THURSDAY, NOVEMBER 13, 1913.

THE ZEEMAN EFFECT.

Researches in Magneto-Optics. With Special Reference to the Magnetic Resolution of Spectrum Lines. By Prof. P. Zeeman. (Macmillan's Science Monographs.) Pp. xvi+219 +viii plates. (London: Macmillan and Co., Ltd., 1913.) Price 6*s*. net..

THIS synthesis of our knowledge in an important and fundamental branch of physics —opened up by our author in 1896, and afterwards cultivated so zealously and fruitfully by many workers, but by himself far in front of all others—will be most welcome to all who wish to keep abreast of the advancing tide of electrical and optical discovery. Prof. Zeeman has paid us the compliment of writing his book in English; and nowhere, perhaps, will he have more attentive readers than here. Though occasional slight differences of idiom betray that the work is not composed in his native language, yet the clearness and directness of statement, and the conciseness of exposition, enable him to cover a large field, so to speak in a single view, in a manner which will make the book a permanent companion of all who are interested in the progress of the marvellous subject which is indissolubly associated with the name of the Professor of Physics of Amsterdam.

In the early days of this research it could scarcely have been anticipated that it would grow almost into a separate science. The present writer well remembers the earliest announcement in this country of the first phase of Prof. Zeeman's discovery, which was contained in a single sentence in NATURE in December, 1896, imbedded in the midst of an abstract of proceedings of the Amsterdam Academy of about a month before; its importance was, however, at once grasped, and the experiment was promptly repeated and verified by Lodge. The idea of a spectrum line being widened by a magnetic field had in fact been thought of; but a rough estimation had shown that if the ions concerned are comparable in mass to atoms, the effect would be far too slight for practical detection. The actual smallness of the inertia of the electron, only 1/1500 of that of the hydrogen atom, which made all the difference in this regard, could not have been anticipated. But when Zeeman's full paper came to hand, it was found to include much more; not only Lorentz's brilliant and decisive test of a magnetic influence, and its verification, viz., the circular polarisations of the edges of the widened spectral line: it also contained the establishment of an actual splitting of each line into sharp components, which had been suggested as possible, though one would imagine scarcely likely, by the special circumstances of Lorentz's simple illustration of a single electron revolving round a centre of force.

This latter very remarkable result, the sharp multiplication of the line instead of a mere general broadening, remains the theoretical crux of the subject, and at the same time is that feature of definiteness which makes and will make the Zeeman phenomenon so effective a probe as regards the inner physical structure of the individual molecules of matter.

The value thus found for the ratio of charge to inertia, for the negative optical electron, fell at once into line with the value belonging to the free corpuscles of J. J. Thomson—the Crookes-Stokes torrent of charged particles which carry the kathode current in vacuum tubes—as announced by the discoverer of free electrons, and of their stupendous translatory velocities, in the earlier part of the same year. Thus the electron theory, which already embraced in its theoretical scope all electric phenomena as well as all effects of radiation, was raised, by convergence from both its aspects in the same year, from a mental constructive synthesis to the rank of tangible experimental fact. Special electron theories could thus in future be launched out in detail, into regions of tentative speculation hitherto almost regarded as fanciful, as the test of experiment became applicable more and more as a check on their exuberance or an indication for their fruitful modification.

The earliest general comparative study of the phenomena of resolution, for the various spectral lines of the same chemical element and of related elements, was made in the two following years by Preston, working within the circle of FitzGerald's influence in Dublin, who was able, as it happened, to turn to account a powerful Rowland grating that had just previously been established at the Royal University. The circumstances which prevented Zeeman himself, for nearly ten years, from proceeding with the full exploration of his own subject in this direction—namely, his transfer from the Leyden laboratory to a lectureship at Amsterdam University, and the very imperfect spectroscopic equipment which he found there—are recorded here not without pathos, at the beginning of chap. iv., in explanation of his occupation during those years mainly on side problems which could be attacked with small optical powers.

The rule announced by Preston, and now appropriately known by his name, as it arose out of his last piece of work before the premature termina-

tion of a promising career in science, viz., that in each spectral series the magnetic separations measured in frequency are the same for all lines, and that there is close parallelism for elements of the same chemical group, remains the chief generalisation in this branch of the subject. It was fully confirmed by the much more extensive investigations of Runge and Paschen published three years later. But in fact the narrower foundation on which Preston built may well have appeared at the time to be sufficient, in view of the pertinent theoretical considerations.

The fundamental puzzle, why there should be definite resolution at all, instead of hazy broadening, has already been referred to. The most general theoretical system for which definite resolution can be predicted remains now, as then, one composed of any number of negative electrons describing orbits, however entangled, under their mutual repulsions in a field of force steady (or nearly steady), thus due to positive charges fixed (or nearly fixed, as they may well be, even though free, on account of attached inertia), and symmetrical with respect to the axis of the impressed magnetic field. In such a case the effect of an impressed magnetic field H on the system is the same as that of an impressed rotation round the axis of the field with velocity $\omega = eH/2m$; and in the analysis of the radiation which the system sends out, all its spectral lines are therefore divided into normal triplets, *i.e.* according to the elementary Lorentz rule, with the common interval $\omega/2\pi$ in their frequencies. If a natural spectral series had been found to behave differently from this theoretical system, it would at that time have been a matter for surprise: yet in Runge and Paschen's work, though Preston's rule is obeyed, the resolution proved often to be very different from the normal triplet type which is characteristic in the proposition above quoted. Instead, however, these experimenters found order of a more general kind, the components, often more than three, being usually symmetrically spaced at intervals which are equal to or exact sub-multiples of the standard Lorentz amount.

Not a few attempts have been made for the theoretical elucidation of this remarkable rule; but it probably still remains as a touchstone for the next substantial advance in the dynamics of molecular structure. Prof. Zeeman rather hints his opinion that its range of approximate application may be limited, just as the original standard triplet resolution proved to be exact only in special systems. Large accumulations of material exist for detailed comparative study: the subject has in fact now definitely entered the chemical laboratory, and attention is specially directed by our author to the work of J. E. Purvis with Dr. Liveing's spectroscopic equipment at Cambridge, revealing identical types of resolution in the spectra of numerous elements in which series are not as yet known.

For further progress on the physical side, much higher resolving power is a desideratum, which, indeed, is now rapidly being applied. A beginning has been made (by Nagaoka in a recent letter in NATURE, August 25) in the mapping of the remarkable changes of type of resolution of the definite satellites attached to certain lines, as the magnetic field is increased: this phenomenon, and the simplification, in fact fusion, which has been found by Paschen and Back to ensue in the resolution of close multiple lines, when the field becomes very great, and more recently by Fortrat, following early isolated observations by Michelson and others, lend weight to Voigt's hypothesis of some kind of vibrational linkage between adjacent lines, even when their own modes of resolution are of different types.

Such difficulties as these have obstructed the general theory, as approached from the side of the radiation from magnetised flames. But at an early stage Voigt had formulated the problem—and has since developed it in many directions, analytically and experimentally, with his usual mastery—from the point of view of propagation of incident radiation through a magnetised medium, a subject already discussed for transparent media in theories of Faraday's rotation of the plane of polarisation and of the related Kerr effect of reflection. If that type of theory is expressed so as to exhibit the mechanism of selective absorption, by the explicit introduction of terms appropriate to molecules vibrating by resonance and attached to the medium, and also of general damping terms when expedient, a dark narrow band which would be single in the absence of an impressed magnetic field should become resolved into Zeeman components when such a field is included; or at any rate this fact will be a guide to the form of the equations.

Almost simultaneously with this theoretical discussion, the Italian physicists Macaluso and Corbino broke the cognate experimental ground, by the detailed observation of an absorption line under very high dispersion, showing that the known excessive and anomalous refraction at its borders was accompanied by excessive and anomalous magnetic rotation, superposed on the magnetic resolution of the line. Indeed, very soon after Zeeman's first discovery, Righi had put the resolution of the line in evidence in a most effective and beautiful manner, in an absorption experi-

ment, simply by showing that a magnetic field restored visibility of the line when applied to an absorbing vapour between nicols crossed for extinction of the light.

In the theoretical procedure of Voigt the radiating molecule has thus disappeared from the scene, or rather has become latent; the problem proposed is now to represent the effect of the medium in bulk heuristically, as well as may be, by introduction of appropriate new types of terms into the differential equations of propagation, new types which owe their justification, or at any rate their suggestion, to the general physical nature of the interaction of the molecules with the æther in the magnetic field. The aim is thus coordination of phenomena rather than their explanation; and the procedure is specially appropriate to that philosophical view which restricts the sphere of physics to the adequate formulation of the relations subsisting between the tangible experimental data. The mode in which the interaction of the vibrating molecules gives rise in a general way to such terms in the equations of propagation, including the relation of reciprocity of the Zeeman to the Faraday effect, had been exhibited by FitzGerald, by means of simple illustrative systems, about the same time. All these converging activities show how ripe for the harvest ideas had become, through the progress of the general theory of absorption and the related anomalous dispersion, first essayed by Young with imperfect means of analysis a century ago, and effectively developed in experiment and theory by Kundt, Maxwell, Rayleigh, Sellmeier, Helmholtz, &c. in more recent days.

Similarly, allusion has been made above to the circumstance that the times had been ripening, before Zeeman's discovery, towards the understanding of the relations of a magnetic field to the vibrations of the molecules which take part in the emission or transmission of radiation. The most remarkable and even precise anticipation of all, and one which by good fortune incited Prof. Zeeman to enter upon his investigation, was an experimental attempt made by Faraday himself, which our author had come to know of, very appropriately, from a reference in a lecture by Clerk Maxwell. Then there was the additional fortunate circumstance that Prof. Lorentz was at hand at Leyden, to bring to bear his exact ideas on the nascent discovery and point out the path for further developments. These are opportunities, seemingly merely born of concurrent chances, yet such as are only grasped by men worthy of them. The skill in optical experimentation, which is revealed by the investigations recorded in this treatise, connotes a long training for the tasks there undertaken: we are thus reminded of Prof. Zeeman's early exact measurements on the Kerr effect in reflection of light from a magnetic pole (not mentioned in this book), by which he won his spurs at Leyden, doubtless in that problem also enjoying the stimulus of Lorentz's advice and inspiration.

Recently the centre of interest has shifted in this subject into a purely observational side, to the mountain peak in California where G. E. Hale and his associates, by refined and determined work with the very powerful special equipment of the Carnegie Observatory, have realised in marvellous ways, still awaiting closer interpretation, one of Zeeman's anticipations in his earliest paper, the application of the method to the exploration of the magnetic phenomena of the sun, greatly expanding thereby our picture of the activities of the ultimate source of all our light and power.

But we must stop: these topics, and many others of absorbing and often perplexing interest, may be followed up in the book itself. Less than twenty years ago the Zeeman effect was unknown, we may almost say unthought of. Already it permeates, as a method of coordination and discovery, all the most refined problems of electrical and optical science. We have now a handbook of the present state of the subject, of the right degree of detail, written from the experimental point of view without undue occupation or distraction with theoretical speculations for which it yet arranges the material, with brief side expositions recalling to mind succinctly such knowledge of related subjects, spectral resolving power, spectral series, &c., as is essential to the argument: and this reasoned survey has come to us from the hands of the discoverer and chief experimental promoter of the Zeeman phenomenon.

J. L.

P.S.—In the foregoing review of Prof. Zeeman's monograph, which was written early in October, it is remarked that recent observations, especially by Paschen and Back, and afterwards by Fortrat, on the modification of the Zeeman effect in strong fields, give support to the theory advanced by Voigt, which postulates mutual influence between the constituents of a close multiple line in the spectrum. The case may now (November 4) be put stronger. The recent account by Fortrat of the magnetic resolution of a sodium doublet (*Comptes rendus*, October 20, 1913, p. 636) seems to leave no room for doubt that the equations advanced by Prof. Voigt are of the essence of the matter.—J. L.

MALARIA AND PARASITOLOGY.

(1) *Malaria, Cause and Control.* By Prof. W. B. Herms. Pp. xi+163. (New York: The Macmillan Co.; London: Macmillan and Co., Ltd., 1913.) Price 6*s.* 6*d.* net.

(2) *A Laboratory Guide to the Study of Parasitology.* By Prof. W. B. Herms. Pp. xv+72. (New York: The Macmillan Co.; London: Macmillan and Co., Ltd., 1913.) Price 3*s.* 6*d.* net.

(1) THE volume on malaria is written in a popular style, and is intended to educate the intelligent public as well as the expert on the methods of controlling this disease. It contains much valuable information, and should be read by all those who live in malarious districts. The contents of the book are based mainly on the author's four years' experience in the State of California. This State is noted for its healthful climate, yet in many localities malaria is a scourge. Malaria is the principal cause of absences from the rural public schools in the infested districts, and three-fourths of the malaria in California is found in nine out of twenty-four malarial counties. The Board of Health there estimates that the annual loss from this disease amounts to 2,820,400 dollars.

A short and popular account is given of the various stages of development of the malarial germ, in the human body and in the mosquito, in order that the reader may obtain a more intelligent grasp of the methods of prevention. The germ is transmitted by the bite of certain species of anopheline mosquitoes. A lucid and well-illustrated description is given of the anopheles and other mosquitoes in general in order to teach the reader how to detect easily the dangerous varieties which transmit the disease.

The breeding places, development, and habits of these insects are thoroughly described. This information is necessary, since the methods of controlling and eradicating the disease are based upon this scientific knowledge. Prevention consists mainly in a systematic and determined crusade against mosquitoes. These can be best attacked at their source of production, or, in other words, their breeding grounds must be destroyed or rendered unsuitable for their development. This is done by draining or filling in the swampy lands near habitations and by spraying oil or poisons on stagnant pools of water. It is also important to destroy as much as possible by fumigation the adult mosquitoes in dwellings; these should be screened in order to prevent the mosquitoes from gaining an entrance. Probably the most important part, however, of an anti-malarial campaign is the systematic education of the public, so that their intelligent co-operation may be obtained. A considerable portion of the book deals with this important subject. Among other methods, the public is best educated by the aid of the local Press and by popular lectures. The book is excellently illustrated throughout, and nothing has been omitted in the endeavour to make the subject clear and intelligible to the ordinary reader.

(2) The work on parasitology is intended to give students a wide practical view of the subject in its application to the health and well-being of man and beast. It is arranged so as to provide sufficient matter for a full laboratory session on human and veterinary parasitology. It is divided into exercises, each of which is sufficient to occupy the student in the laboratory for two and a-half to three hours. The various orders of disease transmitting insects are dealt with, including bed-bugs, mosquitoes, gnats, horse flies, house flies, stable flies, bot flies, lice, ticks, and mites. Parasiticides and their method of use are given. Amœbæ, trypanosomes, and malarial parasites have each one exercise devoted to them. Under the heading of helminthology come the round worms, hook worms, lung worms, whip worms, trichina, filariæ, leeches, flukes, tape worms, &c. A special exercise is devoted to helminth ova and another to the various anthelminthics. Finally, exercises are given on the life-histories of the common house fly, the mosquito, and the flea.

This book must necessarily be of great value to the student and to the teacher. There are no illustrations, but it is intended for use in the laboratory with a lecturer and material at hand, and also as a practical supplement to a general course of lectures on the subject.

A POPULAR MINERALOGY.

The Mineral Kingdom. By Dr. Reinhard Brauns. Translated, with additions, by L. J. Spencer. Parts 1–25. Pp. 432+91 plates. (Esslingen-a-N.: J. F. Schreiber; London: Williams and Norgate, 1912.) Price 2*l.* 10*s.* net.

IN the preface to the original German edition Prof. Brauns states that the book was written for the admirers and collectors of minerals, and aimed at increasing the number of those interested in such things. Since its appeal is to the layman rather than to the student or the expert, the arrangement of the book is somewhat different from that usual in text-books on the subject. A general part deals briefly—perhaps too briefly for satisfactory exposition—with the characters of minerals—their crystalline form, physical proper-

ties, and chemical composition. In the other, and principal, part the characters, chief occurrences, and uses of the principal mineral species are very fully described.

Since the reader for whom the book is intended is mainly interested in knowing what each mineral is used for, the species are grouped together, not as is customary in modern text-books according to their crystallo-chemical relations, but to the uses to which they are put, an arrangement which has much to commend it in a popular work. Thus in the first section we find the ores and the minerals resulting from their weathering, meteorites forming an appendix to iron; in the second the precious stones; in the third the rock-forming minerals, a group of extreme importance, though individually not often attaining to very prominent size; in the third the mineral salts, which includes, besides rock-salt, the phosphates, and the minerals supplying the rare earths, &c., several species left over, such as the calcite and barytes groups; and lastly we have the organic compounds. Some useful hints on the collection and preservation of specimens are given in an appendix. A valuable feature of the book consists in the extensive series of coloured plates, on which are depicted as faithfully as the chromo-lithographic process will permit some of the finest specimens contained in the principal German collections.

The English translation was entrusted to the efficient hands of Mr. L. J. Spencer, of the Natural History Museum, and Prof. Brauns was fortunate in securing the services of one so well qualified for the task. While adhering to the general design of the original, Mr. Spencer has made many small additions and alterations which render the book of greater value to English readers. Since the German edition appeared nearly ten years ago, he has introduced more recent statistics than were given in the original. Owing to a change of publishers the English edition, which, like the German, was issued in parts, was considerably delayed, and was not finally published until last year. For that reason some of the information—for instance, that regarding the carat-weight—is already out of date.

