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"To the solid ground
Of Nature trusts the mind which builds for aye."—WORDSWORTH.

THURSDAY, MARCH 5, 1914.

RADIO-ACTIVE ELEMENTS AND THE PERIODIC TABLE.

The Chemistry of the Radio-Elements. Part ii. The Radio-Elements and the Periodic Law. By F. Soddy. Pp. v+46. (London: Longmans, Green and Co., 1914.) Price 2*s.* net.

MR. SODDY'S contention that there exist sets of elements, incapable of separation from each other by chemical means, has much experimental evidence to support it, taken from the behaviour of some of the radio-active elements. At first sight, the argument against such a statement would appear to be similar to one applicable to the "rare elements" of the earth series, lanthanum and its congeners, viz., that the methods of separation have not yet been found. But a little consideration must show this to be untenable. It is possible to apply electroscopic tests to the radio-active elements capable of estimating their amount with an accuracy of, say, 1 per cent. Suppose, then, that a certain process of separation is applied to a mixture of three elements, one of which is radio-active; and suppose that no diminution or increase is noticed in the relative amount of the radio-active element in either portion, it is legitimate to conclude that the radio-active element is inseparable from that element by the process used. By varying the process, if no separation is still effected, it appears a legitimate conclusion that separation by a chemical process is impossible. This, of course, does not exclude separation by a physical process, supposing the atomic weights of the "inseparable" elements to differ; for it is always possible to imagine the elements in a state of gas; and it is undeniable that a mixture of gases could be separated by diffusion into its constituents, provided the gases possess different densities.

In this volume Mr. Soddy gives a diagram showing the position of the elements of high atomic weight; on the assumption that when a radio-active element loses an atom of helium, weighing 4, it joins a group of inseparable elements. Thus, to take an example:—Radium F, of atomic weight 210, in losing an atom of helium, forms a variety of lead of atomic weight 206; similarly thorium C, of atomic weight 212, gives another element which passes as lead, inseparable from lead, of atomic weight 208; similarly radium C, of atomic weight 214, in losing an atom of helium, yields radium D, of atomic weight 210, inseparable from lead. But this is not all; in the β ray changes, the element shifts its position by one place in the opposite direction to that caused by the loss of an α particle, without perceptibly changing its atomic weight; thus thorium D, losing a β corpuscle, or electron, shifts to another group—the lead group—from the thallium group to which it actually belonged, without change of atomic weight. These processes are somewhat involved; but they appear to me to be a reasonable hypothesis, although further proof is desirable. This proof is evidently to be furnished by accurate determinations of the atomic weight of lead associated with thorium minerals on one hand and with radium minerals on the other. Supposing each variety of "lead" to be pure, the sample of "thorium lead" should have an atomic weight of about 208, while that of the "radium lead" should be about 206. Determinations with this object in view are now in progress. The word "isotopic" is suggested as a fitting name for two elements, both occupying the same place in the periodic table. In his account of the theory, due credit is given to Fleck, Russell, and Fajans, the last of whom stated independently an almost identical hypothesis.

The difficulty of two elements having an identical spectrum is considerable; it is suggested that inasmuch as the spectra are characteristic of the movement of the electrons in an element, rather than of its mass, two elements in which the electrons will have identical motions must have the same spectrum. Mr. Aston's researches on two "neons," which can be separated from each other by diffusion, but which show no difference in spectrum, are adduced as proof of this point of view. It will be remembered that it was owing to Sir J. J. Thomson's finding that ordinary neon contains a small proportion of an element of atomic weight 22, which led to Mr. Aston's research. Here, again, one can only wonder that two elements, neon I. and neon II., of different atomic weights, 20 and 22, which can be separated by diffusion, according to Mr. Aston, have identical vapour-pressures, for they cannot be separated by fractional distillation.

Mr. Soddy has invented a modification of the periodic table which represents his new arrangements; it is three-dimensional.

