flow in many cases before the reservoir is empty. This, he believes, will also explain how the flow may begin as late as five months after the last drop of rain has fallen. Whether or not this is the true explanation of this extraordinary spring, there certainly is much limy matter in suspension in the early part of the flow.

IN a paper published by the University of Nevada Mr. S. P. Fergusson makes some interesting remarks on the use of high-level meteorological observations in making forecasts of temperature. His comments refer more particularly to Mount Rose, a mountain 10,800 ft. high, but he discusses the results from other high stations, such as Mount Washington, Pike's Peak, Colorado, Ben Nevis, and others. Mr. Fergusson finds some correlation between the changes on the summit and the subsequent changes in the lowlands, but on the whole the impression given is that mountain stations are not of much use for forecasting. Pike's Peak, Mount Washington, and Ben Nevis were all given up, unfortunately, for meteorology, but their use in forecasting was not sufficient to make up for the cost and difficulty of maintaining them. It is to be hoped that Mount Rose will not share the same fate. It ought not to do so, as many useful inquiries are in progress; also the records are obtained by autographic instruments, which can run for long periods, so that it is not necessary for the observers to remain always on the summit.

IN a recent note to the Faraday Society on the annealing of aluminium, Messrs. Seligman and Williams describe certain interesting anomalies in the behaviour of this metal. Hard-worked aluminium is more readily soluble in nitric acid than the annealed metal. On heating the hard-worked metal to 125° C. a definite change in the rate of dissolution is brought about. A sample of the hard-worked metal which lost 56 mgr. per 100 sq. cm. per 24 hours in 1·42 nitric acid only lost 39 mgr. when similarly exposed after being annealed at 500° C.—a decrease of 30 per cent. On annealing for 10 hours at 125° C. there was a decrease in the rate of dissolution of 5·3 per cent. It was anticipated that if the heating were prolonged the decrease in the rate of dissolution might be augmented. This was not found to be the case, but, on the contrary, as the heating at 125° C. was prolonged the fall in the rate of dissolution diminished until samples heated for 80 hours at 125° C. showed the same rate of dissolution as, or even a slightly higher rate of dissolution than, samples which had not been heated at all. These facts do not tally completely with the observations of other workers. A release of strain as indicated by Dr. Beilby should be accompanied by a reduction in the rate of dissolution, but such a release of strain would not account for the subsequent increase. The behaviour of aluminium as described above is not accounted for by any theories which have yet been put forward.

PART vi. of the Transactions of the Institution of Engineers and Shipbuilders in Scotland contains an interesting paper on the Ljungström steam turbine and its application to marine propulsion, read by Mr. R. S. Portham on March 21. In this type of turbine the flow is radial and outwards from the centre, and takes place between two discs fixed on shafts which revolve in opposite directions. Each disc is fitted with concentric rings of blades, and each ring of blades on one disc serves as guides for the ring on the other disc, which surrounds it, and is concentric thereto. The relative speed is thus doubled, as compared with a turbine having fixed guide blades, and the system therefore necessitates only one-quarter the total number of rings for the same efficiency. The illustrations in the paper are exceptionally good, and includes drawings of the largest Ljungström turbine yet constructed. This turbine develops 10,000 b.h.p. at a speed of 3000 revolutions per minute; the diameter of the outer blade ring is 34 in. only. Each of the revolving shafts is connected to an alternator, one at each end of the turbine. The condenser is placed underneath. The overall length is 24 ft., height 21 ft., and the weight of the complete turbo-alternator is 45 tons. A machine of this type of 3000 kilowatts, tested in January last with steam at 160 lb. per sq. in. superheated 280° F., gave a consumption of 11·15 lb. of steam per kw. per hour, and showed a thermodynamic efficiency of 87 per cent., as compared with the ideal engine.

IN connection with the electrification of the North-Eastern Railway, the *Engineer* for June 2 contains illustrated particulars of the goods locomotives. These were designed and built at the Darlington works of the North-Eastern Railway, under the direction of Mr. V. L. Raven. There are four enclosed motors, each driving an axle through single-reduction twin gearing. The test results are of interest. A train of 800 tons was hauled from Newport to Shildon, with stops on certain of the heaviest gradients; this train was stopped and started on a gradient of 1 in 103. The maximum draw-bar pull was 16 tons, and the average speed from Newport to Shildon was 18·3 miles per hour. On a gradient of 1 in 230 and 4·5 miles long an average speed of 23 miles per hour was obtained. The locomotive also proved capable of hauling a train of 1400 tons on the level at 26 miles per hour.

OUR ASTRONOMICAL COLUMN.

A LARGE GROUP OF SUN-SPOTS.—A remarkable spot outburst, including a great irregular active spot followed by a widespread disturbed area, was easily seen with the help merely of dark glasses on May 27, 28, and 29. Its reappearance on the eastern limb should occur about June 12 or 13.

THE TOTAL SOLAR ECLIPSE OF FEBRUARY 3, 1916.—A brief announcement in the Publications of the Astronomical Society of the Pacific (April) states that totality was observed through thin clouds by a party from the Argentine National Observatory stationed at Tucacas, Venezuela. Astronomer Chaudet had charge of the expedition, and the equipment included two cameras for coronal photography, two prismatic cameras for recording the "flash" and corona spectra, a small slit spectrograph, and a photometer.