OUR BOOKSHELF.

The Golden Bough: a Study in Magic and Religion. Third edition. Part vi., The Scapegoat. By Prof. J. G. Frazer. Pp. xiv+453. (London: Macmillan and Co., Ltd., 1913.) Price 10*s.* net.

THE sixth part of "The Golden Bough" deals with the folklore and priest-craft of that characteristic human failing, the avoidance of responsibility. The extraordinary prevalence and similarity of the popular ideas and practices in the matter of sin-transference, expulsion of evils, expiatory sacrifices, and vicarious atonement, as shown by Prof. Frazer in a myriad cases from China to Peru, is enough to make the social and political philosopher despair of humanity. The story of "The Scapegoat" depicts the negative aspect of representation, which is the dark and lurid side of social morality. In his famous description of the periodic rage of the people against social offenders Macaulay simply illustrates the modern form of the savage "expulsion of evils." The idea culminates in the use of the Dying God as a scapegoat to free his worshippers from the troubles with which life is beset. The author concludes that "the idea resolves itself into a simple confusion between the material and the immaterial, between the real possibility of transferring a physical load to other shoulders, and the supposed possibility of transferring our bodily and mental ailments to another who will bear them for us." What was in the previous edition the spectacular climax of the exposition, viz., the brilliant explanation of the Gospel story of the Crucifixion as embodying the ritual of the mock king and popular (not to say royal) substitute in sin, is relegated to an appendix, as being doubtful. This is possibly a mistake. Prof. Frazer goes out of his way to assert his belief in the historicity of Jesus. The occasion demanded an examination of the facts.

An important addition is a careful study of the Aztec religion of human sacrifice, the secret lever of which has not yet been discerned. It should be compared with the *auto-da-fé* of Christianity. Such comparisons are avoided by Prof. Frazer, who will not go down to the ultimate depths. Another new feature is an extended treatment of the use of games as magical processes to change the weather, and so forth. Hence the author too easily assumes that certain games were originally magical rites, which is absurd.

But the book is a storehouse of social facts, sympathetically treated, and invaluable to those interested in the development of society and the moral law. As an analysis of religious ideas, of course, like the other volumes, it is epoch-making. A. E. CRAWLEY.

Reports from the Laboratory of the Royal College of Physicians, Edinburgh. Edited by Dr. G. L. Gulland and Dr. James Ritchie. Vol. xii. (Edinburgh: Oliver and Boyd, 1913.)

THIS volume of Reports contains contributions of workers in the laboratory of the Royal College of Physicians, Edinburgh, during the year 1912, and is edited by the Curator, Dr. Gulland, and the Superintendent, Professor Ritchie. Anatomy, pharmacology, pathology, and bacteriology are the branches of medical science represented, and the papers are valuable contributions to science and are evidence of the useful work which is being done in this laboratory.

Of the papers of more general interest, we note Dr. Gardner's on soaps and their effects on the skin. He concludes that all soaps are more or less irritant to the normal skin, particularly the cheaper soaps made with cotton-seed and other oils

and rancid fats. Soaps, even when combined with antiseptic substances, possess little or no antiseptic power, even in more than the quantities in which they are ordinarily used. Dr. Addis has investigated the causation of hæmophilia, the "bleeding disease." He finds that the essential factor is a qualitative defect in the prothrombin, whereby blood coagulation in the hæmophilic individual is delayed; on the other hand, quantitatively all the elements necessary for blood-coagulation are present in the normal individual.

Distemper in dogs and other animals has been investigated by Dr. M'Gowan, who has regularly isolated in this condition a bacterium with distinct characters. Dr. John Fraser has investigated the prevalence of the human and bovine types of the tubercle bacillus in bone and joint tuberculosis occurring in children. He finds that the bovine type of bacillus is present in more than half the cases.

The Edinburgh College of Physicians is to be congratulated on the results of their liberal endowment of research; and in the preface due acknowledgment is made of additional financial assistance received from the Carnegie Trust. R. T. H.

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.*]

The Piltdown Skull and Brain Cast.

IN my previous letters (NATURE, October 2, p. 131, and October 30, p. 267) I refrained from entering into a detailed consideration of the reconstruction of the Piltdown skull, because I am preparing for presentation to one of the learned societies a full statement of all the facts and considerations bearing upon the points at issue. But I am glad to accede to Prof. Keith's invitation (NATURE, November 6, p. 292) to publish a drawing of the brain cast for comparison with his (NATURE, October 16, p. 198, Fig. 2).

It is a pleasure to express my hearty agreement with his appreciation of the excellence of Mr. Barlow's workmanship and of Dr. Smith Woodward's courtesy in permitting anatomists freely to handle and examine the precious fragments. Mr. Barlow's casts of the fossil bones are certainly the best examples of such modelling that I have ever seen; and I strongly resent the interpretation (*op. cit.*, p, 292) put upon my remarks in reference to them. But even such realistically perfect copies cannot display structural details such as the texture of bone, the precise location of certain faintly marked sutures, and the nature of sutural edges of the bones; and all of these points are of crucial importance in this discussion.

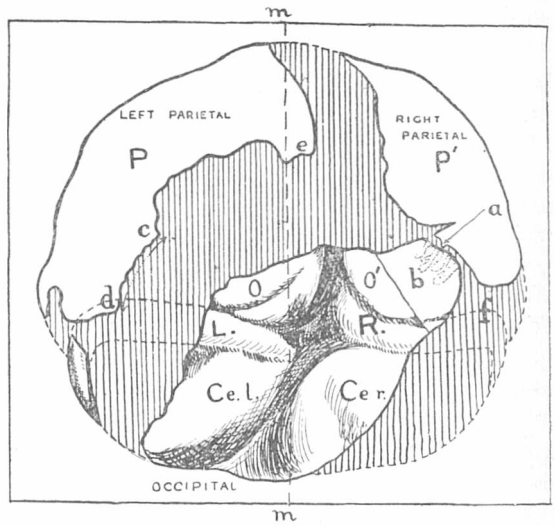
On the actual fragments, for example, one can see quite plainly a part of the *right* half of the coronal suture (not visible on the cast), meeting the more obvious left half at an angle which must, of course, be upon (or very close to) the median plane. Now this point lies upon the forward extension of the plane *mm* (see fig.), which was determined from other evidence (see NATURE, October 30, p. 267).

Then again the texture of the bone covering the area on the brain cast near the line *mm* just above the point *e* (see fig.) is characteristic of that which comes into contact with the median longitudinal sinus. This is further confirmation of the accuracy of the determination of the line *mm*. There are three other features of the bone in the neighbourhood of the line corresponding to *mm*, namely the supralambdoid flattening, the arrangements and medial relations of the meningeal grooves, and the median groove in the frontal region, which confirm this identification of the line *mm* as a close approximation to the real median plane.

On these grounds the orientation of the left parietal (P) to the median plane (*mm*) is settled; but we have still to determine its position in relation to the occipital upon that plane.

In spite of the extreme asymmetry of the posterior poles of the cerebral hemispheres (O and O^1), the two halves of the cerebellum (Ce.l. and Ce.r.) and the lateral sinuses (L. and R.), the orientation of the occipital fragment upon the median plane is fixed, as Prof. Keith has explained (NATURE, October 16, p. 198).

The broken piece (*b*) fits accurately upon the main



fragment (O^1), and as it bears upon its external face and lateral edge traces of the right part of the lambdoid suture, it is important as giving some indication of the breadth of the occipital bone at this level. [To avoid the addition of another diagram, I have inserted alongside the letter *b* a stippled design to suggest, in a purely diagrammatic manner, the extent and complexity of a small fragment of the lambdoid suture preserved upon the external face of the bone that covered the area *b*.]

Now that the occipital and left parietal fragments have been orientated upon the line *mm*, the problem remains of determining their relative heights the one to the other upon that line.

The left lateral sinus left its imprint upon the occipital (L.) and also upon the lower corner of the left parietal (at *d*). Although the sinus is sometimes distinctly arched upward as it passes from the occipital to the parietal, the points *d* and the upper margin of L are as a rule on approximately the same horizontal plane, both in man and the anthropoid apes. Thus we cannot go far wrong if we bring the occipital and the left parietal into the positions shown in the diagram.

But Prof. Keith will object (NATURE, October 16,

p. 198) that this will not bring the two halves of the lambdoid suture (*cd* and *ab*) into symmetrical positions. In answer to this criticism it may be said that the lambdoid suture in this restoration is as nearly symmetrical as it is in many ancient and modern skulls. Moreover, in the case under consideration there is the most positive evidence of a lack of complete symmetry. Not only is there the most striking asymmetry in the whole occipital area (compare O and O^1 and Ce.l. and Ce.r.), but the remains of the lambdoid suture itself present a marked contrast on the two sides, being quite simple on the left (*cd*), but complex and dentate on the right (*b*). To base any far-reaching conclusions upon the position and direction of an isolated centimetre (*b*) of the lambdoid suture (see NATURE, October 16, p. 198) is simply courting disaster. For every anatomist knows that the lambdoid is the most variable and tortuous of all the cranial sutures.

Another indication of asymmetry of the lambdoid suture is the direction of the fragment marked *e*. My critics may say that as it points towards the piece *cd* and not towards *b* and *f*, it clearly belongs to the left and not to the right half of the suture, and that it would fall into its proper position if the left parietal were moved wholly to the left side of the line *mm*. But such a deviation as *e* is quite common. A precisely similar thing occurs in the Gibraltar skull, and in the La Quina skull there is a Wormian bone near the corresponding spot on the right side.

So far I have said nothing of the right parietal fragment (P^1). It bears only a very small fragment (*a*) of the lambdoid suture, which, of course, must lie somewhere near the line joining *e* and *f*. Its lower margin does not quite reach the lateral sinus at *f*. With these and other guides (supplied by the impressions of the brain and meningeal vessels) this fragment may be orientated in a position approximately symmetrical to the left side. Incidentally, as the point *a* must be in the neighbourhood of the sutural line on *b*, the position of the right parietal fragment (P^1) so determined checks the accuracy of the position of the left parietal (P).

No exact symmetry between P and P^1 is attainable because the brain itself is not symmetrical. In the human brain the type of occipital asymmetry seen in this case (O and O^1) is usually associated with a greater prominence of the right parietal eminence (P^1). This was the case in the Piltdown brain. In further confirmation of the reality of this it is found that the right parietal bone is very much thinner than the left, so that, as in the occipital region, the full extent of the cerebral lack of symmetry is not displayed in the outline of the skull.

In making the drawing illustrating this letter I have used a cranial cast which Dr. Smith Woodward kindly sent me a few weeks ago, but have made some slight alterations in the positions of the two parietal fragments.

In conclusion I should like to say how much I am indebted to Prof. Keith for all the help he has given me in my investigations, not only by allowing me to make use of all the valuable material in the museum of the Royal College of Surgeons, but also by discussing with me frankly and openly all the points in dispute concerning the Piltdown skull itself. In the earlier part of July, working with the cranial casts, he seemed to me to have established a good case for his mode of reconstruction; but from the moment I began to examine the actual fragments (August 13, 1913, the day after the discussion of the matter at the International Medical Congress) I became convinced that his solution of the problem was an impossible one. It was this personal experience of the importance of working with the real things that I had in mind when I was writing my last letter (NATURE, October 30, p. 267).

G. ELLIOT SMITH.

The University of Manchester.

The Piltdown Mandible.

IN *The British Journal of Dental Science* of October 1, there are published some excellent radiograms of the Piltdown mandible and of a chimpanzee's, the views having been taken from the side and from above.

In order to compare the outlines of the two specimens, I have superimposed tracings taken from each (Figs. 1 and 2).

FIG. 1.—Outline tracing from radiograms of the Piltdown mandible (continuous line) and of the mandible of chimpanzee (broken line).

The similarity of the specimens brought out in this way is very striking, for the outlines are practically identical. I have also superimposed tracings of the last reconstruction of the Piltdown mandible and of the jaw of a young chimpanzee (Fig. 3), and again the similarity of the outline is very remarkable. No human mandible is known which shows anything

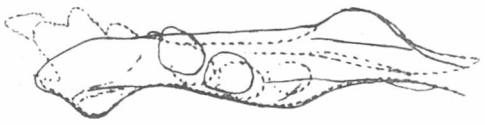


FIG. 2.—Outline tracing from radiograms of the Piltdown mandible (continuous line) and of a chimpanzee (broken line as viewed from above.

like the same resemblance to the chimpanzee jaw in outline and in all its details.

Of the molar teeth, I need only say here that not only do they approach the ape form, but in several respects are identical with them.

The cranial fragments of the Piltdown skull, on the other hand, are in practically all their details

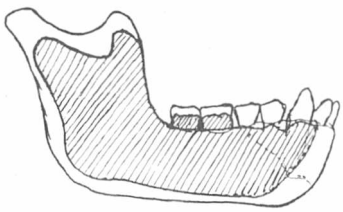


FIG. 3.—Outline tracing of the last reconstruction of the Piltdown mandible, and of the mandible of a young chimpanzee (shaded

essentially human. If that be so it seems to me to be as inconsequent to refer the mandible and the cranium to the same individual as it would be to articulate a chimpanzee foot with the bones of an essentially human thigh and leg.

DAVID WATERSTON.

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Darwinism 100 Years Ago.

WHO was the first to propound clearly the idea of sexual selection as an important factor in evolution? "Darwin, of course," is the usual answer, even of those who, sneering at this great man, delight in pointing out that it was not he who first promulgated the improving effects of selection, and that all he himself did introduce was the subsection of sexual selection; according to them a baseless idea.

Recently I happened to come across the following statement by Friedrich Tiedemann, in his "Anatomie und Naturgeschichte der Vögel" (Zweiter Band, p. 13, Heidelberg, 1814):—"Very often there arise fights between the males for the possession of the females. . . . These fights, which take place also between very many mammals, seem to be very important for the conservation of a healthy progeny, since only the strongest and most vigorous males propagate the race, whilst the young and too old individuals, being weak, are conquered, and removed from the act of propagation.

Tiedemann, who flourished just one hundred years ago, was a zoologist with great and clearly expressed ideas, and the following quotations may be of interest to some readers of NATURE:—

"'Metamorphosis of the Birds.' There is a metamorphosis concerning the whole life of the indivdual bird, from the moment of hatching to its death. There is further a yearly metamorphosis, culminating with the period of propagation; and a less significant diurnal change. Lastly, *there is a metamorphosis due to successive geological epochs*" (pp. 288–325).

". . . With every larger geological epoch (Erd-Revolution) some animals have perished. . . . But it seems also that after each of such revolutions new animals have been formed, mainly—I suppose—through gradual metamorphosis and alteration of the previous remaining animals into new kinds (Thierformen), caused by new climatic and physical influences" (p. 322).

". . . These fossil rests of birds testify to the age of the class of birds. But since all these remnants seem to belong to extinct kinds of birds, they can be taken as proofs that in the course of time the species is just as much subject to metamorphosis as the individual" (p. 325).

H. GADOW.

Cambridge, October 23.

The Stone Implements of the Tasmanians.

THE stone implements of the Tasmanian aborigines are frequently cited as an instance of the survival of an Eolithic assemblage into modern times. Having collected eoliths on the Kent plateau and similar chipped pieces of stone in South Africa, and having recently had the opportunity of collecting worked stones on an old camping ground of the Tasmanian aborigines, I feel impelled to make a few comments on this assertion.

The site that I visited, under the guidance of its discoverer, Mr. W. S. Smith, of Launceston, is about two miles east of that town. It is about ten acres in extent, and occupies rising ground at the side of a stream—a characteristic position, I am told. It is now sparsely strewn with flakes, among which trimmed examples are rare; formerly the reverse was the case, Mr. Smith having removed about 400 trimmed flakes. The ground was ploughed several years ago, so that a large number must be buried. Several such sites are known around Launceston, and Mr. Smith has a large collection from them. I have also examined the collection of the Rev. C. S. Wilkinson and those under the charge of Mr. H. H. Scott, of the museum. Both of these are from various parts of Tasmania, but present the same general facies as those from the neighbourhood of Launceston.

If we accept the eoliths of the Kent plateau as typical, then these Tasmanian implements are certainly not true eoliths, for instead of being made from naturally broken pieces of stone, they are made from artificially produced flakes. They are not even comparable to the flake-eoliths of South Africa, for they include examples that exhibit a neatness of edge-trimming and resultant regularity of outline that is never met with among them. At the same time the bulk of the Tasmanian implements are characterised by an unskilful trimming and irregular outline that remind one forcibly of the eoliths, while they frequently exhibit characteristic eolithic shapes. The minority remind me strongly of a prominent element in some of those South African assemblages that approach nearest to the Aurignacian.

If we eliminate the more advanced implements from these pseudo-Aurignacian assemblages, then they resemble the Tasmanian assemblage, with this difference, that in the one the Eolithic resemblances are subordinate, and in the other they are predominant.