Much of the book under review is taken up with detailed discussion of the generalisation of which a brief account has been given. The concluding section on the "Nature of the Argon Gases," puts forward the view that these elements are inactive owing to their great affinity for their valency electrons. Whereas an atom of sodium, in combining with an atom of chlorine, loses an electron to the chlorine, itself becoming an ion, an atom of argon has no such tendency, being very firmly bound to its electron.

This work of Mr. Soddy's must be termed "provisional"; it brings before the reader the state of knowledge regarding the sequence of radio-active elements, but it does more; it elaborates a hypothesis capable of correlating these facts; a very ingenious theory which, however, its author would be the first to acknowledge is still in need of support. W. R.

TECHNICAL MYCOLOGY.

(1) *Einführung in die Mykologie der Gebrauchs- und Abwässer.* By Dr. A. Kossowicz. Pp. vii + 222. (Berlin: Gebrüder Borntraeger, 1913.) Price 6.60 marks.

(2) *Die Gärungsgewerbe und ihre naturwissenschaftlichen Grundlagen.* By Prof. W. Henneberg and Dr. G. Bode. Pp. v + 128. (Leipzig: Quelle und Meyer, 1913.) Price 1.25 marks.

(1) DR. KOSSOWICZ surveys the subjects of water and sewage purification from the bacteriological point of view. To a large extent the book summarises researches that have been carried out on these subjects, though, on account of their number, the summary of each research is necessarily very brief. Its chief value consists in the contained bibliography—every page teeming with references to the literature—and the student, engineer, or hygienist desiring a guide for his practice will be bewildered by the mass of detail. Diagrams and figures of filters and filter-beds, sterilising apparatus, sedimentation tanks and plant for the biological treatment of sewage have been freely introduced, and form a useful feature.

The earlier chapters deal with the bacterial content of waters and the factors which modify it, the occurrence of pathogenic microbes in water, and the self-purification of water, and in subsequent chapters the subjects of sand-filters, chemical and other methods for the purification and sterilisation of water, sewage farms, the biological treatment of sewage, and the purification of trade effluents are considered.

(2) This little book gives a brief and simple, though at the same time excellent, survey of fermentations and the fermentation industries. The yeasts, bacteria, and moulds concerned in fermentations—alcoholic, souring of milk, acetic and butyric acids, etc.—are first described, with an account of their structure, development, and occurrence. The chemical composition of the substances fermented, the nature of the chemical changes involved, enzymes and enzyme action are next considered, and finally a description is given of the industrial processes involved in the production of beer, wine, and spirits, pressed (German) yeast, bread and vinegar, soured milk and "sauerkraut," cocoa and coffee. The text is illustrated with a number of figures of the micro-organisms involved and of the industrial plants employed in the fermentation industries.

R. T. HEWLETT.

HUMAN MATHEMATICS.

(1) *A First Book of Practical Mathematics.* By T. S. Usherwood and C. J. A. Trimble. Pp. iv + 182. (London: Macmillan and Co., Ltd., 1913.) Price 1s. 6d.

(2) *Practical Geometry and Graphics for Advanced Students.* By Prof. Joseph Harrison and G. A. Baxandall. Enlarged Edition. Pp. xiv + 677. (London: Macmillan and Co., Ltd., 1913.) Price 6s.

(3) *Practical Mathematics.* By Norman W. M'Lachlan. Pp. viii + 184. (London: Longmans, Green and Co., 1913.) Price 2s. 6d. net.

(4) *Exercices d'Arithmétique.* Enonces et Solutions. By J. Fitz-Patrick. Avec une Preface

de J. Tannery. Troisième Edition. Pp. vi+707. (Paris: A. Hermann et Fils, 1914.) Price 12 frs.