THE SPECTRUM OF NOVA GEMINORUM NO. 2.—On a photograph taken by Messrs. Adams and Pease at Mount Wilson on the nights of February 12 and 13, with a total exposure of nine hours, the spectrum still shows Wolf-Rayet features—bright hydrogen lines and a very prominent bright band at λ 4686 are mentioned. The continuous spectrum is described as very strong (Publications, Astronomical Society of the Pacific, No. 163).

LATITUDE OBSERVATIONS BY PHOTOGRAPHY.—The work of the International Latitude Commission bids fair to be remembered as the last great piece of visual measurement. The results obtained at Gaithersburg alone would demonstrate that by means of photography here, as in so many other departments of astronomy, a precision of superior order is now obtainable. From this point of view the report by Dr. Ross might almost be regarded as epoch-making (Special Publication No. 27, U.S. Coast and Geodetic Survey, a quarto memoir of 127 pages and 18 plates). The photographic zenith tube as developed by Dr. Ross is a remarkable and ingenious instrumental achievement, and the detailed description will no doubt be read with the greatest interest by instrument-makers in this country. It consists essentially of a fixed vertical tube carrying a horizontal lens over a dish of mercury, forming an image of zenith stars just below the plane lower surface of the lens on a photographic plate. The objective end can be rotated carrying with it the plate-holder, during exposures by clockwork through a magnetic clutch at suitable rate to give point images, or by hand for reversal through 180°. The design of the lens practically eliminates the effect of errors of level. Freedom from tremor in the mercury reflector was secured by floating the amalgamated dish in a second placed on a tripod resting on a small pier independent of the main concrete base of the tube. The visual routine programme was continued without intermission, and thus a valuable comparison of the two methods has been secured. Numerically the superiority of the photographic procedure is most obvious when the results from a single pair of stars are considered, the mean accidental error of a determination of latitude being reduced from $\pm 0{\cdot}113''$ to $0{\cdot}060''$. Especially important is the fact that although both methods yield abnormal values at times, no *systematic* differences can be traced. The comparison brings to light an error with the visual instrument that results in a progressive increase of latitude during the night. Dr. Ross is of the opinion that his work substantiates the reality of the Kimura term, and, moreover, proves the existence of "fluctuations" not due to a motion of the pole.

THE ROYAL OBSERVATORY, GREENWICH.

THE report of the Astronomer Royal to the Board of Visitors of the Royal Observatory, Greenwich, was read at the annual visitation on Saturday last, June 3. The report describes the chief observations and other work carried on at the observatory during the year ending May 10, 1916. The subjoined extracts refer to a few points of particular interest.

The 28-in. refractor has been throughout the year at the disposition of M. Jonckheere, director of the Lille Observatory, whose observations have been mainly of stars which have been discovered to be double since 1905. He has spent a good deal of time in the identifications and verifications necessary to the completion of the catalogue of double stars referred to in last year's report. During the year 140 new double stars with separation less than 4″ have been discovered.

With the Thompson equatorial photographs have been continued for the determination of stellar parallax in accordance with the programme outlined in last year's report. During the year ended May 10, 1916, a first exposure has been given to 209 plates, and a second exposure, approximately six months after the first, on 226 plates. In the same period 164 plates have been measured, but the measurement has had to be discontinued. During the year thirty-seven photographs have been taken for the determination of the magnitudes of the stars in Kapteyn's selected areas. Of these thirty-four have been passed as satisfactory for measurement. Altogether of the ninety fields from declination +15° to +75°, 149 photographs of fifty-nine fields have been taken. The measurement is well advanced for the plates in zone 15°, but has made very little progress during the year.

The comparison of the position of stars given in vol. iii. of the Greenwich Section of the Astrographic Catalogue with those given in earlier catalogues for the determination of proper motions has been continued. With the exception of from 12h. to 0h. in the zone 65° to 70°, this is practically completed. A search for all stars in the *Bonn Durchmusterung* between the pole and declination 64° with large proper motions is in progress by comparison of photographs from sixteen to twenty years apart. Already 200 plates with centres at declinations 66°, 68°, 70° have been compared in this way.

Photographs of the sun were obtained on 244 days. Of these 502 have been selected for preservation, including thirty-six with double images of the sun for the determination of zero of position angle. The mean daily spotted area of the sun, which was 152 millionths of the sun's visible hemisphere in 1914, as against 7 in 1913, rose in 1915 to considerably over 700 millionths.

The mean values of the magnetic elements for 1915 and four previous years are as follows:—

Year	Declination W.	Horizontal Force in C.G.S. Units	Dip	
1911	15° 33′·0	0·18549	66° 52′ 6″	(3-in. needles)
1912	15 24·3	0·18548	66 51 46	„ „
1913	15 15·2	0·18534	66 50 27	„ „
1914	15 6·3	0·18518	66 49 27	„ „
			66 51 13	(dip inductor)
1915	14 56·5	0 18494	66 51 58	„ „

There were no days of great magnetic disturbance in 1915, but three were classified as of lesser disturbance.