In attempting to convey an idea of the lowly status of the Tasmanian implements by the use of European terminology, one is therefore not justified in speaking of them as Eolithic. Pre-Aurignacian would more correctly indicate their position.

J. P. JOHNSON.

Launceston, Tas., September 25.

A Further Parasite of the Large Larch Saw-fly.

MAY I be permitted to add a brief note to the letter written by Mr. Mangan, which appeared in NATURE of July 24 (vol. xci., p. 530)? In the account of the examination of the parasites that have emerged this year from cocoons collected in the Thirlmere district, it was stated that 25 per cent. of the cocoons yielded specimens of an undetermined species of Mesoleius.

Since the letter was written, this new parasite has been identified by Prof. Otto Schmiedeknecht as *Hyperablys albopictus* grav. (syn. *Mesoleius trans fuga*, Holmgr.). It is described by Mr. Morley in "Ichneumonologia Britannica," vol iv., under the name *Eurycproctus albopictus* grav. It has apparently never been hitherto recorded from *Nematus erichsonii*; it has been bred, however, by Brischke (*Schr. Nat. Ges.*, Danz., 1871) from larvæ of *N. hypogastricus* and of *N. testaceus* in Prussia, and has also been bred, probably at Worcester, from *Camponiscus luridiventris*.

This species is readily distinguished from *Mesoleius tenthredinis* by the white colour of the first and the second coxæ and the dark tint of the third. The face in the female is marked with white, and in the male the white marking present in both species is broader than in *M. tenthredinis*.

R. A. WARDLE.

Department of Economic Zoology,
Victoria University of Manchester.
November 3.

LICENCES FOR WIRELESS TELEGRAPHY.

A QUESTION of considerable importance is raised in certain correspondence which has passed between Mr. F. Hope-Jones and the Secretary to the Post Office in relation to the conditions under which the postal authorities are pre-

pared alone to issue licences, at the present time, for the installation of apparatus for the reception of wireless time signals. Since the commencement of the present year the postal authorities have commenced to charge a fee of 1*l.* 1*s.* in connection with the issue of ordinary licences for a wireless installation; a protest has been raised in some quarters to this charge, and the legality of the action of the authorities has been doubted. However, as the postal authorities have explained that the fee is charged to recoup the expenses incurred in connection with the registration of licences, no serious objection can, it is thought, be raised on a question of principle to this charge, although at first sight it seems difficult to justify so large a fee as 1*l.* 1*s.*, in respect of what is, to a great extent, merely routine clerical work.

The correspondence to which reference has been made raises, however, quite another question. The inauguration of the International Time Service on July 1 last has placed at the disposal of watch and clock makers, as well as the members of the public generally, a means of ascertaining correct time, which involves only a relatively small outlay on a simple wireless receiving set of apparatus. Before such apparatus may be installed for use it is, of course, necessary to obtain a licence from the Postmaster-General. Quite recently applications have been submitted for the necessary licence for such purposes, and in reply thereto the postal authorities have notified the applicants that the introduction of an annual royalty charge of 2*l.* 2*s.* is in contemplation in respect of such installations, and, in consequence, (briefly speaking) licences can alone be issued, provided that applicants make a deposit of 3*l.* 3*s.* (or 2*l.* 2*s.* if the fee of 1*l.* 1*s.* already referred to has been paid) pending the settlement of the question.

No indication is given in the correspondence under review of the source from which the postal authorities claim to derive the power to levy the said annual royalty. As is well known, the powers of control in respect of wireless telegraphy vested in the Postmaster-General are derived wholly from the Wireless Telegraphy Act of 1904; and, therefore, since the postal authorities are at the present time laying down a condition precedent to the grant of a licence, it seems fair to presume that the provisions of the Act of 1904 referred to are relied upon in justification of the demands now being made. It is not surprising in the circumstances that considerable resentment should have been aroused in relation to what can only be considered as an extremely arbitrary attitude on the part of the postal authorities in this matter.

It is evident that the question raised by Mr. F. Hope-Jones has a two-fold importance. In the first place, it raises a question of constitutional usage, and in the second place that of the conditions under which the development of our industries generally is to be permitted to take place under bureaucratic rule. From the constitutional aspect, the real point at issue seems to be whether it is competent for a Government Department to exercise a power of imposing taxes on the public generally, or an industry in particular, without express parliamentary authority. In the time of the Tudors and the Stuarts, the Crown did certainly attempt to exercise a power of independent legislation, in virtue of asserted prerogative by licence and dispensation, or by proclamation and ordinance. The fruit of such action was to give birth to collisions in the courts of law, with the ultimate result that, after violent struggles, the principle was clearly established that the Crown may not legislate or impose, save with the consent of Parliament; and so far as we are aware this principle remains in force at the present day.

The provisions of the Wireless Telegraphy Act of 1904 appear to leave no doubt, on the face of it, as to the intentions of the legislature in framing this measure; and it is evident that no power was, in express terms, conferred on the Postmaster-General, or his advisers, to impose anything in the nature of a tax or other annual charge. If the postal authorities, therefore, persist in their present attitude, it will become necessary to test the legality of their action before the established tribunals of the country.

On investigating the actual merits of the case, quite apart from the constitutional aspects of the situation, we feel that the attitude of the postal authorities in this matter is one requiring condemnation as being entirely opposed to the wise and generous principles which have guided public policy in matters affecting monopolies from very early times right up to the present day. The fact that the monopoly in telegraphs is vested in the State does not appear to afford a good reason for departing from the great principle that it is the duty of a Government to stimulate new industries and not to injure them. It was the recognition of the importance of this principle which in Tudor times established for us the commercial supremacy we have been enjoying for many centuries past. The fact that the postal authorities themselves have not established any system of wireless time signals of which the public may avail themselves, either openly or surreptitiously, seems in itself to afford sufficient grounds for the argument that no justification exists for the contemplated royalty charge in respect of wireless time signal installations. But another serious reason for offering resistance to the proposal lies in the possibility that Government Departments may easily extend the application of the principle on which the postal authorities appear to be acting, to the great prejudice of the public interest, if it is submitted to without protest at the present time. We are strongly of the opinion that the postal authorities are acting contrary to justice and common right, and that they are attempting to impose an unprofitable charge, calculated to do wrong to the liberty and trade of the subject. We hope, therefore, that strenuous opposition will be offered to the imposition of the proposed tax by all who are concerned with either the scientific or applied aspects of wireless telegraphy.

DR. ALFRED RUSSEL WALLACE, O.M., F.R.S.

THE death of Alfred Russel Wallace on November 7, at ninety years of age, marks a milestone in the history of biology. For he was the last distinguished representative of a type that can never be again—a combination of naturalist-traveller, biologist, and geographer, a knower of species, and yet from first to last a generaliser "inquisitive about causes," and, with all this, an investigator who stood outside any of the usual methods of analysis, with "a positive distaste for all forms of anatomical and physiological experiment." It will probably be a very long time before a biologist again rises to real distinction apart from experimental analysis in some form or other. His career and scientific work were described in these columns by Prof. H. F. Osborn in June of last year (vol. lxxxix., p. 367), and we hope to publish a further appreciation of him next week. Here, therefore, we do little more than record his death and point to some outstanding characteristics of his life.

In thinking of Wallace's contributions to science, we recall first the feverish week at Ternate, when he wrote his famous letter to Darwin, "like a thunderbolt from a cloudless sky," expounding the idea of natural selection—a letter which was communicated, along with extracts from Darwin's unpublished work, to the Linnean Society at the historical meeting on July 1, 1858. Everyone is proud of the magnanimity with which each discoverer treated the claims of the other. Their detachment from everything but getting at the truth was congruent with the nobility of both. It was indeed just what might have been expected, but there was throughout an instinctive generosity which has always appealed to the ethical imagination. Darwin's helpful friendliness was met by Wallace's devoted loyalty, which was conspicuous, for instance, when he gave his fine book of 1889 the title "Darwinism," or emphasised at the 1908 celebration the fact that the idea of natural selection had occurred to Darwin nearly twenty years before the joint paper of 1858. Well was it said of him, "Darwinii æmulum, immo Darwinium alterum."

After natural selection, one thinks of the geographical distribution of animals, and it may be justly said that this study, which has evolved vigorously in many directions in the last generation, got its modern start from Wallace's standard work (1876), which fulfilled its intention of bearing to the eleventh and twelfth chapters of the "Origin of Species," a relation similar to that which "Animals and Plants under Domestication" bears to the first. It was followed up by the more popular "Island Life," which has been a stimulus to many a travelling naturalist, and has prompted numerous investigations.

The building up of a science often reminds one of the waves making a new beach—multitudes of particular movements which are not in themselves permanent, but make others of more lasting effect possible. Perhaps the same should be said of much that Wallace's fertile mind contributed, for instance, in regard to sexual selection, concerning which he was wisely sceptical, in regard to "warning colours" and "recognition marks," in regard to the part played by instruction and imitation in the development of instinctive behaviour; and many more instances might be given. As an old man he was impatient of the recent work which centres round Mendelism and mutations, but it was a fine example of his earlier plasticity of mind that he entirely agreed with Weismann in finding the transmission of acquired characters unproved. His independence was conspicuously shown by the vigour with which he maintained in his "Darwinism" and elsewhere that the facts of man's higher nature compel us to postulate a special "spiritual influx," comparable to that which intervened, he thought, when living organisms first appeared and when consciousness began. He may have lacked philosophical discipline, but he was never awanting in the courage of his convictions. Throughout his life he was given to puzzling over difficult problems far beyond the range of biology—in economics and astronomy, in psychology and politics, and perhaps it was this width of interest in part that kept him young so long.

There was a great humanity about Alfred Russel Wallace, which won affection as surely as his services to science commanded respect. Like many hard workers he found time to be generously kind to young men; he did not suffer fools gladly, but he was always ready to champion the cause of the oppressed; he could never divest himself of his citizenship, and almost to his last breath he was thinking of how things might be made better in the State. By nature quiet, gentle, reflective, and religious, he had no ambitions save for truth and justice and the welfare of his fellow-men; he was satisfied with plain living and high thinking, with his garden, and with that "double vision" which was always with him. For, whatever we may think of his "spiritualism," it was peculiarly his—

> To see the world in a grain of sand,
> And heaven in a flower;
> To grasp infinity in the palm of the hand
> And eternity in an hour.

SIR WILLIAM HENRY PREECE, K.C.B., F.R.S.

WILLIAM HENRY PREECE was born near Carnarvon on February 15, 1834, being the eldest son of R. M. Preece. He died at Penrhos, Carnarvon, on November 6, 1913, being in his eightieth year. All his professional life had been connected with telegraphic engineering and the development of electrical engineering; and, saving for the veteran, Mr. C. E. Spagnoletti, who survives him, he was the oldest telegraph engineer in Great Britain. After completing his education at King's College, London, he entered the office of the late Mr. Edwin Clark, who was connected with pioneering work of submarine cables, and at the age of nineteen he was appointed as a junior

engineer on the staff of the Electric and International Telegraph Company, becoming later superintendent of the company's southern division. From 1858 to 1862 he acted as engineer to the Channel Islands Telegraphs, and in 1860 was appointed telegraph engineer to the London and South-Western Railway, and made Southampton his headquarters. In 1864 he married Miss Agnes Pocock, of Southampton, who died in 1874. After ten years of railway telegraph work, he became a divisional engineer under the Post Office, which was then creating a telegraphic staff to deal with the many undertakings which it was taking over from the companies under the Telegraph Act of 1870. From that time his promotion was steady. He was appointed Electrician to the General Post Office in 1877, and Engineer-in-Chief, an office of much more importance then than now, in 1892. In 1894 he was made C.B.; and he was given the honour of K.C.B. on his retirement under the age rule in 1899. Since that date until his decease he was senior partner in the firm of Preece, Cardew, and Snell, consulting engineers; though his failing health for several years past precluded him from much active participation in the responsible work of his firm.

Sir William Preece was an indefatigable worker, and one who was constantly before the public eye by reason of the lectures which he gave, the papers which he contributed to the scientific and professional bodies on telegraphic and electrical inventions, and the considerable part he played in the internal working of the professional societies. He was one of the earliest members of the Society of Telegraph Engineers (now the Institution of Electrical Engineers), to the proceedings of which he made numerous contributions. Its earliest volume (1871–2) contains a lecture which he gave to Postal Telegraph Engineers on the advantages of scientific education, and reports a discourse on the rise and progress of telegraphy, which he gave at the Albert Hall on June 18, 1872. During the next dozen years his contributions to the meetings and journal of the Society of Telegraph Engineers were numerous, and ranged from such topics as shunts, and the winding of electromagnets, to the then newly invented phonograph of Edison. He was President of the Society in 1880, and again in 1893, after its reconstitution as the Institution of Electrical Engineers, to which body he contributed later several papers on telegraphy and electric lighting.

Sir William Preece took a great interest in the early development of the telephone, and gave papers on it to the Physical Society and the Society of Arts, and to the British Association during several successive years. In 1888 he was President of the Mechanical Engineering Section of the British Association at Bath. He read several papers also before the Royal Society in connection with telephone and photophone; also on the effects of temperature on the electromotive forces and resistances of batteries; on a standard of light; and on studies in acoustics; the last-named in conjunction with Mr. Stroh. He was elected a Fellow of the Royal Society in 1881, and served on the Council of that body from 1887 to 1889. He made several communications of importance to the Institution of Civil Engineers on submarine cables, and on various points in the use of electricity on railways, including intercommunication between passengers, guards, and drivers of trains in motion. He delivered the "James Forrest" lecture on the relations between electricity and engineering, and in 1889 became President of the Institution. To the Society of Arts he gave a number of papers and lectures on electric lighting, and on electrical exhibitions, and delivered a set of Cantor lectures in 1879. He was chosen Chairman of the Council of the Society of Arts for the year 1901–2. He took out patents in his earlier career for various inventions in connection with duplex telegraphy and railway signalling. As a lecturer he excelled, having a good delivery and a power of presenting matters in a simple and practical way. His lecture in 1878 on electric lighting at the Albert Hall, during the height of the electric lighting fever, will not be readily forgotten by his hearers; while his discourses at the Royal Institution, where he expounded various recent developments in electric lighting, telephony, and telegraphy, were always welcomed by a crowded audience.

Sir William Preece will probably be best remembered in after time by the pioneering work he carried out for a number of years on the subject of telegraphy without wires, experimenting as he did by conductive and inductive methods across arms of the sea, such as the Bristol Channel or the Solent, or from land to lighthouse, or between coal mines. To this work he had been attracted by observations of the stray currents which, on the establishment of telephonic circuits in London in 1884, were found to disturb even well-insulated lines. In 1892 he was able to send inductive messages across the Bristol Channel between Penarth and the Flat Holm, a distance of more than three miles. In 1895 he established temporary wireless communication between the Island of Mull and Oban, during an interruption of the cable connecting them, before a cable-repairing ship could arrive. Strange to say, he entirely missed the significance of the wireless signalling by Hertzian waves that was shown by Oliver Lodge at the British Association meeing at Oxford in 1894; and yet when Signor Marconi arrived upon the scene in 1896, using the same method and the same devices of oscillators, spark-gaps, coherers, and tappers, Sir William Preece received him with open arms, and put the resources of the Post Office at his disposal, with results known to all the world.

Sir William Preece wrote several valuable text-books—one on telegraphy in conjunction with Sir James Sivewright, and two on the telephone.

Sir William's work at the Post Office during the strenuous years of the development of the national telegraphic system out of the conflicting systems of rival companies, is a record

of honest work conscientiously performed. As Chief Engineer he enjoyed the confidence of successive Postmasters-General, and his attainments and qualifications raised the prestige of that post. It is a deplorable circumstance that since he quitted it, the post of Chief Engineer has been degraded and circumscribed, so that now the occupant of what should be a post of dignity and independent technical responsibility can only approach the Postmaster-General through secretaries or other non-technical officials, and is not even master over the technical men in the Post Office Department. This could never have occurred in the days when Sir William Preece was Chief Engineer; his efforts to secure adequate recognition for the scientific and technical side of telegraphic work were persistent and successful during the term of his administration. That he had the courage of his opinions all who knew him intimately are well aware; yet even in his severest contentions with opponents he bore no malice. A foreign "inventor" who had trifled with him he indignantly showed to the door; a deserving subordinate who had some technical improvement to suggest found in him a sympathetic listener. Doubtless he had the defects of his qualities. His entire inability to appreciate the work of Oliver Heaviside is inexplicable in view of the stress he laid at times upon the need for technical men to study abstract theory. Genial, cheery, thorough, industrious to the last degree, Sir William Preece's name and memory will long be cherished. An excellent portrait of him by Miss Beatrice Bright adorns the walls of the Institution of Civil Engineers. He held the distinction of Officier in the Légion d'Honneur, and was a Doctor of Science of the University of Wales. S. P. T.

NOTES.

THE President of the Board of Education has appointed Dr. Aubrey Strahan, F.R.S., to be Director of the Geological Survey and Museum, in succession to Dr. J. J. H. Teall, F.R.S., who will retire from the post on January 5 next.