(1) IN the old days a boy had to reason in geometry "acording to the rules of the game." Many a boy felt that he must put aside common sense for fear that it might contradict the "rules," and that he must "play the game according to the rules." Hence came grotesque howlers, and the boy felt it unreasonable that grotesque results should be ridiculed, for they arose from strict adherence to rules. While in the present happy days we have altered that as regards geometry, the old method persists in algebra; the subject is treated in a purely abstract manner, it has no relation to anything in every-day life; the student can only commit to memory the rules of the game, and do his best to play the game. In this case the results also are generally abstract, so that appeal to common-sense would be impossible even if the boy allowed the validity of the appeal.

Now, however, a brighter dawn is breaking for the ill-treated boy. Usherwood and Trimble connect the algebraic work with the concrete throughout. The boy no longer has to play a game with rules he does not understand. Each algebraic process arises out of concrete instances, which are themselves easy of comprehension, and give a common-sense meaning to the process. The book is thus in the van of the movement to humanise algebra as geometry has been humanised, and in another generation no headmaster will mourn the blighting influence which $x+y$ had upon him.

The authors approve of the use of contracted methods, as do most of the best teachers at the present moment. We venture, however, to question whether these authors and teachers do well in this matter. It is customary to work to a significant figure more than will be required in the result; this generally gives the result to the required approximation, but not always. Are we to chance the accuracy, or are we to complicate the process further by an estimate of the trustworthiness of the result? Moreover, the estimation of the number of figures to be retained, even in the normal case, is a matter of no little skill; we have frequently known professors and schoolmasters of good standing to be at fault.

There appears to be no educational principle at stake, and the question is simply whether contracted methods conduce to speed and accuracy or not. Does the shortness of the contracted calculation compensate for the time spent in deciding how far to contract, and for the chance of error by excessive contraction? For the expert calculator, like the teacher of arithmetic or the observatory computer, it compensates without doubt. For ourselves, and we imagine for most people (adults and children), contracted methods in their strict form do not compensate. For us the best way is to calculate stolidly through, and at the end throw away the unnecessary figures, or if the numbers get very heavy, to contract to a modified extent, keeping, perhaps, two or three more figures than a strict contractionist would allow.

(2) Why do the universities so carefully exclude Mongian geometry from their "pure" mathematical courses? To many a pure mathematician the happening upon such a book as Harrison and Baxandall's is like the acquisition of a new sense. His ideas of solid geometry are those of Euclid's Eleventh Book, in which he is instructed to "draw a plane through three given points," or to carry out in three dimensions some construction that has been discussed in the plane, and which he had imagined was meant to be carried out on a sheet of paper with ruler and compasses. On arriving at the Eleventh Book he discovers that when Euclid says "draw a plane through three given points," he only means that three points determine a plane; on the Book I. construction carried out in three dimensions he has to put such interpretation as he can.

In course of time he happens upon a book on Practical Solid Geometry and regions unknown to Euclid and the universities. With what joy he finds that it is possible to represent points in space upon a sheet of paper, and actually possible to draw a plane through them. He wishes he was young again so that he might follow up all the wonderful consequences, actually carrying out all the constructions and not merely talking about "how it is done," as was his custom at the university. And Harrison and Baxandall would be a first-rate book to use if he could be young again. It contains the most alluring problems, wonderful in variety. There are no watertight compartments, but every branch of mathematics that can help is allowed to do so. The language, moreover, is excellent, a statement that cannot always be made of English mathematical writing.

Part III. of Messrs. Harrison and Baxandall's book is Graphics, an admirable subject, neglected in pure mathematics in the same unaccountable way as Mongian geometry. The story runs that Prof. P. G. Tait held that the analytical method was always superior to the graphical, and applied it to ascertain the stresses in the Forth Bridge. Although a man of unrivalled intellectual power he failed that time. Those days are gone, the schools are learning the value of Graphic Statics, and perhaps in time the universities may follow.