The principal features of interest in the meteoro-

logical conditions at Greenwich during the year ending April 30, 1916, are: (i) the warm January with a mean temperature 2° higher than any January from 1841 to 1915; (ii) the great pressures of wind in the gales in the winter; and (iii) the heavy rainfall in March, the wettest March since the commencement of the Greenwich records in 1841.

The following details of the chronicle of the weather refer to the year ended April 30, 1916. The mean temperature was 49·6°, or 0·1° above the average of the seventy years 1841–1910. The highest temperature in the shade was 87·2° on June 8, and the temperature exceeded 80° on only six days, as against twenty-one in the previous year. The lowest temperature was 23·0° on November 27, and on forty days fell as low as 32·0°.

The mean daily horizontal movement of the air was 287 miles, which is three miles above the average of the previous forty-eight years. The greatest daily movement, 955 miles, was recorded on February 16, and the least, 63 miles, on October 15. The greatest recorded pressure on the square foot was 35·0 lb. on January 1; the greatest velocity in one hour 51 miles on December 27.

The duration of bright sunshine registered by the Campbell-Stokes instrument was 1476 hours, out of a possible 4473 hours, or 33 per cent. This is below the average, principally owing to a deficiency in August and March.

The rainfall was 32·17 in., or 8·05 in. above the average for the period 1841–1905. The number of rainy days (0·005 in. or over) was 168. June, with 0·56 in., was the driest, and December, with 5·20 in., the wettest month. The rainfall in March was 4·13 in.

The scientific work of the observatory has necessarily been somewhat curtailed, but it has been found possible to keep up all observations of the sun, moon, and planets; sun-spots, latitude; magnetic and meteorological registers; observations which would otherwise be permanently lost. The reductions are in some cases behindhand, and must be brought up to date later. Both the scientific staff and the workmen have made every effort to cope with the additional work caused by the absence of their normal assistance. In the course of the year six Belgian refugees have been employed at the observatory.

THE PLACE OF SCIENCE IN MODERN METALLURGICAL INDUSTRIES.

IT is significant of the position which science now occupies in the iron and steel industry that Sir William Beardmore, the head of a great armament firm in Glasgow, and the president-elect of the Iron and Steel Institute, in discussing the various factors which determine the success of any particular process, said in his recent presidential address:—"Science comes first. It is the dominant factor because it should be the beginning of all things. . . ." He went on to point out that there is, however, a tendency at the moment to neglect the other factors, and especially the attitude of labour towards improved methods of manufacture which are evolved by scientific research. This attitude amounts in many cases to an absolute refusal to utilise such improvements, and when manufacturers are charged with a lack of enterprise in not adopting modifications which are demonstrably advantageous the reason frequently is that the obstructionist attitude of labour organisations renders those improvements impossible of execution. Sir William Beardmore quite rightly insists that the question is one of profound national importance. He says:—

"The employment of the people and their well-being depend upon plenty of work. This in turn requires the maintenance of a great export trade. Efficiency and economy in manufactures can do much to win and retain foreign as well as British Imperial markets. This necessitates advance towards perfection of design and greater volume of output, through improvement in the mechanical means of production evolved by experiment. It follows that research should be a charge upon the selling price. To counterbalance this charge it is essential that the volume of output should be increased. Thus, when we reach the bedrock of industrial conditions we find that unless restrictions and limitations dictated by workers' organisations are abolished much of the gain possible to the nation due to research and experiment must be lost."

Seldom before has this point been made with such brevity and convincingness. Sir William Beardmore went on to give instances of the restrictive methods of trade unions during the war, which would be almost incredible if they were not, as they unfortunately are, amply proved to be true.

One of the best points made in his address was the clear and proper distinction drawn between the two main divisions of scientific research, which he classified as "in one case purely theoretical, almost classical; in the other as distinctly technical, or practical," each of which has its proper sphere. As regards the former, the results obtained merely indicate potentialities for the future; as regards the latter, they are generally contemporaneous with actual manufacture. No more difficult questions come up for decision than the potentialities, from a commercial point of view, of problems which have been solved in the laboratory. It is very encouraging to scientific workers in metallurgy to find such stress laid on the importance of theoretical research by a practical man of the attainments of Sir William Beardmore.

H. C. H. C.

RECENT ENTOMOLOGY.

THE Termites, or "white ants," of the United States are described by Thomas E. Snyder from the bionomic and economic point of view in Bulletin 333 of the U.S. Department of Agriculture. Three species of Leucotermes—one an introduced immigrant from South Europe—are included in the survey. The principal injury caused by the termites is the destruction of wooden buildings and other structures, but at times they devour living trees and growing crops, as well as books, papers, cloth fabrics, and stored grain and flour.