MR. AUSTEN CHAMBERLAIN has received from the Secretary of State for India a contribution of 500*l.* towards the fund for the enlargement and endowment of the London School of Tropical Medicine. The fund now amounts to 71,276*l.*

AT the annual meeting of the Challenger Society, held on October 29, Sir John Murray, K.C.B., in the chair, the following officers were elected for the ensuing year:—*Secretary,* Dr. W. T. Calman; *Treasurer,* Mr. E. T. Browne; *Committee,* Prof. E. W. MacBride, Messrs. D. J. Matthews and C. Tate Regan.

AT Dijon on November 9 the centenary was celebrated of the discovery of the element iodine by the French chemist, Bernard Courtois, who was a native of Dijon. Prof. Camille Matignon, professor of mineral chemistry at the Collège de France, gave an address on the history of iodine and its identification as an element. A commemorative tablet is to be placed on the house, 78 rue Monge, Dijon, where Courtois was born.

IT is announced that the Swedish Academy of Sciences has decided to award this year's Nobel prize for physics to Prof. Kamerlingh Onnes, of Leyden, and the prize for chemistry to Prof. A. Werner, of Zurich. Each prize is worth about 7880*l.*

THE next annual meeting of the Iron and Steel Institute will be held on Thursday and Friday, May 7 and 8, 1914. By the kind invitation of the Comité des Forges de France, the autumn meeting next year will be held in Paris, on Friday and Saturday, September 18 and 19. The first half of the following week will be devoted to excursions to the chief iron mining and manufacturing districts of France. The Bessemer gold medal for 1914 will be awarded to Dr. Edward Riley.

THE death is announced on November 10, at fifty-seven years of age, of Dr. R. D. Sweeting, Senior Medical Inspector of the Local Government Board. Dr. Sweeting was for twenty years hon. treasurer of the Epidemiological Society of London, afterwards becoming fellow of the Royal Society of Medicine and vice-president of the Epidemiological Section. In 1890 he joined the Medical Department of the Local Government Board, of which he had served as temporary inspector during the Cholera Survey of 1885–6.

ON the recommendation of the committee on the award of the Hodgkins prize of 300*l.* for the best treatise on the relation of atmospheric air to tuberculosis, which was offered by the Smithsonian Institution in connection with the International Congress on Tuberculosis, held in Washington in 1908, the institution announces that the prize has been equally divided between Dr. Guy Hinsdale, of Hot Springs, Virginia, for his paper on tuberculosis in relation to atmospheric air, and Dr. S. Adolphus Knopf, of New York City, for his treatise on the relation of atmospheric air to tuberculosis.

THE following is a list of those who have been recommended by the president and council of the Royal Society for election into the council at the anniversary meeting on December 1:—*President:* Sir William Crookes, O.M. *Treasurer:* Sir Alfred Kempe. *Secretaries:* Sir John Bradford, K.C.M.G., and Prof. A. Schuster. *Foreign Secretary:* Dr. D. H. Scott. *Other Members of the Council:* The Right Hon. A. J. Balfour, Prof. W. M. Bayliss, Dr. F. W. Dyson, Dr. H. J. H. Fenton, Prof. W. Gowland, Dr. F. G. Hopkins, Sir Joseph Larmor, Prof. C. H. Lees, Prof. E. W. MacBride, Prof. G. Elliot Smith, Prof. J. Lorrain Smith, Sir John Thornycroft, Prof. W. W. Watts, Mr. A. N. Whitehead, Mr. C. T. R. Wilson, and Dr. A. Smith Woodward.

A TABLET to the memory of Capt. L. E. G. Oates, of the 6th (Inniskilling) Dragoons, who lost his life in the Scott Antarctic Expedition, has been erected by his brother officers in the Parish Church of Gestingthorpe, Essex, where his family reside, and was unveiled on November 8. The tablet bears the following inscription:—"In memory of a very gallant

gentleman, Lawrence Edward Grace Oates, Captain in the Inniskilling Dragoons. Born March 17, 1880. Died March 17, 1912. On the return journey from the South Pole of the Scott Antarctic Expedition, when all were beset by hardship, he, being gravely injured, went out into the blizzard to die, in the hope that by so doing he might enable his comrades to reach safety. This tablet is placed here in affectionate remembrance by his brother officers. A.D. 1913."

THE death is announced, at the age of seventy-seven, of Dr. J. P. Kimball, of Cody, Wyoming. After pursuing scientific studies in America and Germany, he was appointed geologist on the Wisconsin and Illinois State Surveys. He was occupying the chair of chemistry and economic geology in the New York Agricultural College when the Civil War broke out. He took part in that conflict as captain and assistant adjutant-general, and at the end of the war was breveted major for "gallant and meritorious services" in the Wilderness campaign. He then engaged in mining practice for several years. From 1874 to 1885 he was honorary professor of geology at Lehigh University, and from 1885 to 1888 he was director of the Mint at Washington. His later years were spent in the west, where he did considerable pioneer work upon the glaciers and mining fields, and contributed largely to American and foreign technical journals.

IT is announced that the Postmaster-General has appointed a committee to consider how far and by what methods the State should make provision for research work in the science of wireless telegraphy, and whether any organisation which may be established should include problems connected with ordinary telegraphy and telephony. The names of the members of the committee are as follows:—The Right Hon. C. E. H. Hobhouse, M.P. (chairman), the Right Hon. Lord Parker of Waddington, Sir Joseph Larmor, M.P., F.R.S., Sir Henry Norman, M.P., Dr. R. T. Glazebrook, F.R.S., Mr. W. Duddell, F.R.S., Mr. R. Wilkins, C.B., Rear-Admiral E. F. B. Charlton, R.N., Sir Alexander King, K.C.B., Mr. W. Slingo, Commander F. Loring, R.N., Major the Hon. H. C. Guest, M.P., and Commander J. K. Im Thurn, R.N.

THE Royal Society of Arts will commence its 160th session on November 19 with an address by the chairman of the council, Col. Sir Thomas H. Holdich. Before Christmas there will be four meetings, besides the opening meeting. The first of these will be devoted to a paper by Dr. Chalmers Mitchell, on zoological gardens; the second to a paper by Mr. John Umney, on perfumery. At the third, Mr. Thorne Baker will read a paper on applications of electricity to agriculture, and at the last meeting before Christmas, the question of the Channel Tunnel will be brought forward by Mr. Arthur Fell, M.P. There will be five courses of Cantor lectures. The first, by Prof. Coker, on the measurement of strains in materials and structure, will comprise, amongst other matters, the results of his own investigations into the application of polarised light to the measurement of stresses. The second course will be by Sir Charles Waldstein, who will deal generally with the subject of industrial art; the third by Mr. Joseph Pennell on artistic lithography. The subject of the fourth course will be announced later. The last will be by Mr. William Burton on recent developments in the ceramic industry. A course of juvenile lectures to be delivered as usual during the Christmas holidays will be given by Mr. Howgrave Graham, and will deal in a popular way with the subject of wireless telegraphy.

AT the meeting of the Royal Geographical Society the medals awarded by the society and by the Italian Geographical Society to officers and men who took part in Capt. Scott's Antarctic Expedition of 1910–13 and to relations of those who lost their lives in the expedition were presented. The Italian Ambassador presented to Lady Scott the gold Humbert medal which bore the inscription:—"Alla memoria di Robert F. Scott, R.N, Giunto Secundo al Polo Australe Suggella Colla Morte La Verità della Scoperta, 1913." The replicas in silver bore an inscription in Italian to the memory of Capt. Scott's "companions in glory and martyrdom," and were presented to Mrs. Wilson, Mrs. Oates, and Mrs. Bowers. The widow of Petty Officer Evans was not present, and the medal is to be sent to her. Lord Curzon, president of the society, presented the society's special Antarctic medal to the ladies and to Commander Pennell, R.N., Commander Bruce, R.N.R., Staff-Paymaster Drake, R.N., Lieut. Renwick, R.N., Surgeon L. Atkinson, R.N., Surgeon Levick, and to the following members of the scientific staff:—Mr. Griffith Taylor, Mr. Frank Debenham, Mr. Charles Wright, Mr. Raymond Priestley, and Mr. Apsley Cherry-Garrard. Commander V. Campbell was not present, and the medal is to be sent to him. The medal has on the obverse the inscription:—"British Antarctic Expedition, 1910–13. Captain R. F. Scott, C.V.O., R.N., Commander," and on the reverse:—"Presented by the Royal Geographical Society for the Antarctic Discovery, 1913."

AN interesting paper was read at the Royal Geographical Society on Monday, November 10, by Mr. Raymond Priestley, on the experiences of the northern party during Capt. Scott's last Antarctic Expedition. This party had been organised under the command of Lieut. Campbell in order to explore King Edward's Land, which it was unfortunately unable to reach owing to the heavy pack-ice. It accordingly adopted the alternative mission entrusted to it by Capt. Scott, and landed at Cape Adare. It thus became the northern party. As its supply of mutton was condemned immediately after landing at Cape Adare, the party was compelled to rely for meat on seals and penguins—an experience which possibly saved them the following winter. The hope of a long sledge journey to the west was frustrated by the bad condition of the sea ice, and the party therefore undertook a detailed survey of Robertson Bay. In January, 1912, the *Terra Nova* returned from New Zealand and transferred the party to the neighbourhood of the Drygalski glacier, and there the six members were landed with only stores for the summer. This

district Mr. Priestley regards as of especial interest, but the paper was confined to an account of the adventures and life of the party during the following winter. Owing to the failure of the steamer to return they had to live through the winter on an island which they have named Inexpressible Island; they excavated chambers in the snow, and their food consisted of a scanty supply of seals and penguins. The experiences of this party were unique in the Antarctic, and the fact that, in spite of their sparse supply of food, they were able to live through the winter without the loss of a single man reflects the highest credit on their ingenuity and judgment. As was expected years ago, this coast is subject to strong westerly winds, which added greatly to the discomfort of the explorers. In the spring of 1913 the party sledged down the coast, found one of Taylor's food depôts, and crossed McMurdo Sound to the headquarters. Mr. Priestley regards the risks run by this party during both seasons as unduly great. He remarks of one experience, "this is the sort of thing that does not happen twice without disaster."

NEWS was received at the latter part of last week announcing the death, on November 4, at Leyden, at the age of sixty-nine, of Dr. Fredericus Anna Jentink, director of the Rijks Museum van Natuurlijke Historie, commonly known as the Leyden Museum. Dr. Jentink's connection with the museum of which he eventually became the head was a long one, dating, we believe, at least from the 'seventies. Throughout his scientific life the deceased naturalist devoted such time as could be spared from his other duties to systematic work on mammals, one of his earlier important efforts in this direction being the catalogue of mammalian osteology in the Leyden Museum, published in 1889, which was followed by a catalogue of the entire collection of mammals, issued three years later. African mammals early attracted much of his attention; and his name is perpetuated in connection with one of the two largest species of duikerboks, or crested antelopes (*Cephalophus jentinki*). The Dutch possessions in the Malay Archipelago and Papua were, however, the means of affording to Jentink exceptional and unrivalled material for extending our knowledge of the mammalian fauna of those regions, this being especially the case in regard to the Papuan islands, from which a large number of new generic and specific types were described by him. As a climax to this work, particular value attaches to the summary of the whole mammalian fauna of Papua given by Jentink in his "Nova Guinea," if for no other reason than as showing the enormous advances which have been made in our knowledge of this subject since the appearance of Dr. Wallace's "Geographical Distribution." But his administrative and other official duties, in addition to the large amount of work he accomplished on mammals, by no means sufficed to exhaust the energies of Dr. Jentink, for after the issue of the first volumes, which commenced in 1879, he undertook the editorship of "Notes from the Leyden Museum," a task which he continued, we believe, to the end. The amount of valuable information with regard to the zoology of the Eastern Archipelago contained in the long series of volumes bearing that title is known to every worker.

THE October number of *Science Progress* contains an editorial article in which the necessity for a "serious stocktaking in the business affairs of science" is emphasised, and united effort is advocated to "insist that proper attention be paid to science, that disabilities be removed, and that enough means be provided." In a striking phrase it is pointed out that "science has now become an industry. It has indeed become the premier industry of all," and the great necessity is to see that this industry is properly organised. "Men of science are apt to think that their duties extend to no more than investigation," but they must also attend to the means by which great investigation is to-day rendered possible; "the scientific education of the individual and the national encouragement of scientific work." The political importance for scientific research is emphasised: "it gives hegemony to the nations which possess it and leaves nations, like individuals, which do not possess it in a backwater of failure and poverty."

IN the September issue of *The Journal of Economic Biology*, Prof. F. V. Theobald completes his revision of the British species of Macrosiphum, the genus of Aphidæ usually known as Siphonophora, and including some familiar "greenfly" pests of rose, pea, and other cultivated plants. The distinctive structural characters of each species are clearly figured, and the paper cannot but be useful to students of this important and interesting group.

THE recently issued vol. ix. of the *Fortschritte der naturwissenschaftlichen Forschung* contains an interesting summary by Dr. C. Wesenberg-Lund of our knowledge of the dwellings, in the form of burrows or built-up "houses," constructed by fresh-water insects. Noteworthy are his own recent observations of the tunnelling habits of larvæ of Libelluline and other European dragonflies, paralleled by the researches of B. J. Tillyard on the Australian *Petalura gigantea*. There are also illustrated notes on the form and arrangement of tubes made by larval Chironomus, Orthocladius, Tanytarsus, and other midges. As might be expected, the greater part of the review is devoted to the architecture of the caddis-worms (Trichoptera) among which the detailed account, with drawings, of the nets constructed by Hydropsychid larvæ for catching their minute aquatic prey will be found especially interesting.

MR. H. F. WITHERBY, editor of *British Birds*, informs us that the readers of that magazine have now placed more than 32,000 rings on wild birds of many kinds. This work is leading to results of great interest and importance in connection with the study of birds, and a remarkable case of a swallow ringed in Ayrshire being recovered in Orange River Colony is described in the November number. Mr. Witherby has received a letter from Mr. A. C. Theron, dated from "Riet Vallei, District Lindley, O.F.S.," stating that a swallow bearing a ring with his name and address was captured at Riet Vallei on March 16,

1913. This ring was placed on a nestling swallow by Mr. R. O. Blyth, at Skelmorlie, Ayrshire, on July 27, 1912. A few months ago an adult swallow ringed in Staffordshire was recorded as having been captured near Utrecht, Natal, in December, and the present record is from about one hundred and fifty miles west of that place, which is not far in comparison with the total length of the journey. Mr. Witherby adds:—"In writing of the Natal record I expressed surprise that a swallow breeding in the far west of Europe should migrate so far east in South Africa, but now that Dr. Hartert has shown by his observations in the middle of the Sahara that deserts are not necessarily a bar to the passage of migrating birds, as was formerly supposed, it may perhaps be presumed that these swallows take a more direct line than one would previously have thought possible."

THE monthly meteorological chart of the North Atlantic for November (first issue), published by the Meteorological Office, contains daily maps showing the distribution of air-pressure, wind, &c., for October 10-16. These exhibit at the beginning of that period low-pressure systems extending from beyond the Great Lakes' region of North America to Central Asia. The central area of the most important of these disturbances lay near latitude 53° N., longitude 27° W. It was in the heavy gales associated therewith that the ill-fated steamship *Volturno* was abandoned on October 10, near latitude 48° N., longitude 34° W. (see NATURE, October 16). The Meteorological Office report states that the effects of the storm were felt in a modified degree on the western coasts of the British Islands, the wind reaching gale-force at a few exposed points.

SOME interesting observations that promise to throw a much-needed light upon several problems in the later geological history of Northumberland and Durham were described at the opening meeting of the Northumberland Coast Club by Mr. S. Rennie Hazelhurst. Mr. Hazelhurst has found in natural and artificial exposures at the mouth of the Tyne a series 25 ft. thick of gravels, sands, clays, and loams containing well-preserved plant remains. They are traceable over an area of about a square mile, and reach an altitude of 100 ft. above the sea. The suggestion is made that they mark the site of a post-glacial lake which is regarded as exceeding in magnitude any similar lake recognised by its deposits in any other part of these islands—a claim that can scarcely be maintained in view of Fox Strangways's description of Lake Pickering. The details so far published of Mr. Hazelhurst's observations make no mention of their bearing upon the question of the alleged raised-beaches on this coast. The local geologists are unanimous in asserting the existence of a well-preserved raised beach in Northumberland and Durham at about 150 ft. above sea-level, but most outsiders regard the features as of glacial origin. A lake at 100 ft. O.D. at the mouth of the present Tyne may have preceded, or succeeded, the period of supposed submersion, and in either case the relations of the two conditions may furnish decisive arguments for or against the hypothesis of the beaches.

IN "Mendelism and the Problem of Mental Defect" (London, Dulau and Co., Ltd., 1913) Dr. David Heron enters into a lengthy and elaborate criticism of some of the work of the American Eugenics Record Office. In particular the theory that feeble-mindedness is caused by the absence of a mendelian factor, and therefore behaves when inherited as a simple recessive character is shown to be unfounded. The care and thoroughness with which Dr. Heron has performed the task of writing sixty-two pages of destructive criticism are worthy of high praise; but if, as he anticipates, "jealousy of the work of another laboratory" is assigned by some as his motive for doing something so unusual, he will only have himself to thank. For the whole pamphlet is written in a highly provocative way, and seems, intended, so far as possible, to wound the feelings of the head of the Eugenics Record Office, who is responsible in one way or another for most of the work criticised.