(3) Mr. M'Lachlan's book is mainly a collection of exercises in geometry, arithmetic, algebra, and trigonometry. They are all good, natural questions, straight from the workshop and other human sources. For the engineering student (for whom they are designed) they are ideal, while other students also will find much of value. The text is inferior in value, as if the writing of it had been a perfunctory task; but there is not much text, and the exercises alone are well worth the half-crown at which the price is fixed.

(4) M. Fitzpatrick's book of exercises in algebra might have been written for the express purpose of enabling English mathematicians to thank God that they are not as other men. There are 1300 questions, drawn mainly from French examination papers. The book contains all the old artificial questions which England is in process of discarding, and among the whole thirteen hundred we have been unable to find one natural problem taken straight from human life. In one particular, however, it is for the English mathematician to drop the *rôle* of Pharisee and take up that of Publican. We have nothing but praise for the clearness and exactness of the language of M. Fitz-Patrick's book, while in the first and third of the English books now under review we find carelessness of language that often produces ambiguities, and sometimes amounts to misstatement. In language we have much to learn from France. D. B. M.

OUR BOOKSHELF.

The Child: Its Care, Diet, and Common Ills. By Dr. E. Mather Sill. Pp. viii + 207. (New York: Henry Holt and Co.) Price 1 dollar net.

IN the modern nursery the mother requires information on many questions which used to be disregarded or left entirely to the discretion of the doctor. She now realises that in her kingdom of the nursery, preventive medicine depends to a large extent upon her care and foresight. If she provides her children with the conditions they require for healthy development, they tend to remain well and happy, and the services of the physician will be required seldom.

Dr. Sill has had a large experience of children's medicine, and, in this small volume, he has contrived to present, in simple language, much valuable information on the clothing, feeding, general hygiene, and minor ailments of children. It is an unpretentious book, admirably adapted to its purpose as a handbook for young mothers. It is well printed, and is supplied with attractive illustrations and an index.

Some useful tables are included, and a few recipes for invalid dishes, together with clear directions for the preparation of simple domestic remedies, such as the various kinds of medicated baths. The common slight ailments of childhood are described, and a list is given of the poisons most liable to invade the nursery, together with their domestic remedies.

In every treatise on infant care, the instructions for the modification of cow's milk for bottle-fed babies are apt to be involved and lengthy, and perhaps in the little volume under review the author has not been entirely successful in avoiding this fault.

The book closes with advice to parents to tell their children some elementary physiological facts about the phenomenon of reproduction and the care that they should take of their bodies. This wise advice is strengthened by suggestions as to the best way of explaining these matters to children.

Dr. Sill's book is one to recommend cordially, as it is certain to be appreciated by those for whom it is intended.

An Account of the Morisonian Herbarium in the possession of the University of Oxford. By Prof. S. H. Vines, F.R.S., and G. Claridge Druce. Pp. lxviii + 350 + plates. (Oxford: Clarendon Press, 1914.) Price 15*s.* net.

ALL who take an interest in the history of botany, and especially the history of botany in Britain, will be glad to see the second work on the Oxford Collections, which has just been issued under the joint authorship of Prof. Vines and Mr. Druce. These names are a guarantee both of accuracy and of erudition, nor will the reader fail to discover on every page of the interesting and valuable introduction a breadth of acquaintance with the old literature, as well as with sources of information by no means readily accessible. The position of the Bobarts, father and son, in relation to the carrying out of Morison's great work, is made very clear, and, incidentally, the earlier history of the Oxford Botanic Garden is well told in the letters and remarks of those who were interested in its inception and early progress.

The bulk of the work is occupied by the "Plantarum Historiæ universalis Oxoniensis, pars secunda et pars tertia." The second part of the "Historia" was issued by Morison, while the younger Bobart was entrusted with the completion of the third part. In the present work, in which the plants are enumerated, the modern reader will find the critical notes incorporated by the authors of great service in identifying the older names and descriptions. The book is a scholarly one, and well worthy of the reputation of its authors.