From the current number (part 3, vol. iv. B) of the *Review of Applied Entomology* it is evident that the destruction of lice infesting troops on the Eastern battle-front is a problem confronting both German and Russian army surgeons and sanitarians. From a summary of Dr. A. Hase's recent paper in the *Centralbl. Bakt. Parasit. u. Infektionskrankh* (lxxvii., 2, 1915), we learn that dirty, greasy underclothing causes a high temperature which is deterrent to lice, and we are struck by a touch of human interest rarely found in the summary of a technical paper. "The troops were all anxious to be freed from the pests with the exception of an East Prussian, who said that the little creatures reminded him of home."

A recent number (vol. iii., 3) of the *Indian Journal of Medical Research* contains some papers of interest to students of the Diptera. Major S. R. Christophers revises the list of Indian Anophelini, and describes the various stages of *Anopheles plumbeus*—a species apparently common to Europe, North America, and India—the larvæ of which were found inhabiting holes

in tree-trunks near Simla. Baini Prashad describes the microscopical structure of the halteres in mosquitoes, and discusses their use, believing that the equilibrating sense is the only function certainly attributable to the organs, which appear to have no connection with sound production or stridulation. The same author gives an account of the internal male organs in several mosquito genera. A paper of very considerable importance by P. R. Awati, entitled "Studies in Flies, II.," contains descriptions of the genital armature in several Muscid genera as compared with those of other Diptera, illustrated by nineteen clearly drawn plates. The author points out that ten segments may be represented in the abdomen of the higher Diptera, confirming the view put forward by G. H. Carpenter and T. R. Hewitt in their account of the reproductive organs of warble-flies (Hypoderma) published in 1914 (Sci. Proc. R. Dublin Soc., vol. xiv., No. 19). Mr. Awati attempts to co-ordinate the inconveniently divergent terminology which has grown up in connection with the male armature of flies studied by various writers.

The important families of the Tabanidæ and Therevidæ are dealt with in part ii. of A. White's monograph of the Diptera-Brachycera of Tasmania (Proc. R. Soc. Tasmania, 1915, pp. 1–59).

In the *Journ. Agric. Research* (vol. v., No. 12) D. G. Tower writes on the "Biology of *Apanteles militaris*," a parasite of the noctuid moth, *Heliophila* (or *Leucania*) *unipuncta*, the caterpillar of which is notorious in North America under the name of "army worm"; he describes the outlines of the embryonic development, the hatching of the larva, and its various stages. The whole life-history occupies about twenty-five days. Parthenogenesis may occur; all the offspring of virgin females appear to be males. The author discusses the function of the curious embryonic outgrowth of the hind-gut, known as the "caudal vesicle," and agrees with the view of R. Weissenberg (*Sitzb. Gesellsch. naturf. Freunde*, Berlin, 1901, 1) that it is a temporary organ of excretion.

Prof. Vernon L. Kellogg and Gordon F. Ferris publish, in the Stanford University Series (California), some valuable notes on the Anoplura and Mallophaga of North American mammals. They point out that the systematic study of the Anoplura has been markedly neglected, and furnish a diagnostic table of families and genera which will prove useful to students. The importance of these blood-sucking insects as transmitters, and possibly as alternate hosts, of Protozoa causing disease in mammals is naturally emphasised.

Students of economic entomology and of sacred history will alike be attracted by John D. Whiting's article on a recent plague of locusts near Jerusalem in the *National Geographic Journal* (Washington, vol. xxviii., No. 6). This article gives a vivid description of the locust swarms and the damage done by them to vegetation; it is illustrated by a most remarkable series of photographs. G. H. C.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

OXFORD.—A party of sixteen professors from various universities in France has lately visited Oxford. They received a cordial welcome, and were given ample opportunities of observing the effect of the war upon the life of the University.

Prof. A. Schuster has been appointed Halley lecturer for 1917.

Owing to circumstances connected with the war the election of a reader in geography is postponed until further notice.

BY the will of the late Miss C. E. Beckwith one-half of the residue of her estate, which amounts to about 8000*l.*, is bequeathed to the Victoria University of Manchester in aid of the "John Henry Beckwith Scholarship," founded by her mother.

Science announces that by the will of the late Mr. C. W. Harkness Yale University will receive 100,000*l.* and the Harkness Fund for scientific and educational work 50,000*l.* It is also announced that a bequest of 30,000*l.* has been made to the Johns Hopkins University by Miss Jessie Gillender for the purpose of instituting organised research into the problem of epilepsy.

SOME months ago the German authorities removed to Germany as prisoners two professors of the University of Ghent, Messrs. Frédéricq and Pirenne, against whom no charge was made and no reason was given. The Dutch Government afterwards approached the German Government with the view of obtaining their release; and now a memorial has been sent with the same object to the Berlin Academy of Sciences, to other German academies and learned societies, to the senates of the German universities, and individually to a large number of German professors. There are nearly 200 signatories, all professors in Dutch universities or members of the Academy of Sciences of Amsterdam, and the list includes many of the best-known names of Dutch science. The memorialists call upon their German colleagues to obtain from the Government permission for Profs. Frédéricq and Pirenne to proceed to Holland, in order to continue their studies there. They are convinced that a refusal would seriously disappoint a large part of the Dutch nation.