IN the August number of *Le Radium*, M. de Broglie gives the results of his observations of the interference patterns produced on photographic plates by Röntgen rays reflected from the surfaces of crystals. He finds that the positions of the spots obtained by reflection from various crystals of the cubic system are identical, but that the intensities are characteristic of each crystal. The effect of temperatures from that of liquid air to a red heat is slight, a diminution being just perceptible at the highest temperature. Magnetic fields of strengths up to 10,000 appear to have no effect on the patterns. M. de Broglie directs attention to the close similarity between the patterns produced by reflection of Röntgen rays from the surfaces of crystals and the patterns produced by transmitting light through two crossed diffraction gratings. As a general rule each spot shows a number of bands which the author attributes to the presence in the crystal close to the surface of incidence of regions in which the orientation of the crystalline elements varies slightly.

WE have received from Messrs. Watson and Sons, Ltd., specimens of a new optical glass, called "Spectros." Specialists have long desired a glass which would absorb (or cut out) the harmful or irritant ultra-violet rays, but which would at the same time allow the ordinary visual rays to pass unhindered. Hitherto the only lenses employed for this purpose have been made of the dark smoked or coloured glass so often seen; but unfortunately this glass not only absorbs the visual rays to a large extent but also fails to cut out the ultra-violet rays. "Spectros" glass, as it absorbs the ultra-violet and part of the red, is of a green colour, and is made in six distinct tints. The first is so light as to be practically unnoticeable—this is used for reading glasses—especially by artificial light. The other tints are used as occasion may require, and the deepest only in severe cases of ophthalmia, snow-blindness, &c. Few people recognise the harm done to eyes by the ultra-violet light present in bright electric illumination, especially by

arc lamps, and on snow surfaces at a great elevation when the absorption of the atmosphere is reduced. Snow-blindness and its concomitants are due to this cause. Examined by a prism it is seen that by this "Spectros" glass all the ultra-violet light is stopped, while that in the central portion of the spectrum is allowed to pass; there are no absorption bands. Microscopists may find the use of various thicknesses or prisms of this glass an advantage in their work.

PROF. A. M. WORTHINGTON has contributed a very valuable paper on multiple vision with a single eye to vol. vi. of the Proceedings of the Royal Society of Medicine. The cause of monocular diplopia and polyopia has hitherto been considered rather obscure by ophthalmologists, who have usually contented themselves with the view of Donders that "the polyopia arises from the fact that each of the more or less regular sectors of which the eye is structurally built up forms a separate image." This explanation fails to cover the fact that even widely separated images of an object seen out of focus are at once accurately superposed, when the error is corrected by means of a suitable lens (spherocylindrical if necessary. The main value of the paper is the production of direct experimental evidence that similar multiple images are formed on a photographic plate when the lens of the camera is obscured by a spattering of black plasticine. This is a confirmation of Ruete's explanation in 1853 that polyopia was due to irregularities and opacities on the surface of the lens. Prof. Worthington has succeeded in obtaining a well-marked polyopia, or rather a multiude of images, by putting a thin layer of a dilute solution of canada balsam on a clean lantern slide. This is a very fair representation of the normal irregularities on the anterior capsule of the lens of the eye, and it will be found that, if the object be fine enough and sufficiently brightly illuminated. any eye when a little out of focus will exhibit this phenomenon, which indeed may be considered as a variation of Scheiner's experiment when an object is viewed through a card pierced by a great number of pinholes. The illustrations which accompany the paper are excellent.

THE address of Mr. A. G. Lyster, president of the Institution of Civil Engineers, was delivered on November 4. Mr. Lyster dealt with the constitution of port authorities as affecting the organisation and development of ports, a subject to which he brought his long experience derived in the port of Liverpool. Such authorities should be bodies capable not only of bringing special commercial knowledge and sound judgment to bear on problems with which they have to deal, but also able to take a broad view of their responsibilities and to recognise that national and imperial, as well as local interests, are involved in the successful administration of their charge. The ownership and management of docks and harbours may be grouped as (*a*) private, (*b*) public dock companies, (*c*) railway companies, (*d*) municipal corporations, (*e*) trusts or commissions, (*f*) governments. The constitution of these variously governed ports has not been based on any common standard of suitability; the adoption of a variety of systems has the merit of arriving by experience at a practical determination of their relative utility. Mr. Lyster pronounces adversely on municipal control; some of our largest ports, such as Liverpool, Glasgow, and Dublin, were under municipal control in their early stages, and it was deemed expedient to convert them into trusts, or, in the case of London, to sell the City's interest to dock companies. It is difficult to see how the essentials required of a body to manage successfully a port can be obtained under Government control. The responsible authorities in this case are remote in every sense of the word from those whose interests are involved. Under an efficient system there ought to be close connection between the management and the whole commercial interests of the port. The trust system has recommended itself to the people of this country as best suited to their largest and most important ports.

WE have received the October number of "Lewis's Quarterly List of New Books and New Editions added to the Technical and Scientific Circulating Library." It contains the books which have been published and added to the library during the months of July, August, and September. The first part of the list is occupied with the additions to the medical side of the library, while in the second, under the general heading "Scientific," will be found those on such subjects as chemistry, engineering, metallurgy, motor-cars, technology, &c. Short notes are given to the more important works, and the list should be useful to students and others wishing to see what has appeared during the months included on any subject in which they are interested.

THE 1914 issue is now available of the "Nature Calendar," published by Messrs. G. Philip and Son, Ltd., at the price of sixpence net. The special notes for the months of 1914 deal with problems of nature-study suitable for continuous observation. The calendar is eminently adapted for exhibition on the walls of schoolrooms and natural history club-rooms, where nature-study is taken up in a practical manner.

OUR ASTRONOMICAL COLUMN.

COMET 1913*d* (WESTPHAL).—This very interesting periodic comet of 1852 IV. is likely, according to *The Observatory* for November, to be visible for several months, and that journal publishes an ephemeris up to the middle of January, in continuation of that given by Prof. Kobold. This ephemeris is computed with slightly different elements, and a portion of it is as follows:—

Greenwich, Midnight.

	R.A.	Dec. N.
	h. m. s.	° ′
Nov. 17 ...	20 31 51 ...	34 8
21 ...	32 28 ...	36 20
25 ...	33 54 ...	38 25
29 ...	20 35 56 ...	40 27

The comet is about magnitude 8·7, and is situated in the constellation of Cygnus.

EUROPIUM IN STELLAR SPECTRA.—In this column for October 2 reference was made to the striking variations in the spectrum of α Canum Venaticorum discovered by Prof. Belopolsky. The full account of his

observations was published in the *Bulletin de l'Académie Impériale des Sciences de St. Petersbourg* (April 24, 1913). In the current number of *The Observatory* (November) Mr. F. J. M. Stratton gives an account of the work of Belopolsky on this star, and Mr. F. E. Baxandall contributes a communication on the chemical origin of certain of the spectrum lines. Some of the conspicuous lines in the spectrum of this star which underwent periodic changes were those at λλ4130·04 and 4205·20, lines of unknown origin. Mr. Baxandall has now identified these lines as two very strong lines of Europium, and the evidence is the more convincing as the other lines of Europium in the region of the spectrum photographed by Belopolsky are found also to be represented. Two other strong lines of Europium are just outside the photographed region of the star, and, as Mr. Baxandall points out, it would be of very great interest to know whether these lines are represented also. The presence of Europium lines in stellar spectra has previously been suggested by Mr. Lunt in the case of Arcturus, and Dr. Dyson and Mr. Jewell have identified them also with weak lines in the spectrum of the chromosphere.

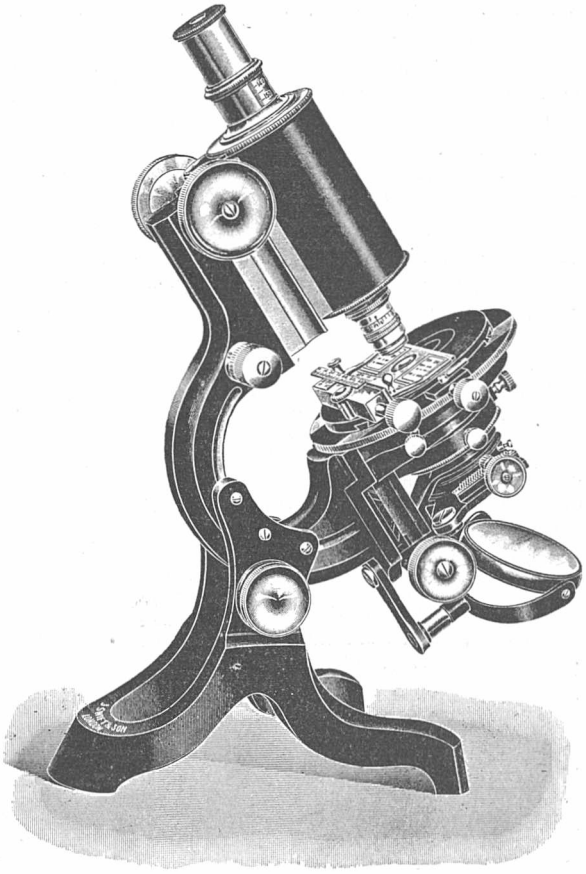
RADIAL VELOCITIES WITH THE OBJECTIVE PRISM.—The problem of obtaining radial velocities by means of the objective prism is one that needs urgent solution, and few practical workers have as yet taken the subject up. Dr. Frank Schlesinger sums up in a very interesting way the state of the problem to-day (Proc. Amer. Phil. Soc., vol. lii., No. 209, April, 1913), and stellar spectroscopists will no doubt be glad to have their attention directed to this paper. He reviews three methods of procedure, all of which, he says, warrant a trial, but he thinks that the process involving an absorptive medium to produce one or more narrow and sharp absorption bands, such as neodymium chloride, would probably lead to immediate results provided a moderate degree of precision is only wanted. Dr. Schlesinger's remarks apply chiefly to the spectra of stars fainter than the fifth magnitude, for the brighter stars are well dealt with by means of slit spectroscopes, instruments which only utilise a very small percentage of the light which falls on the slit plate.

SOLAR ACTIVITY AND CYCLONES.—In addition to the detailed observations of the meteorological elements for the year 1912, No. 2 of the Annals of the Observatory of Montserrat, Cuba, contains a study of the synchronism between solar activity and the hurricanes of the Antilles, by the director, Father Simón Sarasola, S.J. It appears that each of the last four sun-spot minima was followed by minima of cyclonic activity. Further, it is stated that maxima of cyclonic and solar activities do not coincide, although cyclones are frequent and violent about the time of a maximum of sun-spots. The dates given show a minimum of cyclonic activity in the year 1884, thus almost coinciding with a spot maximum.

MICROSCOPE STANDS AND OBJECTIVES.

WE have received from Messrs. Swift and Son their catalogue of microscopes and accessories. The microscope stands listed are of varying degrees of complexity suited to the requirements and pockets of all classes of microscopists. The higher priced stands all have centring substage condensers, and are fitted with the "improved climax" fine adjustment. This is constructed with an accurately cut micrometer screw with graduated drum fixed horizontally parallel to the coarse adjustment, and with milled heads on either side of the pillar. The adjustment automatically ceases to act should the objective touch the coverglass. The "Premier," first constructed to the specification of Mr. J. E. Barnard, for the bacteriological department of King's College, London, is one of the most perfect stands we have seen (see figure). It is swung on an arc on the "Wales" principle; the body-tube is of wide diameter, adapted for use with wide-angled photographic lenses, and is provided with two graduated draw-tubes, one of which is actuated by a rack and pinion. The substage has centring screws, and the iris diaphragm can be racked eccentrically and rotated, so as to allow of the use of light of any azimuth, and can be swung out of the optic axis independently of the condenser.

A full series of apochromatic objectives, of which Messrs. Swift are the sole British makers, is also listed, and we have had the opportunity of examining two of the 1/12 in. oil immersions with numerical aperture of 1·4. Tested with a Zeiss apertometer, one



of these lenses was found to come up to 1·4, the other was slightly less—1·37. With both lenses the image was free from colour, and the definition excellent, even with the higher-power compensating oculars, and both lenses compare very favourably in all respects with similar lenses of other makers at double the price. We think it would be an advantage if the tube-length were engraved on the mounts of these lenses.

CHEMISTRY AT THE BRITISH ASSOCIATION.

THE chemical section was well supported throughout the meeting both by chemists and by the general public. The programme was a varied one, appealing both to the specialist and to the public generally. In particular, the discussion on fuel was of extreme importance, and it was evident that though

there is far too much apathy on this question among men of science and the general public, yet a great deal is being done on scientific lines to effect greater efficiency in the utilisation of fuel. Probably nothing but economic pressure will make the public at large abandon the present wasteful methods which were indicted by Prof. Armstrong. A minor feature of the meeting was the number of chemical papers read in other sections: this is an inevitable consequence of the splitting up of the sections of the association during the last decade. The spread of chemistry is satisfactory, if it be regarded as a sign of the growing appreciation of the subject by biologists and others; but, on the other hand, it leads to statements being made and accepted without comment which would be criticised drastically by an audience of chemists.

The section welcomed Prof. Feist (Kiel), Prof. Sörensen (Copenhagen), and Prof. Tschugaeff (St. Petersburg) at its meetings, and had the pleasure of entertaining them to dinner on the Saturday evening.

After Prof. W. P. Wynne had delivered the presidential address on substitution, Mr. P. K. Dutt gave a brief account of work carried out with Prof. J. B. Cohen on the progressive bromination of toluene in which the orienting effect of the various mono- and di-halogen compounds has been studied; the results were contrasted with those obtained by chlorination.

Dr. R. S. Morrell described his recent work on the saturated acids of linseed oil which he has identified as stearic acid and palmitic acid with a trace of oleic acid. The great difficulty experienced in the quantitative separation of the fatty acids was emphasised. In a discussion of the paper, attention was directed to the necessity from the biological point of view of a more complete study of the fatty acids.

Dr. Tinkler made a communication on a series of mixtures of nitro compounds and amines which are coloured only in the liquid state, which he illustrated experimentally. Mixtures of diphenylamine with certain nitro compounds give solutions which are coloured at one temperature but become colourless on cooling. Thus a mixture of diphenylamine and parachloronitro-benzene acquires a reddish-yellow colour when held in the hand, and loses this colour when the temperature falls. The colour is considered due to the combination of nitro-compound and amine in the liquid state only. Various physico-chemical investigations of the fused mixtures were undertaken.

Mr. E. Vanstone dealt with the influence of chemical constitution on the thermal properties of binary mixtures of benzoin with other organic compounds which had been studied by the usual methods of thermal analysis.

A short paper by Mr. H. Ehrhardt established the fact that anthranilic acid is formed by the decomposition or over-reduction of indigo in the bisulphite-zinc-lime vat. Some remarks on the influence of the presence of gas upon the inflammability of coal-dust in air by Prof. W. M. Thornton completed the day's programme.

Optical Properties.

The morning of Friday, September 12th, was devoted to a series of papers dealing with the significance of optical properties. The first, by Dr. R. H. Pickard and Mr. J. Kenyon, concerned the optical rotatory powers and dispersions of the members of some homologous series of organic compounds. More than one hundred optically active compounds belonging to ten such series have been synthesised. Although they possess simple and closely related constitutions, no numerical relationship between their rotatory powers has yet been detected. Well-marked regularities are shown which are more or less common to all the series. A comprehensive account of the present state of the knowledge of optical activity was given by Dr. Pickard.

Rotatory dispersion was the subject of Dr. Lowry's paper. Formerly measurements of optical rotation were made with the light of one wave-length only, but it is necessary to make them over a range of wave-lengths, especially in the case of substances which exhibit anomalous rotatory dispersion. The methods of measuring rotatory dispersion have been greatly simplified by Dr. Lowry, so that they present no difficulty. Use is made of the green and violet mercury lines, of sodium and lithium, and also of the red and green cadmium lines. The curve of rotatory dispersion for organic liquids was shown to have an extremely simple form. It is expressed by the equation

$$\alpha = \frac{K}{\lambda^2 - \lambda_0^2}$$

where K is the rotation constant and λ_0^2 the dispersion constant for the substance. If α is plotted against λ_0^2, the curve is a simple rectangular hyperbola. If $1/\alpha$ is plotted against λ^2, the curve becomes a straight line.

Prof. L. Tschugaeff followed with a paper on anomalous rotatory dispersion, of which there are three different types. These were dealt with by the reader at some length. The shape of the dispersion curve is largely influenced by constitutive factors, the whole curve resulting from the superposition of several partial curves. The relative positions of the centres of activity and of the chromophor groups within the active molecule are of much influence. The influence of varying factors on the rotatory dispersion of the optically active xanthates was compared with that of the tartrates. There is an intimate analogy in the origin of the anomaly in both cases.

Prof. P. F. Frankland directed attention to another part of the subject, namely, the so-called Walden inversion. He gave an account of researches carried out with W. E. Garner to determine the nature of the action of thionyl chloride on lactic acid and ethyl lactate. In each case the action was very complicated, but the investigation is throwing light on the process of substitution in optically active compounds.