A Gypsy Bibliography. By Dr. G. F. Black. Pp vii + 226. (London: Bernard Quaritch, 1914.) Price 15*s.* (Gypsy Lore Society, Monograph No. 1.)

FOR the first time, Dr. G. F. Black, of the New York Public Library, has undertaken the difficult task of compiling a comprehensive bibliography

of gypsy literature. A preliminary edition of this bibliography was issued for revision by European and American scholars in 1909, and the information thus obtained has been used in the present compilation, which includes 4577 entries, accompanied by a good subject index. No attempt has been made to sift the chaff from the wheat, and many books and articles now included have obviously no claim to be regarded as scientific authorities. In a new edition it would be well to define by special type those publications which are really of value. The leading writers on gypsy lore have been fully dealt with—Borrow with 103 entries, Wlislocki, 182, and Bataillard, 41; while the work of English authorities like MacRitchie, Sampson, Thompson, and Winstedt, is adequately recorded.

The bibliography is prepared on scientific principles, and footnotes to the more important articles supply useful information. It is disappointing to note that the Oriental material has been less carefully examined than that of the West. For example, in the case of India, much second-rate material is recorded, while the records of recent ethnographical surveys, and locally published books and pamphlets have often been neglected. It may be hoped that in a new edition the libraries of the India Office, Royal Asiatic Society, the Imperial Library at Calcutta, and other local sources will be more carefully examined.

A Textbook of Domestic Science for High Schools. By Matilda G. Campbell. Pp. vii + 219. (New York: The Macmillan Company, 1913.) Price 4s. net.

HAD this book been published a few years ago in this country it would probably have been described in its title as a book of "domestic economy." It is concerned chiefly with cookery, which is regarded frankly as an art, and taught as usual by recipes. The treatment is not scientific in the proper sense, and the few chemical formulæ and statements of fact about chemistry introduced will serve only to confuse the student. Under a different title, and with some omissions, we should have here a good book on practical cookery.

The Religious Revolution of To-day. By Prof. J. T. Shotwell. Pp. ix + 162. (Boston and New York: Houghton Mifflin Co., 1913.) Price 1.10 dollars net.

PROF. SHOTWELL here publishes the William Brewster Clark Memorial lectures he delivered last year at Amherst College. These lectures are in memory of Dr. W. B. Clark, who graduated from Amherst in 1876, and their object, a foreword to the volume states, is to assist "in throwing light in a genuinely scientific spirit upon the relation of the research, discovery, and thought of the day to individual attitude and social policy." The titles of the lectures are: "Contrasts," "Devolution or Evolution?" "The Problem and the Data," and "The New Régime."

LETTERS TO THE EDITOR.

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Active Nitrogen.

A FURTHER paper by Tiede and Domcke has appeared (*Berichte*, February 7, 1914) in which it is stated that bomb nitrogen passed over copper moderately heated (to about 400° C.) is incapable of giving the glow characteristic of active nitrogen. This is held to confirm the previous statement by the same authors relative to nitrogen prepared by heating a metallic azide. In each case the result is attributed to the successful elimination of any trace of oxygen.

We have carefully repeated this new experiment, taking every precaution. All parts of the apparatus were sealed together by fusion. Its lightness was thoroughly tested, both before and after the experiment, and occluded gases were carefully got rid of. The column of copper employed consisted of rolls of the finest gauze (ninety threads to the inch), carefully reduced from the oxidised condition. Its length was 50 cm., and its diameter 17 mm. The temperature was slowly taken up from 15° C. to 480° C., without any distinct change in the intensity of the glow at any stage. The experiment has been repeated on several occasions before colleagues. A subsequent examination of the copper showed that oxidation had not proceeded for more than 8 cm. We emphatically dissent therefore from Tiede and Domcke's conclusion, in this case, as in the previous one.