UNDER the title, "Om Børns Idealer," Dr. A. Lehmann has published (*Kgl. Danske Videnskabernes Selskabs Forhandlingen*, 1916, No. 2, pp. 107) an illuminating analysis of the replies given by 4602 Danish children to the question, "What person would you wish to be like, and why do you prefer the model you have chosen?" The subjects of the inquiry were selected from five distinct types of schools, and included boys and girls of all ages from eight to sixteen. Many interesting points are brought out—for example, that although parents and other personal acquaintances fail badly to maintain their original position as the heroes of childhood, they tend to be rehabilitated in the esteem of the adolescent. Taking the results as a whole, the curves showing the preferences of the two sexes for persons, virtues and accomplishments fall rather widely apart. In a final section of the paper the author seeks to determine the influence of co-education upon the course taken by these curves, and shows that it represents something much more positive than a mere tendency to bring the views of boys and girls closer together.

DURING the past year the sub-committee on research funds of the Committee of One Hundred of the American Association for the Advancement of Science has tried to secure information regarding research funds in the United States, and particularly such as are available without substantial limitations as to the residence and so on of the person receiving the grant. A list of the more important endowments to which no restrictions are attached, with the exception of those devoted to medical research, has been prepared, and is published in the issue of *Science* for May 12. The total capital value of these endowments is 4,603,150*l.*, and those funds where the endowment reaches 5000*l.* or more are as follows:—The Carnegie Institution, 4,400,000*l.*; the Smithsonian Institution, 50,000*l.*; the Engineering Foundation Board, New York City,

40,000*l.*; the National Academy of Sciences, 30,640*l.*—including the Bache Fund, 11,200*l.*, and the Watson Fund, 5000*l.*; the American Association for the Advancement of Science, 20,000*l.*, made up of the Colburn Fund of 15,000*l.* and the General Research Fund of 5000*l.*; the American Academy of Arts and Sciences, 15,760*l.*, made up of the Rumford Fund of 13,260*l.* and the C. M. Warren Fund of 2500*l.*; the California Academy of Sciences, 13,000*l.*; Harvard College Observatory Advancement of Astronomical Science Fund, 8000*l.*; the National Geographic Society Fund for Exploration and Geographical Research, 7000*l.*; the Elizabeth Thompson Science Fund, 5200*l.*; and the Archæological Institute of America, Washington, 5000*l.*

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, June 1.—Sir J. J. Thomson, president, in the chair.—Prof. H. M. **Macdonald**: The transmission of electric waves around the earth's surface. A formula is obtained for the magnetic force at any point of the earth's surface supposed imperfectly conducting when the source is a simple oscillator normal to its surface. If $\eta=(\sigma/2\lambda V)^{\frac{1}{2}}$, where σ is the specific resistance of the earth at its surface, V is the velocity of radiation in the space outside the earth, λ is the wave-length of the oscillations, and $z=(2\pi a/\lambda)$, where a is the earth's radius, it appears that, when ηz is a small quantity, the effect of imperfect conduction is to increase the magnetic force at a distance from the oscillator, the ratio of the magnetic force in this case to the magnetic force when the conduction is perfect increasing with the distance from the oscillator and diminishing with increasing wave-length. When squares and higher powers of $\eta z^{\frac{1}{2}}$ are neglected, the results at angular distances from the oscillator of 6°, 9°, 12°, 15°, 18° for a wave-length of five kilometres agree with those derived from Love's results when the square of k/m is neglected. The effect of the terms involving squares of $\eta z^{\frac{1}{2}}$ is opposite to that of the first order terms. Values of the ratio are calculated from the general formula for wave-lengths of five kilometres and two kilometres, for a wave-length of five kilometres the ratio increases almost uniformly from 1·004 at an angular distance of 6° to 1·027 at 18°, and for a wave-length of two kilometres from 1·106 at 6° to 1·082 at 18°.—Prof. W. M. **Hicks**: A critical study of spectral series. Part IV.—The structure of spark spectra. The communication deals with the nature of the structure of spark spectra, using for this purpose the spectra of silver and gold. It is found that practically the whole of a spectrum in each case is built on a similar plan. Lines differ from other lines by constant differences of wave number called links, and sets of lines are connected by these links into chains or linkages attached each to one of the ordinary series lines. These links depend on successive Δ-displacements on the series limits, where Δ is the displacement which gives the doublet separation, all of which may be calculated from data already known. The discussion is confined only to displacements on the p and s sequences. Those depending on the d sequences exist, but their discussion is postponed.—K. **Terazawa**: Periodic disturbance of level arising from the load of neighbouring oceanic tides. In Hecker's observations on the lunar deflection of gravity the force apparently acting on the pendulum at Potsdam is a larger fraction of the moon's direct attraction when it acts towards east or west than when it acts towards north or south. A similar result has been found by Michelson in his observation of the lunar perturbation of water-level at Chicago. A calculation is here made to ascertain to what extent the tilting of the ground caused by the excess pressure of the tide in the North Atlantic is important for the explanation of this geodynamical discrepancy. Replacing the North Atlantic by a circular basin of radius 2000 km., taking the position of Chicago to be 1000 km. from the coast, and the rigidity of the earth to be 6×10^{11} c.g.s., it is found that the attraction effect of a uniform tide per metre of height is about 0·0024″, while its tilting effect is as much as 0·0069″, the maximum of the direct lunar attraction being 0·017″. If the surface of tide is ellipsoidal, shelving towards the coast, nearly the same result is reached for the same mean tidal height.—E. B. R. **Prideaux**: The use of partly neutralised mixtures of acids as hydrion regulators. It has been shown that mixtures of acids have certain advantages over single acids which have been hitherto used for hydrion regulators. The principle of inserting the acids required to make the neutralisation graph more nearly linear should be capable of wide application. A mixture of phosphoric, acetic, and boric acids has been investigated, the (H′) values tabulated, and details given for the reproduction of these as standards. They were found to possess the advantages predicted.—Dr. E. A. N. **Arber**: The fossil floras of the Coal Measures of South Staffordshire. A flora of fifty-eight species is described from a new horizon in South Staffordshire, the Red Clay Series, or Old Hill Marls, of Transition Coal Measure age. A new genus, Calamophloios, and new species of Sphenopteris and Cardiocarpus are described, as well as several records new to this horizon. Ten new records are added to the known flora of the Productive Series (Middle Coal Measures), including new species of Calamites and Lepidostrobus. A large number of additional records from new localities or horizons are added in respect to fossils already known from these beds.