Dr. T. S. Patterson directed attention to the rotation of active compounds as modified by temperature, colour of light, and solution in indifferent liquids. It has been found that the rotation of certain compounds reaches a maximum at a definite temperature. This may indicate that one of the groups attached to an asymmetric carbon atom attains to a maximum influence. The theory is extended to afford a reason why anomalous dispersion should exist. The influence of the solvent in shifting the temperature-rotation curves so as to bring the parts in the neighbourhood of the maximum into view was demonstrated.

Unfortunately, time did not permit of a discussion of the views represented.

Lieut.-Col. J. W. Gifford described a partially corrected fluor-quartz lens for spectrum photography of a very high degree of accuracy. Dr. J. Hulme made a brief communication on crystalline-liquid substances.

Utilisation of Fuel.

The subject of the proper utilisation of coal and fuels derived therefrom was introduced before a large attendance by Prof. Armstrong, who urged that coal was burned wastefully and wrongly, and that certain issues ought to be brought prominently before the public. He deplored the exclusion of the chemist from the gas industry until quite recently, and considered gas and coke production should be associated in every

large town. In the same way the methods of burning gas had been very inefficient until recently the chemist had come in. He asked for legislation to secure the proper use of coal, and urged the appointment of a royal committee of experts to organise and direct experimental work. The efforts of the remaining speakers were directed to show how economy had been secured in various branches of the subject as the result of the application of scientific inquiry.

Dr. Beilby dealt with low temperature carbonisation, describing for the first time a form of apparatus which he had devised in which coal could be exposed to the action of heat in thin layers. This consisted of a column heated externally in a gas-fired oven at 400° to 450°, and fitted internally with a series of sloping shelves. The coal was fed mechanically to the top of the column and the shelves jolted, so the coal passed over the whole series from top to bottom in a sheet of from 2 in. to 2½ in. in thickness. The time required was about an hour and a half, and a unit with a capacity of fifteen tons per day had been reached. He was satisfied that the production of a mechanically perfect apparatus into which small coal was automatically fed, passed through a distilling zone, and finally passed through a cooling chamber, only required a little more patient step by step development. Present disadvantages of the apparatus were that it would only work smoothly with non-caking coal and that it tended to break down the coal into small stuff. The coke from this plant had proved quite satisfactory in water-gas plant, and when aggregated into briquettes with about 7 per cent. of pitch it had proved eminently suited for domestic fuel.

Dr. H. G. Colman followed with a comprehensive account as to how far the gas industry was helping towards the economic use of fuel. The industry takes at present sixteen million tons of coal per annum. A steadily increasing proportion of the gas output is now employed for heating. The intrinsic luminosity of the gas was now only of minor significance, the calorific power being vastly more important. The cost at which gas was sold was steadily decreasing owing to greatly improved technological methods in the manufacture, to economies due to the larger scale on which operations were carried out, and to the increased value of some of the by-products.

Twenty-five per cent. of the heat units in the coal were obtained in the gas, 50 per cent. in the coke, and about 5 per cent. in the tar, the remainder being used in the process of manufacture. At present only about 20 per cent. of the nitrogen present in the coal is recovered in the form of ammonia. The efficiency of gas when used for lighting and for domestic heating and cooking was discussed, and its present increasing employment on a large scale for other industrial purposes was mentioned. In Birmingham this use accounts for some 8 per cent. of the total output.

Recent progress in gas-fire science was the subject summarised by Mr. H. James Yates. The drawbacks of the early gas fire were explained, and the evolution of the modern form of radiating fire, in which the fire-front consists of a series of hollow fire-clay columns (radiants), each flame rising into the cavity of its radiant, care being taken to prevent any infringement on the inner cone of the flame. Radiation has taken the place of convection as the mode of heat transference, and more than 50 per cent. of the net heat combustion of the gas is delivered as radiant energy. The author next enlarged on the testing of gas fires. The important question of ventilating effect was next considered. To ensure good ventilation without any sacrifice of radiant efficiency, an adequate vertical distance between the top of the radiants and the bottom of the canopy must be preserved. The entire change in the construction principle of gas fires was leading to their general adoption. To-day there were upwards of 350,000 gas fires in use in London alone.

Prof. W. A. Bone, who spoke at some length, dealt with the use of cheap gaseous fuel generated at or near the point at which it was to be used. He discussed the cost of generating water-gas and of ammonia-recovery producer gas, the latter being equivalent to coal-gas at 4*d.* per 1000 cubic feet. He outlined recent improvements in connection with a modern steel works plant which had led to the substitution of producer gas by a mixture of blast-furnace gas and coke-oven gas. This resulted in the abolition of the gas-producer with an economy of 2 to 3 cwt. of coal per ton of steel produced. Progress of this type represented an enormous economy in the use of coal; in addition, both tar and ammonia were recovered from the coal used.

Dr. R. V. Wheeler, speaking on the composition of coal, described a method of discriminating between coking and non-coking coals, his object being to explain the variations in the bituminous coals which cannot be accounted for by the differences which occur in their ultimate chemical composition. Coal was extracted with pyridine, and this extract separated further by partial solution in chloroform.

Dr. R. Lessing returned to the economics of domestic coal consumption, pointing out that any great increase in the use of coal-gas in the future would result in an over-production of gas-coke. He advocated more attention being paid to low-temperature carbonisation.

Mr. W. H. Patterson spoke with regard to the improvement of combustion and the blending of coals. The discussion then became general.

A lengthy paper by Messrs. J. F. Liverseege and A. W. Knapp entitled "The Action of an Alkaline Natural Water on Lead" concluded the sitting. The subject is now one of wide importance since so many of the large cities are now using very soft water gathered in distant hilly country. Such water may corrode or erode lead pipes, and requires treatment to prevent any danger arising from this action. The behaviour of the Birmingham water, gathered chiefly in Wales, towards lead pipes and sheet lead has been very thoroughly investigated by the authors, who find that given sufficient oxygen, the alkalinity of the water is the principal factor determining the amount of erosion. The use of lime as a preventative was not found satisfactory, but protection was given by the addition of four parts of calcium carbonate or two parts of calcium bicarbonate per 100,000. In practice a small proportion of powdered chalk is added to the water in Wales. The authors gave a full account of their methods of analysis. These were criticised by Prof. P. F. Frankland, who contended that the employment of Houston's test for determining the action of the water on lead was valueless, and that the only suitable test is to place the water in a corked lead pipe. The authors determined the alkalinity of the water by titration. This did not represent the true condition of the water, as it overlooked the dissolved carbon dioxide. He advised the use of Walker's method.

Radio-active Elements.

The discussion on radio-active elements and the periodic law attracted a very large audience. Unfortunately the counter-attractions of Sir J. J. Thomson's new gas limited it to an hour and a half, but Mr. Soddy, who opened it, was properly very brief. His main conclusion, based on the existence of chemically identical and non-separable groups of elements may be summarised as follows:—

The chemical analysis of matter is not an ultimate one. It has appeared ultimate hitherto, on account of the impossibility of distinguishing between elements which are chemically identical and non-separable unless these are in the process of change the one into the other. But in that part of the periodic table in which the evolution of the elements is still proceeding, each place is seen to be occupied not by one element, but on the average, for the places occupied at all, by no fewer than four, the atomic weights of which vary over as much as eight units. It is impossible to believe that the same may not be true for the rest of the table, and that each known element may be a group of non-separable elements occupying the same place, the atomic weight not being a real constant, but a mean value, of much less fundamental interest than has been hitherto supposed. Although these advances show that matter is even more complex than chemical analysis alone has been able to reveal, they indicate at the same time that the problem of atomic constitution may be more simple than has been supposed from the lack of simple numerical relations between the atomic weights.

The general law is that in an α-ray change, when a helium atom carrying two atomic charges of positive electricity is expelled, the element changes its place in the periodic table in the direction of diminishing mass and diminishing group number by two places. In a β-ray change, when a single atomic charge of negative electricity is expelled from the atom as a β particle, and also in the two changes for which the expulsion of rays has not yet been detected, the element changes its position in the table in the opposite direction by one place.

The discussion was continued by Mr. A. Fleck, who has determined experimentally what element each of the short-lived radio-elements most resembled, and whether it was separable from the ordinary element by fractional methods.

The results of the work show that :—

1. Uranium-X and radio-actinium are chemically identical with thorium.

2. Mesothorium-2 is chemically identical with actinium.

3. Radium-*A* is chemically identical with polonium.

4. Radium-*C*, thorium-*C*, actinium-*C*, and radium-*E* are chemically identical with bismuth.

5. Radium-*B*, thorium-*B*, and actinium-*B* are chemically identical with lead.

6. Thorium-*D* and actinium-*D* are chemically identical with thallium.

In the cases in which the inseparable elements are common elements these latter have all atomic weights above 200, and occupy one or other of the last twelve places of the periodic table.

Closely allied to the discussion was the next paper by Dr. G. Hevesy, entitled "Radio-active Elements as Indicators in Chemistry and Physics."

By means of an α-ray electroscope of ordinary sensitiveness it is possible to measure accurately as small a quantity as 10^{-17} grm. of a radio-active substance having a half-value period of one hour. The extraordinary simplicity and at the same time sensitiveness with which these extremely small quantities of radio-active bodies can be determined makes them of the greatest use not only in studying substances in great dilution, but also as indicators of physical and chemical processes. Radio-active indicators are conveniently divided into two principal groups. To the first group belong those the use of which as indicators depends only on their physical properties, and not on their chemical properties. Several examples of the use of indicators of this kind were given. The radio-active elements may be used chemically as indicators of the metals from which they are known to be non-separable. In this way 10^{-6} mg. of lead is quantitatively determinable.

The section then divided into physico-chemical and metallurgical divisions. After Dr. Patterson had communicated certain novel suggestions for the nomenclature of optically active compounds, two papers were read by Dr. B. de Szyszkowski, of Kieff. He first described the influence of sodium and potassium chloride in varying concentration upon the distribution of benzoic and salicylic acids. Both the affinity constant and partition coefficient were calculated. The former first rises, passes through a maximum, and then falls as the concentration of the salt is continually increased. Maxima of solubility are shown to exist for salicylic acid and 1 : 3 : 5-dinitrobenzoic acid. The increased solubility of acids in presence of salts is due to double decomposition and increase of the affinity constant, both factors contributing towards the diminution of the undissociated proportion of the acid.

The second paper dealt with solubility and distribution.

Dr. Prideaux, in a paper entitled "The Hydrogen Ion Concentration of the Sea and the Alkali-carbon-dioxide Equilibrium," supported the opinion that the interaction between the small quantities of carbon dioxide and free alkali is a most important factor controlling life in the sea and dealt at some length with the physico-chemical constants which connect the concentrations of the hydrogen and carbonate ions. It is supposed that the first and second dissociation constants of carbonic acid are both altered in saline solution. A lively discussion followed, in which Prof. Sörensen, Dr. Syzszikowski, and Dr. E. F. Armstrong took part.

Metallurgical Chemistry.

The metallurgical section sat separately on two mornings, Prof. T. Turner being in the chair. The first item was a discussion on metals, crystalline and amorphous, introduced by a paper from Dr. W. Rosenhain, who submitted advance proofs of the full paper to the meeting. The "amorphous" theory, as it now stands, appears to consist of three distinct propositions. The first of these is that mechanical disturbance of the material at the surface of a piece of crystalline metal, locally destroys the crystalline nature of the material and produces on the finished, polished surface a thin film of amorphous metal.

The second is that, just as friction and polishing of a metal surface produces a thin amorphous layer or film, so the internal rubbing which takes place on surfaces of internal slip when crystalline metal is plastically strained, will also bring about local disturbance resulting in the formation of a thin layer of amorphous metal. This amorphous metal is regarded as being less dense and much harder than the crystalline variety, and its formation is regarded as explaining the changes in hardness and density which are known to accompany plastic strain.

The third proposition is that where the constituent crystals of a metal meet, thin films of residual liquid metal will remain in circumstances which render them incapable of crystallising, so that they will constitute thin films of undercooled liquid or amorphous metal acting as an intercrystalline cement.

The author reviewed in detail how far these propositions can be regarded as established. The second in particular has been much criticised, but it was demonstrated that it offers an explanation for a larger number of facts than any rival theory.

In the subsequent discussion Dr. G. T. Beilby pointed out that interpenetration of the surface layer and the polishing powder is not essential, as calcite may be polished without any powder. The layers

produced by polishing were not of molecular thinness, but really very deep. Unlike the author, he considered the microscopical evidence of a mobile phase in the interior of a strained metal conclusive.

Dr. C. H. Desch considered it necessary to distinguish between the hypothesis of amorphous phase in strained metal, due to Dr. Beilby, and that of an intercrystalline cement in unstrained metal, developed by Dr. Rosenhain. The first was now fully established; the second, although highly ingenious, was yet unproved. Most of the facts could be explained by the surface tension of the crystal grains.

Dr. Rosenhain, in reply, said that iron, unlike calcite, would not give a layer of amorphous material without the use of a powder. He could not agree that there would be any surface tension at the boundaries of crystals in contact.

In a paper by F. E. E. Lamplough and J. T. Scott it was stated that the "halos" sometimes seen around the crystallites in alloys containing a eutectic are not due to undercooling, but to segregation. They appear more readily when the alloy is slowly cooled, and their formation still occurs when undercooling is prevented by inoculation. By quenching experiments it is shown that the two constituents of a eutectic crystallise simultaneously, not alternately.

Prof. T. Turner's paper on the volatility of metals, especially under reduced pressure, was concerned with a subject in which there are considerable possibilities of future practical application. Distillation *in vacuo* is specially suitable for easily oxidisable metals such as sodium, potassium, cadmium, and zinc. Quantitative separations of the constituents of some alloys can readily be effected at suitable temperatures *in vacuo*. A general description of the work was given with particular reference to the influence of the pressure on the rate of volatilisation.

The structural changes brought about in certain alloys by annealing formed the subject of a paper by Mr. O. F. Hudson, which had reference mainly to those alloys which consist of a solid solution. On annealing, the cored structure characteristic of the cast alloy disappears and the crystals become quite uniform. Structurally the alloy does not now differ from a pure metal. Alloys which have been worked before annealing practically became recrystallised during the process. In the case of alloys consisting of crystals of two or more kinds, the chief effect of annealing is to promote equilibrium between the two phases present. Prolonged annealing is required to attain complete phase and structural equilibrium. The paper gave a valuable summary of the existing knowledge on the subject.

In a paper on diffusion in solid solutions, Dr. C. H. Desch alluded to the fact that since his report to the Dundee meeting of the association, Bruni and Meneghini have succeeded in demonstrating the occurrence of diffusion in a clear, crystalline solid in the case of sodium and potassium chlorides. A mixture of these two salts, heated at 500° or 600°, yields a homogeneous solid solution, the formation of which is recognised by determining the heat of solution in water, which differs from that of a mechanical mixture. The author's further experiments with metallic alloys show that a sharp boundary is characteristic of diffusion in solids when a chemical compound is formed. An abrupt discontinuity of composition is also observed when one component is removed by solution, as in the dezincification of alloys of copper and zinc.

Mr. E. Vanstone described the methods and results of determinations of the electrical conductivity of sodium amalgams when in the solid state.

The work described by Dr. A. Holt in a paper entitled "The Solubility of Gases in Metals" had reference mainly to the solubility of hydrogen in palladium, but there seems distinct evidence that the phenomena are not peculiar to this case, but occur also with other metals and gases.

Rapid solution of gas appears only to take place when the metal is in an amorphous condition. The metal may be wholly amorphous, as in the case of palladium black, or it may have an amorphous surface associated with amorphous films round the crystals of the otherwise holocrystalline material. The rate of solution appears to depend on the amount of amorphous metal present, hence when the amorphous and crystalline phases are in physical contact, the metastable amorphous phase tends to crystallise, and so causes a falling off in the rate of solution. When, however, the amorphous phase alone is present, the rate of change is so excessively slow that the rate of solution appears to be a constant, even after a long period of years.

The activity can be increased up to a maximum value by repeated saturation and removal of gas from the metal. According to Beilby, "the gas molecules as they find their way among the metal molecules of the solid are quite capable of producing sufficient movement to arrest crystallisation, or even to flow the crystals which are already formed into the amorphous variety," and this would explain the above-mentioned increase in activity.

Since, however, all forms of the metal appear eventually to dissolve almost the same volumes of gas, it must be concluded that when the metal is mainly crystalline, the amorphous phase functions as a vehicle for the transference of gas, for some amorphous metal is always present in physical contact with the crystalline phase.

Dr. R. E. Slade and Mr. G. I. Higson contributed two papers. The first, on the equilibria of reduction of oxides by carbon, described the methods followed to determine the equilibrium temperature and pressure of carbon monoxide for vanadium, tantalum, chromium, tin. The second described the determination in a similar manner of the dissociation pressures and temperatures of the nitrides of vanadium, tantalum, and boron.

Mr. F. D. Farrow gave a concise summary of the recent work on the melting points and dissociation pressures of the system copper oxygen, the data being collected to form temperature-composition and temperature-pressure diagrams. The influence of traces of impurities on the properties of copper was surveyed by Mr. F. Johnson, who urged the importance of metallurgical testing and analysis and the use of the microscope in studying the commercial brands of crude copper for practical use.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—It is proposed to confer the degree of Master of Arts, *honoris causâ*, upon Mr. W. Dawson, reader in forestry.