The rest of their paper is an attempt to show that some of the characteristic effects can be got with oxygen only, in the entire absence of nitrogen. We must content ourselves here with saying that we do not agree with their observations, but that these would not tell against the existence of active nitrogen, even if they were correct. The conclusive fact is the capacity of the gas to react with, *e.g.* hydrocarbons, to form hydrocyanic acid. This they have not attempted to dispute.

We are glad to see that Koenig and Elöd (*Berichte*, February 21, 1914) are in agreement with us that azide-nitrogen gives the glow perfectly well.

H. B. BAKER.
R. J. STRUTT.

Imperial College of Science, March 3.

Remarkable Upper-Air Records at Batavia.

TWO sounding-balloons liberated at Batavia during the present rainy season have met with exceedingly low temperatures, when entering the stratosphere at the usual height of about 17,000 metres (10·6 miles).

On December 4, 1913, −90·9° C. (−131·6° F.) was registered, and on November 5 −91·9° C. (−133·4° F.). Though in this last case the clockwork had stopped, the register may be accepted without reservation. I believe this air temperature of −91·9° C. to be the lowest on record.

On December 4 the balloon (weight 2·2 kg.) reached a height of 26,040 metres (16·2 miles), and the registering, both in the ascent and in the descent, is to be depended upon, as will be proved below. What is most remarkable in the temperature record is that from 17,000 metres upward an increase from −91·9° C.

to −57·1° C. is shown, the latter agreeing with the value which is usually found in Europe. In former balloon ascents made at Batavia, temperature records have been obtained only twice for heights above 20 km. In one of those cases (August 6, 1913), an increase similar to that of December 4 was recorded, viz., −82·6° C., at 17 km., and −63·7° at 22 km.; in the other case, however (October 2, 1912), the temperature showed a much smaller increase (−80° C. to −75° C.), the balloon reaching 23 km.

Regarding the trustworthiness of the records, the scale-values of the thermo- and barograph may be entirely depended upon, the instruments having been subjected to thorough verification before the respective ascents.

The only seemingly prejudicial circumstance is that, though the balloon was liberated before sunrise, the sun rose above the horizon as the balloon entered the stratosphere, so that the insolation may have caused an apparent rise of temperature, notwithstanding the sun was low in the sky. Comparison of the temperature records for ascent and descent, however, prove that this has not been the case. The balloon descended at a quicker rate than it ascended; accordingly ventilation was more efficient in the downward movement, and consequently any heating effect of the sun-rays smaller. Thus we should expect higher temperatures during the ascent, even if we take into account that the sun had risen higher in the meantime. On the contrary, however, on December 4 the temperatures during ascent were lower than, and on August 6 nearly equal to, those recorded during descent. The higher temperatures in the descent on December 4 are easily explained as an effect of sluggishness of the thermograph, especially as the sign of the difference between ascent and descent changes with the temperature gradient, when going from the troposphere to the stratosphere, quite in accordance with any effect of sluggishness. The values of temperature and ventilation are given here for heights from 15 km. upwards:—

Height in km.	Temperature Ascent	Temperature Descent	Average	Temperature higher in ascent	Ventilation (m.p. sec.) Ascent	Ventilation (m.p. sec.) Descent
	°C.	°C.	°C.			
15	−76·4	−79·6	−78·0	3·2	0·5	1·6
15·5	−79·0	−84·0	−81·5	5·0		
16	−83·1	−89·1	−86·1	6·0	0·4	1·6
16·5	−87·1	−90·9	−89·0	3·8		
17	−89·5	−89·7	−89·6	0·2	0·3	0·9
17·5	−88·8	−85·8	−87·3	−3·0		
18	−87·4	−83·2	−85·3	−4·2	0·4	0·5
19	−81·3	−74·9	−78·1	−6·4	0·2	0·6
20	−74·5	−68·9	−71·7	−5·6	0·2	0·6
21	−69·7	−66·7	−68·2	−3·0	0·2	0·7
22	−67·8	−64·2	−66·0	−3·6	0·2	0·7
23	−64·0	−62·0	−63·0	−2·0	0·2	0·7
24	−60·0	−60·0	−60·0	0·0	0·2	0·7
25	−59·4	−59·4	−59·4	0·0	0·2	0·2
26	−57·2	−57·2	−57·2	0·0	0·2	0·2

As to the temperature gradients, it may be remarked that in the stratosphere they show a succession of low and very high (>1·0) values.