Faraday Society, May 9.—Sir Robert Hadfield, president, in the choir.—E. **Hatschek**: An analysis of the theory of gels as systems of two liquid phases. The generally accepted theory of the constitution of gels is that they are systems of two liquid phases. No attempts have been made to determine whether this assumption accounts for various observed properties of gels. The present paper is a mathematical investigation directed to determining whether the observed elastic properties of gels are compatible with their being composed of two liquid phases only, and it is concluded that this theory is untenable.—F. C. **Thompson**: The properties of solid solutions of metals and of intermetallic compounds. By considering the space-lattice of a solid solution of two metals as resulting from the substitution of atoms of B for an equal number of A in the space-lattice of the latter, it is possible to predict with some completeness the properties, hardness, specific volume, and electrical resistance of the alloy.—F. C. **Thompson**: The annealing of metals. After briefly considering the structural changes induced in metals and simple alloys by such processes as rolling or wire drawing, as a result of which the crystalline elements remain unchanged in hardness, the conditions governing such mechanical treatment of metals are examined.—Z. **Jeffries**: Grain size measurements in metals, and importance of such information. The author's method for measuring grain size consists in counting the grains completely included and partly included in the circular portion of an image of the specimen of standard magnification, and by means of an empirical formula determining therefrom the equivalent number of whole grains in the standard area.—Dr. F. J. **Brislee**: The changes in physical properties of aluminium with mechanical work. II.—Specific heats

of hard and soft aluminium. It was found that the specific heat of the hard aluminium was higher than for annealed, and this confirmed the view that aluminium is converted into an amorphous form by excessive mechanical work. It was further found that the specific heat underwent a change when the hard-drawn bars and wire were heated to 100° C.—Dr. R. **Seligman** and P. **Williams**: Note on the annealing of aluminium. Hard-worked aluminium which had been heated for ten hours at 125° C. was less readily soluble in nitric acid than the same metal before heating, but if the heating were continued for eighty hours, this comparative immunity from attack was lost (see p. 310).—E. J. **Hartung**: Contribution to the theory of solution. The author has tested the divergence in physical properties from those calculated by the simple mixture law shown by two completely miscible liquids which do not visibly react with each other. No simple solvate theory will suffice to explain the experimental results, even though the liquids used, with one exception, are little associated.

Physical Society, May 12.—Prof. C. V. Boys, president, in the chair.—Dr. H. S. **Allen**: The latent heats of fusion of metals and the quantum-theory. The latent heat of fusion is identified with the energy necessary to counterbalance that of a certain number of "oscillators" concerned in holding together the crystalline structure. Assuming that the energy of an oscillator having a vibration frequency ν is

$$\mathrm{RT}\times\frac{x}{e^x-1},$$

where x stands for $h\nu/\mathrm{RT}$, it is found that the atomic heat of fusion of a metal can be calculated with fair accuracy by the formula,

$$\mathrm{AL}=c\mathrm{NRT}\times\frac{x}{e^x-1}.$$

Here A denotes the atomic weight, L the latent heat, and c the ratio of the number of oscillators in question to the number of atoms. Thus, the number of oscillators in one gram molecule is Nc, where N is Avogadro's constant. It is found that to the factor c must be assigned a value which is either unity or a simple fraction. The frequency at the temperature of the melting point is calculated by means of the formula of Lindemann. The application of Debye's theory is also discussed.—T. **Smith**: Lenses for light distribution. The principle on which lenses for securing a required distribution of light from a given source have been designed is illustrated by a two-dimensional example. The principle employed is to divide the incident and emergent energy into a number of equal parts, and compute the lens system so that the rays which separate off these portions of incident light from one another are refracted as rays which separate the corresponding portions of the emergent light. The surfaces obtained are in general of varying curvature, and the lenses must, therefore, be moulded. It is shown how the effect of the finite size of the light source may be determined.—T. **Smith**: The choice of glass for cemented objectives. The strict fulfilment of the mathematical conditions for freedom from colour, spherical aberration, and coma, for objects at varying distances from a thin cemented doublet lens, necessarily demands a change in the kinds of glass as the position of the object is changed. The paper describes a method by which the proper glasses can be determined by using a glass chart on translucent paper, in conjunction with diagrams calculated for the purpose, as a slide-rule.