Dr. A. S. F. Grünbaum, of Gonville and Caius College, and Mr. F. R. C. Reed, of Trinity College, have been approved by the General Board of Studies for the degree of Doctor of Science.

Mr. F. T. Brooks, of Emmanuel College, is leaving England for the Federated Malay States, in order to make a report to the Government on the fungoid diseases and as to whether anything can be done to arrest them. Mr. Brooks has received one year's leave of absence from the University.

OXFORD.—It is proposed to raise a memorial to the late Dr. Francis Gotch, Waynflete professor of physiology in the University. The form taken by the

memorial will be determined by the success of the appeal which is being made to the friends and former pupils of the late professor in London, Liverpool, Oxford and elsewhere. In a circular that has been issued by the provisional committee, which includes the names of the Dean of Christ Church (Vice-Chancellor), the heads of Magdalen, Brasenose, and Keble, Profs. Bayliss, Bourne, Dreyer, Elliott, Sir W. Osler, Poulton, Sir Walter Raleigh, Sherrington, Arthur Thomson, H. H. Turner, and Dr. J. S. Haldane, attention is directed to his strenuous work in physiology and his wide sympathies in other branches of science and in art. Subscriptions may be sent to either of the secretaries (Dr. W. Ramsden, Pembroke College, and Dr. H. M. Vernon, Magdalen College), or to Messrs. Barclay and Co., Ltd., Old Bank, Oxford.

The electors to the Waynflete professorship of physiology have elected Dr. C. S. Sherrington F.R.S., Holt professor of physiology in the University of Liverpool, to succeed Dr. Gotch.

An appeal is issued for the endowment of a professorship of forestry at Oxford. In no branch of exact knowledge is this country more backward than in scientific forestry. Chairs of forestry at the universities have existed on the Continent for more than a century. The higher forest instruction is now firmly established in the United States of America. The Oxford Forest School has for many years been at the head of scientific forestry teaching in the British Empire. Founded originally for the training of Indian forest students, it has grown steadily under Sir William Schlich's guidance. It is no longer mainly occupied with the training of Indian forest officers. Of the thirty-five students at present under instruction only seven are destined for India. South Africa, which in forest organisation is some quarter of a century ahead of the other British Colonies, has long had its forest officers trained under Sir William Schlich. The appeal now issued states that a total of 3,744*l.* has been raised out of 10,000*l.* required to secure permanently a fully competent professor of forestry. In the list of contributions, Sir W. Schlich and his pupils appear at the head with 500*l.*, and a like sum is contributed by the Secretary of State for India and by four other Colonial Governments. The Oxford colleges promise donations amounting to 875*l.*, and St. John's College, Oxford, 50*l.* a year permanently. When we reflect on 30,000,000*l.* going yearly out of this country to pay for the timber and paper pulp that could demonstrably be produced in it (Cd. 4460, 1909), and that this huge amount of rural employment is lost to us yearly, it will be seen that the appeal for the endowment of a chair of forestry at Oxford has claims that in the truest sense are national as well as scientific.

SIR RICKMAN GODLEE, president of the Royal College of Surgeons, has had the honorary degree of Doctor of Laws conferred upon him by the University of Toronto.

THE University of Bristol has made a regulation whereby the Bath Municipal Technical School will be connected with the faculty of engineering of the University, which is provided and maintained in the Merchant Venturers' Technical College. It will be possible for a student to take the preliminary and intermediate courses for the University certificate in engineering, either in whole or in part in evening classes in the Bath Technical School, provided that the classes included in them have been approved by the Senate, and are conducted by teachers recognised by the Senate for the particular purpose.

WE learn from the issue of *Science* for October 31 last that the General Education Board of the United States, in addition to a gift of 280,000*l.* to the Johns Hopkins Medical School, to provide professorial salaries which will enable the professors to be independent of private work, has made conditional grants of 40,000*l.* for Barnard College, Columbia University; 40,000*l.* for Wellesley College, and 10,000*l.* for Ripon College. From the same source we find that two gifts have been made to the Massachusetts Institute of Technology from anonymous donors, sums of 100,000*l.* and 20,000*l.* respectively. There is an understanding that the larger gift is to be used for the buildings, while the other has no restrictions. By the will of the late Mr. Simeon Smith, of Indiana, DePauw University has recently added 16,000*l.* to its productive endowment. By the terms of the will, 10,000*l.* of this amount has been set aside specifically as an endowment of the department of chemistry.

THE Board of Agriculture and Fisheries is not allowing the grass to grow under its feet, and in furtherance of its educational schemes for the benefit of agriculture it has just issued a memorandum (Cd. 7118) "as to the constitution of the advisory councils for agricultural education in England and of the agricultural council for Wales." The Rural Education Conference recommended that joint councils should be constituted in each of the twelve divisions which were being formed in England and Wales in connection with the Board's scheme for the provision of technical advice to farmers, and that their duties should primarily be to promote the organisation of the different forms of agricultural instruction which are not provided for inside the agricultural colleges forming the divisional centres. The first appendix to the memorandum sets out in detail the steps which have been taken to establish such advisory councils in nine of the ten divisions which cover England, with particulars as to their constitution and membership. No formal steps have, as yet, been taken to constitute such a council for Lancashire and Cheshire. The Board has rejected the proposal of the conference to establish two councils for Wales, and has preferred to constitute a single agricultural council for Wales and Monmouth. Details of its constitution are given in Appendix II. The function of these councils is twofold:—(*a*) Educational, including the assistance and advice of local education authorities on such points as the organisation and coordination of agricultural education each within its sphere of action, provision of agricultural experiments, demonstrations, and instructors, inquiry into the need for farm schools and other educational centres of a type less advanced than the agricultural colleges, and so forth; (*b*) advisory: to keep the Board informed on the state of agricultural education within their respective provinces, and, through a live-stock committee, to assist the Board in furthering its schemes for the improvement of the live-stock of the country. Further developments will be watched with keen interest by all who have the welfare of British agriculture at heart.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, November 6.—Sir Archibald Geikie, K.C.B., president, in the chair.—Prof. E. W. **MacBride**: Studies in heredity. II., Further experiments in crossing the British species of sea-urchins. In this paper the results obtained two years ago and communicated to the society are confirmed and extended. The hybrid produced by fertilising the egg of Echinus with the sperm of Echino-cardium is described. This hybrid was not obtained two years

ago. The effect of foreign sperm in producing cytolysis on an egg is described, and it is also shown that an egg may become totally unreceptive for foreign sperm, whilst it is still perfectly capable of being fertilised with the sperm of its own species.—A. D. **Hall**, W. E. **Brenchley**, and L. M. **Underwood**: The soil solution and the mineral constituents of the soil.—Prof. B. **Moore** and T. A. **Webster**: Synthesis by sunlight in relationship to the origin of life. Synthesis of formaldehyde from carbon dioxide and water by inorganic colloids acting as transformers of light energy.—Dr. B. **Blacklock** and Dr. W. **Yorke**: The trypanosomes causing dourine (mal de coït or Beschälseuche).—T. G. **Brown**: Postural and non-postural activities of the mid-brain.—J. O. W. **Barratt**: The nature of the coagulant of the venom of *Echis carinatus*.—E. H. **Rodd**: Morphological studies in the benzene series. IV., The crystalline form of sulphonates in relation to their molecular structure.—Prof. W. H. **Bragg** and W. L. **Bragg**: The structure of the diamond.—Hon. R. J. **Strutt**: Note on electric discharge phenomena in rotating silica bulbs.—J. N. **Pring**: The origin of thermal ionisation.—Clive **Cuthbertson** and Maude **Cuthbertson**: The refraction and dispersion of gaseous nitrogen peroxide.

Physical Society, October 24.—Prof. C. H. Lees, vice-president, in the chair.—Ezer **Griffiths**: The ice calorimeter, with remarks on the constancy of the density of ice. The primary object of the work was the redetermination, by an electrical method, of the constant of Bunsen's ice calorimeter. The mean value of the calorimeter constant was found to be 15·486 milligrams of mercury per mean calorie. Various observers have advanced evidence tending to show that the density of ice at 0° C. is not a definite constant. A consideration of their work leads to the conclusion that the small variations of density found for different samples might be simply due to the presence of occluded water or an amorphous modification cementing the ice crystals together. The value (80·30) of the latent heat of fusion of ice, calculated from the ice calorimeter, supports this view, as it is higher by about 0·7 per cent. than the value obtained by direct determinations with ice in bulk.—H. **Ho** and S. **Koto**: An electrostatic oscillograph. The paper describes an electrostatic oscillograph suitable for recording very high voltages. Two vertical bronze strips pass symmetrically between two parallel metallic plates called "field plates." They are connected at their lower ends by a silk fibre which passes under an ivory pulley. An extremely small mirror is fixed to the strips. This arrangement constitutes the vibrator, which, mounted on an ebonite frame, is immersed in an oil bath. To the upper extremities of the strips are connected the terminals of a direct-current voltage of about 300. The alternating voltage to be recorded is connected to the "field plates," in parallel with which there are two oil condensers in series. The electrical midpoint of the direct-current battery is connected to a point between the condensers. The turning moment on the strips is proportional to the product of the momentary values of the alternating-current voltage and the direct-current voltage, so that if the latter is constant, the deflection of the mirror accurately follows the variation of the former.

Zoological Society, October 28.—Prof. E. A. Minchin, F.R.S., vice-president, in the chair.—Dr. F. E. **Beddard**: The anatomy and systematic arrangement of the Cestoidea. A new genus and species of tapeworms from the double-striped thicknee (*Œdicnemus bistriatus*) was described.—Dr. F. A. **Bather**: The fossil Crinoids referred to Hypocrinus Beyrich. The two specimens of *Hypocrinus schneideri*, Beyr., described by Beyrich and Rothpletz respectively, are redescribed and re-figured. The structure of the genus is shown to agree with that of the Devonian family Gasterocomidæ, the content of which is discussed; but it is suggested that in this case and in that of "*Lecythiocrinus*" *adamsi* the distinctive features may have been independently acquired. The holotype of *Hypocrinus piriformis*, Rothpletz, is redescribed and refigured, and proved to be no Hypocrinus. It is thought to be a highly modified descendant of the Taxocrinidæ, by way of such a genus as Cydonocrinus. The left posterior radial appears to have borne a large arm, but the other arms are more or less atrophied, and the right posterior radial has almost disappeared.—D. M. S. **Watson**: *Batrachiderpeton lineatum*, Hancock and Atthey, a Coal-Measure Stegocephalian. The paper contained the description of the skull, lower jaw, and pectoral girdle of this species, based on a series of specimens in the Newcastle Museum, derived from the low main seam of Newsham Colliery.—R. W. **Palmer**: The brain and brain-case of a fossil ungulate of the genus Anoplotherium. A cranium from the Phosphorites of Quercy, together with an exceptionally perfect and well-marked brain-cast obtained from it, were described from material in the British Museum collections.

Challenger Society, October 29.—Sir John Murray in the chair.—Dr. E. J. **Allen**: A new quantitative tow-net for the collection of plankton. A net of bolting-silk is enclosed within a canvas case so arranged that all the water passing through the net escapes from the canvas case through a meter The meter consists of a propeller and a clockwork recorder, and is calibrated by running through it a measured stream of water. The number of organisms collected by the net can be counted or the amount of plankton determined in some other way, and the quantity per unit volume of water calculated. The net can be used for horizontal or for vertical hauls, in the latter case working both when going down and when coming up.—Dr. Francis **Ward**: Reflection as a concealing and revealing factor in aquatic life.

MANCHESTER.

Literary and Philosophical Society, October 7.—Mr. Francis **Nicholson**, president, inaugural address: The old Manchester Natural History Society and its museums. An account of the society, which existed from 1821 to 1868, first in St. Anne's Place, afterwards in King Street, and from 1835 in a museum built for the purpose in Peter Street. The museum was eventually passed over to Owen's College, in trust for the people of Manchester, and exists to-day, improved out of recognition, as the Manchester Museum. The museum was perhaps strongest in the class of birds, in which it once rivalled the British Museum. As trustees, the University are now carrying on the work initiated by the Natural History Society much more efficiently than the society did in its most prosperous days.—Prof. F. E. **Weiss**: Juvenile flowering in *Eucalyptus globulus*. A young plant developed flower buds during its second year, after the main stem had been cut down. The flowers were subtended by leaves characteristic of the immature plant and very different from the mature foliage. Such occurrences have been recorded for one or two species of Australian Eucalypti. In the case described by the author, the interference with the growth of the plant seems to have led to the juvenile flowering, as another plant dealt with in a similar way has produced flowers on the lateral branch, which had taken the place of the main stem after the latter was cut down.

October 21.—Mr. Francis Nicholson, president, in the chair.—Miss D. A. **Stewart**: Changes in the branchial lamellæ of *Ligia oceanica* after prolonged

immersion in fresh- and salt-water. *Ligia oceanica*, the quay-slug, is found at various heights above high-water mark, but not far inland, and has congeners which inhabit fresh-water or are amphibious or terrestrial. The gills of these forms are similar, and Miss Stewart carried out experiments to determine the effect upon the gill structure of prolonged immersion in sea-water and fresh-water.

PARIS.

Academy of Sciences, November 3.—M. F. Guyon in the chair.—A. **Haller**: The alkylation of the β- and γ-methyl*cyclo*hexanones by means of sodium amide. The reaction between sodium amide, methyl*cyclo*hexanone, and ethyl iodide gives a condensation product of the ketone in addition to the substituted ethyl derivatives. Details are given of the variation of this secondary reaction with the experimental conditions.—A. **Laveran** and G. **Franchini**: Experimental infections of mammals by the flagellæ of the digestive tube of *Ctenocephalus canis* and *Anopheles maculipennis*. Flagellæ from both sources are equally capable of infecting the mouse and rat.—Pierre **Termier**: The excursion C1 of the twelfth International Geological Congress. The Pre-Cambrian strata of the Lake region; the tectonic problems of the great chains of the west.—E. **Belot**: Zodiacal matter and the solar constant. A discussion of the perturbations due to zodiacal matter, the reflection of sunlight upon the same, and the variations of the solar constant due to absorption by zodiacal matter.—M. **Giacobini**: The comet 1913*e*. Position of the Zinner comet on November 1. The comet appeared as a round nebulosity of about 45″ diameter, with a nucleus of about 9·5 magnitude. There were indications that the light from the comet was polarised.—M. **Couadé**: An aviation parachute. A description of experiments made with small-scale models.—P. **Helbronner**: The complementary geodesic triangulations of the higher regions of the French Alps.—Bohdan de **Szyszkowski**: The rôle of the neutral molecule in electrolytes.—B. **Szilard**: A direct reading static voltmeter for the measurement of very small currents.—Thadée **Peczalski**: Compressibility and the differences of the specific heats of liquids.—Georges **Baume**: Some physico-chemical applications of the Maxwell-Barthoud distribution equation.—Eugène L. **Dupuy** and A. **Portevin**: The influence of various metals on the thermo-electric properties of the iron-carbon alloys. Sixty alloys were studied, the elements added to the iron-carbon alloy including chromium, manganese, aluminium, tungsten, and molybdenum. The thermo-electric power was measured over the ranges −78° C. to 0°, and 0°−100°.—Amé **Pictet** and Maurice **Bouvier**: The distillation of coal under reduced pressure. The coal was heated to about 450° C., and the pressure in the retort maintained at about 16 mm. The aqueous portion of the distillate was acid, and contained no ammonia. The tar contained neither phenols nor naphthalene, but the presence of secondary bases was proved. The hydrocarbons belonged nearly exclusively to the fatty series.—Aug. **Rilliet** and L. **Kreitmann**: 6-Aminopiperonal.—Pierre **Lesage**: Contribution to a critical examination of the action of atmospheric electricity upon plants.—J. **Beauverie**: Frequent presence of the germs of rust in the interior of the seeds of the Graminaceæ.—R. **Robinson**: The physiology of the cæcal appendix. The hormone of the vermium.—Raoul **Bayeux**: A new distributing gas micrometer for use in intravenous injections.—Jules **Amar**: The respiratory signs of fatigue.—L. C. **Soula**: The mechanism of anaphylaxis.—Gabriel **Bertrand** and A. **Compton**: The presence of a new diastase, salicinase, in almonds.—C. **Gessard**: The salts in the coagulation of the blood.—Fred **Vlès**: The absorption of the visible rays by the blood of the octopus.—Louis **Gentil** and Pereird de **Sousa**: The effects in Morocco of the great earthquake in Portugal of 1755.

NEW SOUTH WALES.

Linnean Society, September 24.—Mr. W. S. Dun, president, in the chair.—W. N. **Benson**: The geology and petrology of the great Serpentine belt of New South Wales. Part ii., the geology of the Nundle district. The formations present are, the Woolomin Series, the Bowling Alley Series (equivalent to the Tamworth Series), of which five divisions are recognised; and the Nundle Series, equivalent to the Barraba Mudstones. The last lies conformably on the Bowling Alley Series, for the Baldwin Agglomerates are not developed. The first two contain numerous interstratified flows of spilite, and, in the second, sills of albitised dolerite are abundant. All three contain radiolaria. A well-marked Middle Devonian limestone horizon runs throughout the Bowling Alley Series.—E. C. **Andrews**: The development of the natural order Myrtaceæ. The Myrtaceæ are widely distributed over the tropical and subtropical regions of the world, particularly in the fertile tropics. The number of species is approximately 3100 (America, 1670; Australia, about 800; Asia, about 235; Africa, 85; Malay Archipelago and Pacific Islands, 310 species; Europe only one). By far the greater number of these are of luxuriant types, possessing fleshy and indehiscent fruits. The capsular genera are endemic in Australasia and the neighbouring regions, and the majority of the species grow on poor sandy soil, and are strikingly depauperate in nature, compared with the widely spread genera, such as the Myrtles, Guavas, and Eugenias. Whereas Ettingshausen considers the modern endemic flora of Australia as being of cosmopolitan range in early and later Tertiary time, the present author considers the present endemic flora of Australia as being the depauperate descendants of luxuriant and cosmopolitan types of the Cretaceous and Eocene periods.—R. T. **Baker**: Descriptions of three new species of the natural order Myrtaceæ. Two species of Melaleuca from littoral Eastern Australia, and one of Angophora from the New England district, are described as new.

BOOKS RECEIVED.

Index of Spectra. By Dr. W. M. Watts. Appendix v. Pp. iv+92. (London: W. Wesley and Son.)

Die radioaktive Strahlung als Gegenstand wahrscheinlichkeitstheoretischer Untersuchungen. By Prof. L. v. Bortkiewicz. Pp. 84. (Berlin: J. Springer.) 4 marks.

The Life of the Fly, with which are Interspersed some Chapters of Autobiography. By J. H. Fabre. Translated by A. T. de Mattos. Pp. xi+508. (London: Hodder and Stoughton.) 6*s*. net.

The Diesel or Slow Combustion Oil Engine. By Prof. G. J. Wells and A. J. Wallis-Tayler. Pp. xvi+286. (London: Crosby Lockwood and Son.) 7*s*. 6*d*. net.

Key to "A New Algebra." Vol. ii., containing parts iv., v., and vi. By S. Barnard and J. M. Child. Pp. 447–915. (London: Macmillan and Co., Ltd.) 8*s*. 6*d*.

Ministry of Finance, Egypt. Survey Department. The Rains of the Nile Basin and the Nile Flood of 1911. By J. I. Craig. Pp. 110+viii plates. (Cairo: Government Press.) P.T.10.

The Johns Hopkins University Circular, 1913, No. 8. Catalogue and Announcement for 1913–14 of the Medical Department Established in Connection with the Johns Hopkins Hospital. Pp. 276. (Baltimore, Md.)

Our Common Sea-Birds: Cormorants, Terns, Gulls, Skuas, Petrels, and Auks. By P. R. Lowe. Pp. xvi+310. (London: *Country Life*, Ltd.) 15*s*. net.

The Archæology of the Anglo-Saxon Settlements. By E. T. Leeds. Pp. 144. (Oxford: Clarendon Press.) 5*s*. net.

University College of North Wales. Calendar for the Session 1913–14. Pp. 446. (Manchester: J. E. Cornish, Ltd.)

Le Scienze Esatte Nell' Antica Grecia. By Prof. G. Loria. Seconda edizione. Pp. xxiv+970. (Milano: U. Hoepli.) 9.50 lire.

Opere Matematiche di Luigi Cremona. Tomo Primo. Pp. viii+497. (Milano: U. Hoepli.) 25 lire.

Cement, Concrete, and Bricks. By A. B. Searle. Pp. xi+412. (London: Constable and Co., Ltd.) 10*s*. 6*d*. net.

Dysenteries: their Differentiation and Treatment. By Prof. L. Rogers. Pp. xi+336+x plates. (London: H. Frowde and Hodder and Stoughton.) 10*s*. 6*d*. net.

Milton's Astronomy: The Astronomy of "Paradise Lost." By Dr. T. N. Orchard. Pp. xi+288+plates. (London: Longmans and Co.) 7*s*. 6*d*. net.

Scott's Last Expedition. In two vols., vol. i. being the Journals of Capt. R. F. Scott, R.N., C.V.O. Pp. xxvi+633+plates; vol. ii. being the Reports of the Journeys and the Scientific Work undertaken by Dr. E. A. Wilson and the Surviving Members of the Expedition. Arranged by L. Huxley. With a Preface by Sir Clements R. Markham, K.C.B. Pp. xiv+534+plates. (London: Smith, Elder and Co.) 42*s*. net the two vols.

Notions fondamentales de Chimie Organique. By Prof. C. Moureu. Quatrième édition. Pp. 383. (Paris: Gauthier-Villars.) 9 francs.

The Library Association Book Production Committee. Interim Report. Pp. 32. (London: Library Association.) 1*s*. net.

Report of the Bombay Bacteriological Laboratory for the Year 1912. By Major W. G. Liston. Pp. 39. (Bombay: Government Central Press.) 5 annas, or 6*d*.

Ueber Neo-Vitalismus. By E. du Bois-Reymond. Edited by E. Metze. Pp. 60. (Brackwede i.W.: Dr. W. Breitenbach.) 1 mark.

Transactions of the Royal Society of Edinburgh. Vol. xlix., part 2 (No. 3). A Monograph on the General Morphology of the Myxinoid Fishes, based on a Study of Myxine. Part v., The Anatomy of the Gut and its Appendages. By Prof. F. J. Cole. Pp. 293–344+plates. (Edinburgh: R. Grant and Son; London: Williams and Norgate.) 6*s*. 3*d*.

The Elements of Descriptive Astronomy. By E. O. Tancock. Pp. 110+xv plates. (Oxford: Clarendon Press.) 2*s*. 6*d*. net.

Papers of the British School at Rome. Vol. vi. Pp. xiv+511+xl plates. (London: Macmillan and Co., Ltd.) 42*s*. net.

Clinical Bacteriology and Vaccine Therapy for Veterinary Surgeons. By W. Scott. Pp. xiv+222+xii plates. (London: Ballière, Tindall and Cox.) 7*s*. 6*d*. net.

Chemische Technologie der Gespinstfasern. By Dr. K. Stirm. Pp. xvi+410. (Berlin: Gebrüder Borntraeger.) 12 marks.

A Text-book of Elementary Statics. By Prof. R. S. Heath. Pp. xii+284. (Oxford: Clarendon Press.)

All Men are Ghosts. By L. P. Jacks. Pp. ix+360. (London: Williams and Norgate.) 5*s*. net.

Institut de Paléontologie Humaine. La Pasiega. A. Puente-Viesgo (Santander), Espagne. By Prof. H. Breuil, Prof. H. Obermaier, and H. Alcalde del Rio. Pp. 64+xxix plates. (Monaco: A. Chêne.)

Hope and Help. Golden Advice on the Overcoming of the Drink Habit. By One Who Cured Himself. Pp. 44. (London: A. M. King and Co.) 1*s*.

The Cambridge Manuals of Science and Literature. The Fertility of the Soil. By Dr. E. J. Russell. Pp. iv+128+plates. The Life-Story of Insects. By Prof. G. H. Carpenter. Pp. iv+134. The Peoples of India. By J. D. Anderson. Pp. xii+118+vii plates. Pearls. By Prof. W. J. Dakin. Pp. viii+144. Natural Sources of Energy. By Prof. A. H. Gibson. Pp. viii+131. The Flea. By H. Russell. Pp. xi+125. (Cambridge University Press.) Each 1*s*. net.

The Ideals and Organisation of a Medical Society. By Dr. J. B. Hurry. Pp. 51. (London: J. and A. Churchill.) 2*s*. net.

Carbon Dioxide Snow: its Therapeutic Uses (Methods of Collection and Application). By J. Hall-Edwards. Pp. xv+78+plates. (London: Simpkin and Co., Ltd.) 3*s*. 6*d*.

Introduction to Biology. By Prof. M. A. Bigelow and A. N. Bigelow. Pp. xi+424. (London: Macmillan and Co., Ltd.) 6*s*.

Letters and Recollections of Alexander Agassiz, with a Sketch of his Life and Work. Edited by G. R. Agassiz. Pp. xi+454+plates. (London: Constable and Co., Ltd.) 14*s*. net.

Philips' Nature Calendar, 1914. (London: G. Philip and Son, Ltd.) 6*d*. net.

Cassell's Natural History. By F. M. Duncan. Pp. xx+432+plates. (London: Cassell and Co., Ltd.) 9*s*. net.

The British Empire Universities Modern English Illustrated Dictionary. Edited by E. D. Price and Dr. H. T. Peck. Pp. lxxx+1008+plates. (London: The Syndicate Publishing Co.) 20*s*.

Farm and Creamery Buttermaking and Students' Reference Book. By C. W. Walker-Tisdale and T. R. Robinson. Third revision. Pp. 194. (London: *Dairy World and British Dairy Farmer*.) 3*s*. 6*d*. net.

Fishery Board for Scotland. Fifth Report (Northern Area) on Fishery and Hydrographical Investigations in the North Sea and Adjacent Waters. Conducted for the Fishery Board for Scotland in Co-operation with the International Council for the Exploration of the Sea, under the Superintendence of D'Arcy W. Thompson, 1908–11. Pp. vi+404+plates. (London: H.M.S.O.; Wyman and Sons, Ltd.) 14*s*.

A History and Description of the Royal Observatory, Cape of Good Hope. By Sir D. Gill. Pp. cxc+136+plates. (London: H.M.S.O.)

Studien zur Pathologie der Entwicklung. By Dr. R. Meyer. Edited by Dr. E. Schwalbe. Erster Band, Erstes Heft. Pp. iii+196+iii plates. (Jena: G. Fischer.) 8 marks.

Dansk Botanisk Arkiv. Bind i., No. 1. By E. Ostrup. Pp. 40+plate. Bind i., No. 2. By M. Vahl. Pp. 18. Bind i., No. 3. By O. Galloe. Pp. 119. Bind i., No. 4. By F. Borgesen. Pp. 160. (Kobenhavn: H. Hagerups Boghandel.) Prices various.

Beiträge zur Kenntnis der Kapverdischen Inseln. Die Ergebnisse einer Studienreise im Sommer 1912. By I. Friedlaender. Gesteine der Kapverdischen Inseln. By Prof. W. Bergt. Pp. xii+109+xix plates. (Berlin: D. Reimer.) 15 marks.

Matter and Some of its Dimensions. By W. K. Carr. Pp. 120. (London: Harper and Bros.) 2*s*. 6*d*. net.

Mountains: their Origin, Growth and Decay. By Prof. J. Geikie. Pp. xix+311+plates. (Edinburgh: Oliver and Boyd; London: Gurney and Jackson.) 12*s*. 6*d*. net.

A Dictionary of Applied Chemistry. By Sir E. Thorpe, assisted by Eminent Contributors. Revised and enlarged edition. Vol. v. Pp. viii+830. (London: Longmans and Co.) 45*s*. net.

A Treatise on Chemistry. By H. E. Roscoe and C. Schorlemmer. Vol. ii., The Metals. New edition, completely revised by the Right Hon. Sir H. Roscoe and others. Pp. xvi+1470. (London: Macmillan and Co., Ltd.) 30*s*. net.

Gardens of the Great Mughals. By C. M. V. Stuart. Pp. xviii+290+xl plates. (London: A. and C. Black.) 12*s*. 6*d*. net.

The Gannet: a Bird with a History. By J. H. Gurney. Pp. li+567+plates. (London: Witherby and Co.) 27*s*. 6*d*. net.

Canada: Department of Mines. Mines Branch. A General Summary of the Mineral Production of Canada during the Calendar Year 1912. Pp. 46. (Ottawa: Government Printing Bureau.)

New Zealand. Department of Lands and Survey. Report on the Survey Operations for the Year 1912–13. By J. Mackenzie. Pp. 77+maps. (Wellington: J. Mackay.)

DIARY OF SOCIETIES.

THURSDAY, NOVEMBER 13.

ROYAL SOCIETY, at 4.30.—The Preparation of Eye-preserving Glass for Spectacles: Sir William Crookes, O.M.—An Inversion Point for Liquid Carbon Dioxide in regard to the Joule-Thomson Effect: Prof. A. W. Porter.—Negative After-Images and successive Contrast with Pure Spectral Colours: Prof. A. W. Porter and Dr. F. W Edridge-Green.—The Positive Ions from Hot Metals: Prof. O. W. Richardson.—(1) The Diurnal Variation of Terrestrial Magnetism.—(2) A Suggestion as to the Origin of Black Body Radiation: G. W. Walker.

CONCRETE INSTITUTE, at 7.30.—Presidential Address: E. P. Wells.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—Pressure Rises: W. Duddell.

FRIDAY, NOVEMBER 14

ROYAL ASTRONOMICAL SOCIETY, at 5.—Note on a Method of Balancing Dome Shutters: W. H. Maw.—Mean Areas and Heliographic Latitudes of Sun-spots in the Year 1912: Royal Observatory, Greenwich.—Reply to Mr. Denning's "Observations of the Orionids": C. P. Olivier.—The Expression of Sun-spot Frequency as a Fourier Sequence, and on the General Use of a Fourier Sequence in Similar Problems: H. H. Turner.—Further Note on the Possibility of Refraction by the Solar Atmosphere: R. S. Capon.—Sixth Note on the Number of Faint Stars with Large Proper Motions: F. A. Bellamy.—Seventh Note on the Number of Faint Stars with Large Proper Motions: R. J. Pocock.—The Dynamics of a Globular Stellar System: A. S. Eddington.—*Probable Papers:* Retrograde Satellite Orbits: J. Jackson.—(1) Photographic Magnitudes of 265 Stars within 25° of the North Pole; (2) The Application of Parallel Wire Diffraction Gratings to Photographic Photometry: S. Chapman and P. J. Melotte.

PHYSICAL SOCIETY, at 8.—On the Thermal Conductivity of Mercury by the Impressed Velocity Method: H. R. Nettleton.—On Polarisation and Energy Losses in Dielectrics: Dr. A. W. Ashton.—A Lecture Experiment to illustrate Ionisation by Collision and to show Thermoluminescence: F. J. Harlow.

ALCHEMICAL SOCIETY, at 8.15 (at The International Club, Regent Street, S.W.)—The Hermetic Mystery: Mme. Isabelle de Steiger.

MONDAY, NOVEMBER 17.

JUNIOR INSTITUTION OF ENGINEERS, at 7.—Annual General Meeting.—The Institution: E. King.

TUESDAY, NOVEMBER 18.

ROYAL ANTHROPOLOGICAL INSTITUTE, at 8.15.—The Evidential Value of the Historical Traditions of the Baganda and Bushongo: E. S. Hartland.

ROYAL STATISTICAL SOCIETY, at 5.—The Course of "Real Wages" in London, 1900–1912: Frances Wood.

ILLUMINATING ENGINEERING SOCIETY, at 8.—Report on Progress during the Vacation: L. Gaster.—Proceedings at the National Gas Exhibition: F. W. Goodenough.—The Fourth International Congress on School Hygiene: Dr. J. Kerr.

INSTITUTION OF CIVIL ENGINEERS, at 8.—*Further Discussion:* The Construction of the "White Star" Dock and adjoining Quays at Southampton: F. E. Wentworth-Sheilds.

WEDNESDAY, NOVEMBER 19.

ROYAL METEOROLOGICAL SOCIETY, at 7.30.—Daily Temperature Range at Great Heights: W. H. Dines.—Eddy Wind of Gibraltar: H. Harries.

GEOLOGICAL SOCIETY, at 8.—Exhibition of Implements and Reputed Implements of Palæolithic or Earlier Age, and of Flints showing Various Types of natural Fracture, followed by a Discussion.

AËRONAUTICAL SOCIETY, at 8.30.—The Right to Fly: Roger Wallace, K.C.

ROYAL SOCIETY OF ARTS, at 8.—Opening Meeting. Address by Col. Sir T. H. Holdich, K.C.M.G.

ENTOMOLOGICAL SOCIETY, at 8.

ROYAL MICROSCOPICAL SOCIETY, at 8.—Notes on the Shell Structure in the Genus Lingula, Recent and Fossil: F. W. Chapman.—Development of an Embiid: J. C. Kershaw.

THURSDAY, NOVEMBER 20.

ROYAL SOCIETY, at 4.30.—*Probable Papers: Medullosa Pusilla:* Dr. D. H. Scott.—Neuro-muscular Structures in the Heart: Prof. A. F. S. Kent.—The Alleged Excretion of Creatine in Carbohydrate Starvation: G. Graham and E. P. Poulton.—The Origin and Destiny of Cholesterol in the Animal Organism. XI. The Cholesterol Content of Growing Chickens under Different Diets: J. A. Gardner and P. E. Lander.—Contributions to the Biochemistry of Growth—The Lipoids of Transplantable Tumours of the Mouse and the Rat: W. E. Bullock and W. Cramer.

FRIDAY, NOVEMBER 21.

INSTITUTION OF MECHANICAL ENGINEERS, at 8.—Cutting Power of Lathe Turning Tools: Prof. W. Ripper and G. W. Burley.

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