Zoological Society, May 23.—Dr. Henry Woodward, vice-president, in the chair.—Lieut. R. **Broom**: The structure of the skull in Chrysochloris. Two stages in the development of the skull have been studied. The earlier is that of a newly born *Chrysochloris hottentota,* the skull of which has been cut into microscopic sections and reconstructed, and a somewhat later stage of *Chrysochloris asiatica,* the skull of which has been prepared for the study of the membrane-bones. The skull is held to be in some respects highly specialised, and in others degenerate, although also retaining a number of very primitive characters.—Dr. C. W. **Andrews**: An incomplete sternum of a gigantic carinate bird from the (?) Eocene of Nigeria. Comparison with the sterna of several groups of birds leads to the conclusion that this specimen, though differing considerably from the sternum of any living member of the group, belonged to a very large representative of the Tubinares. It has about twice the linear dimensions of the sternum of an albatross, of which the spread of wing (in the flesh) was 10 ft. 8 in. It is proposed to refer this species to a new genus Gigantornis, the specific name being *G. eaglesomei,* after its discoverer.—Dr. A. Smith **Woodward**: A mammalian mandibular ramus from an Upper Cretaceous formation in Alberta, Canada. The specimen represented an opossum-like marsupial, and the author referred it to a new species of Cimolestes, named *C. cutleri,* in honour of its discoverer, Mr. W. E. Cutler. The close dental series behind the canine measured 30 mm. in length, and the molars differed from those of the two known species of the genus in their relatively less elevated trigonid. The fourth premolar was a large, tumid, laterally compressed cone, with one well-separated posterior cusp.—V. **Lutshnik**: (1) A list of Carabidæ collected in Chopersk district, South Russia; (2) a new species of the genus Platysma from China; and (3) notes on species of Platysma from Australia.—E. G. **Boulenger**: A new lizard of the genus Phrynosoma.—Dr. R. W. **Shufeldt**: Notes on cases of albinism seen in American animals.

PARIS.

Academy of Sciences, May 22.—M. Camille Jordan in the chair.—G. **Bigourdan**: The immediate collaborators of Peiresc. These included Jean Lombard, Simon Corberan, and Antoine Agarrat, and an outline of the astronomical work of each is given.—E. **Cahen**: The general reduced numbers of Hermite.—T. **Bialobjeski**: The influence of the pressure of radiation on the rotation of the celestial bodies.—T. **Peczalski**: The effect of temperature on the structure of paraffin. A study of the effects produced on paraffin wax by prolonged exposure to temperatures slightly below its melting-point. For a paraffin wax the density of which was originally below 0·900 the density increased with prolonged heating, and this change is accompanied by a considerable reduction in the electrical conductivity of the material.—M. **Siegbahn**: The existence of a new group of lines (series M) in high-frequency spectra. The lines were produced by uranium. On account of the absorption of these lines by air the spectrograph was in a vacuum, the crystal used being a plate of gypsum. This series has also been found to be represented in the spectra of thorium, bismuth, lead, thallium, and gold.—A. **Schidlof** and A. **Targonski**: The Brownian movement of particles of oil, tin, and cadmium in different gases and at different pressures. From the results obtained experimentally it is concluded that Einstein's theory of Brownian motion applies to all spherical particles without restriction. It also applies to non-spherical particles of not too irregular form, whatever may be the gaseous medium.—F. **Pisani**: A new method for the estimation of fluorine. The method is based on the insolubility of thorium fluoride in solutions faintly acidified with acetic or nitric acid. 0·01 per cent. of fluorine can be detected. The application of the method to various minerals containing fluorine is

described.—M. and Mme. F. **Moreau**: The phenomena of sexuality in lichens of the genus Solorina.—J. **Glover**: An electrical apparatus for auscultation, clinical exploration, and experimental physiology.—P. **Lecène** and A. **Frouin**: Experimental researches on the mechanism of encystment of foreign bodies and on latent microbism.—M. **Marage**: The classification of deaf soldiers according to their power of hearing. A criticism of the current methods for determining deafness in the French Army. These are shown to be faulty in three respects.

BOOKS RECEIVED.

Quartic Surfaces with Singular Points. By Prof. C. M. Jessop. Pp. xxxv+197. (Cambridge: At the University Press.) 12*s.* net.

British Birds. Written and illustrated by A. Thorburn. Vol. iii. Pp. vi+87+plates. (London: Longmans, Green and Co.) 1*l.* 11*s.* 6*d.* net.

Hart's Note-Book for Navigators and Others. (Colchester: Benham and Co., Ltd.)

Memoirs of the Geological Survey. Special Reports on the Mineral Resources of Great Britain. Vol. v., Potash, Felspar, Phosphate of Lime, Alum Shales, Plumbago or Graphite, Molybdenite, Chromite, Talc and Steatite (Soapstone, Soap-rock, and Potstone), Diatomite. By Dr. A. Strahan and others. Pp. iv+41. (London: H.M.S.O.; E. Stanford, Ltd.) 1*s.*

Men of the Old Stone Age: their Environment, Life, and Art. By Prof. H. F. Osborn. Pp. xxvi+545. (London: G. Bell and Sons, Ltd.) 21*s.* net.

Central American and West Indian Archæology. By T. A. Joyce. Pp. xvi+270. (London: Philip Lee Warner.) 12*s.* 6*d.* net.

The Breath of Life. By J. Burroughs. Pp. x+295. (Boston and New York: Houghton Mifflin Co.; London: Constable and Co., Ltd.) 5*s.* net.

The Psychology of Relaxation. By Dr. G. T. W. Patrick. Pp. viii+280. (Boston and New York: Houghton Mifflin Co.; London: Constable and Co., Ltd.) 5*s.* net.

The *Athenaeum* Subject Index to Periodicals, 1915. Fine Arts and Archæology. Second edition. Pp. 33. (London: The *Athenaeum*.) 1*s.* 6*d.* net.

Department of Statistics, India. Agricultural Statistics of India, 1913–14. Vol. i. Pp. x+415. (Calcutta: Superintendent Government Printing.) 2.8 rupees.

Costruzioni di Strade e Gallerie. By Prof. Ing. S. Rotigliano. Pp. xxiii+808. (Milano: U. Hoepli.) 18 lire.

The Life of Inland Waters. By Prof. J. G. Needham and J. T. Lloyd. Pp. 438. (Ithaca, N.Y.: Comstock Publishing Company.)

A Manual of Practical Physics. By H. E. Hadley. Pp. viii+265. (London: Macmillan and Co., Ltd.) 3*s.*

Synchronous Signalling in Navigation. By Prof. J. Joly. Pp. 64. (London: T. Fisher Unwin, Ltd.) 3*s.* 6*d.* net.

Wild Flowers of the North American Mountains. By J. W. Henshaw. Pp. xv+383. (London and New York: McBride, Nast and Co., Ltd.) 10*s.* 6*d.* net.

Forty-seventh Annual Report of the American Museum of Natural History for the Year 1915. Pp. 194. (New York.)

The Cicindelinæ of North America as arranged by Dr. W. Horn in Genera Insectorum. Edited by E. D. Harris and C. W. Leng. Pp. vi+23. (New York: American Museum of Natural History.)

DIARY OF SOCIETIES.

THURSDAY, JUNE 8.

ROYAL SOCIETY, at 4.30.—Further Determinations of Direct Osmotic Pressures: The Earl of Berkeley and E. G. J. Hartley.—The Magnetic Shielding of Large Spaces, and its Experimental Measurement: Prof. E. Wilson and Prof. J. W. Nicholson.—Motion of Solids and Fluids when the Flow is not Irrotational: G. I. Taylor.

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

MATHEMATICAL SOCIETY at 5.30.—The Classification of the Integrals of a Linear Partial Differential Equation of the First Order: Prof. M. J. M. Hill.—(1) Non-absolutely Convergent, not necessarily Continuous, Integrals; (2) The Convergence of Fourier Series and of their derived Series: Prof. W. H. Young.—The General Linear Differential Equation: Dr. S. Brodetsky.—A Note on the Series $\Sigma a_n \sin n\theta$ and $\Sigma a_n \cos n\theta$, where (a_n) is a Sequence of Positive Numbers tending steadily to Zero: A. E. Jolliffe.

INSTITUTION OF MINING ENGINEERS, at 10.45 a.m.—The History of the Safety-Lamp: Prof F. W. Hardwick.—The Health of Old Colliers: Dr. J. S. Haldane.—The Estimation of Moisture in Coal: T. F. Winmill.—(1) The Absorption of Oxygen by Coal. VIII. and IX.; (2) The Oxidation of Pyrites: T. F. Winmill.

OPTICAL SOCIETY, at 8.—Modern Technical Applications of Radium and other Luminous Substances: F. Harrison Glew.

FRIDAY, JUNE 9.

ROYAL INSTITUTION, at 5.30.—Eyesight and the War: Dr. E. Clarke.

ROYAL ASTRONOMICAL SOCIETY, at 5.—An Inequality in the Period of the Eclipsing Variable RZ Cassiopeiæ: R. S. Dugan.—A Probable Relation between the Changes in Solar Radiation and the Melting of the Polar Snow Caps of Mars: E. M. Antoniadi.—Micrometrical Measures of Double Stars: Rev. T. E. R. Phillips.

MALACOLOGICAL SOCIETY, at 8.—Note on *Erato guttula*, Sow.: J. R. le B. Tomlin.—An Undescribed Ammonoid from the Lower Greensand (Aptian) of Kent: G. C. Crick.—*Helix scytodes*: Prof. G. K. Gude.

SATURDAY, JUNE 10.

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

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