I believe the remarkable behaviour of temperature in the tropical stratosphere, revealed by these upper-air soundings, will furnish a key to the explanation of the two salient features of the stratosphere, viz., the lowering of the temperature at its base and its rise in height, when proceeding from the poles to the equator.

W. VAN BEMMELEN.

Batavia, January 23.

The Vertical Temperature Distribution in the Atmosphere.

IN the observations described by Dr. van Bemmelen in the foregoing letter, the vertical temperature distribution in the tropics is so typically represented that it seems worth while to consider a little more closely the essential difference between the curve obtained from them and curves obtained in temperate latitudes, and to discuss its probable cause. This difference, as Dr. van Bemmelen has pointed out already, chiefly relates to the greater height of the stratosphere and the large and rapid increase of temperature in it.

As to the vertical temperature distribution in higher latitudes, theory has already been able to give account of its principal properties. These theories (Humphreys, Gold, Emden [1]), however, deal only with those latitudes and not with the particular features of the tropical atmosphere. I will briefly formulate the results of these researches so far as they will be used in the further discussion.

(1) When convective temperature equilibrium is supposed to exist and the decrease of water vapour with height is taken into account, Gold finds that above the isobaric surface of a quarter atmosphere, radiation has a heating effect, below a cooling influence. In Europe this surface has a height of 9500 metres. With a slightly different conception as to the distribution of water vapour Emden calculates nearly the same height for the limit between heating and cooling effect, viz., 8950 metres.

(2) According to Emden, his equations used for the lower regions do not hold good in the upper part of the troposphere in consequence of the very small quantity of water vapour. Taking this small amount of vapour into account, he derives a minimum radiation temperature of −59° C. Supposing the condition in (1) to be gradually changing into those mentioned in (2), his theory fully agrees with the facts observed over the tropics.

(3) The equations of Emden show at greater elevations a gradual increase of temperature in the stratosphere, in agreement with the results of observation.

The very low temperatures, observed in the upper part of the tropical troposphere, which are about 30° C. below those observed at the same height in temperate regions, must be ascribed to another effect. Besides the radiation and the resulting vertical convection currents, which explain the principal features of the gradients in higher latitudes, in the low-pressure belt of the tropics the rising air currents of the general atmospheric circulation cooperate. They disturb the temperature distribution as determined by radiation, and shift the troposphere to greater heights.

Dr. van Bemmelen, who found at Batavia the upper limit of the anti-trade winds at about the same level as the base of the stratosphere, thereby proved that the convection currents reach as high as the upper limit of the troposphere.

Also from a theoretical point of view, it is evident that the vertical convection currents do not reach higher than the limit of strato- and tropo-sphere, as this would be inconsistent with the stability of the temperature gradients of the stratosphere; on the other hand, it is improbable that their height remains much below this limit, for without convection the high radiation temperatures would rapidly take possession of their dominion.

At higher levels the conditions in the stratosphere will rapidly approach those of the temperate latitudes at the same height. Therefore the marked increase of temperature, as shown by the observations is exactly what might be expected.

[1] R. Emden: Über Strahlungsgleichgewicht und atmosphärische Strahlung. Ein Beitrag zur Theorie der oberen Inversion. Sitz. Ber. d. math. phys. Klasse d. K. B. Akad. d. Wiss. zu München, 1913, Heft 1.

The upheaval of the stratosphere in the tropics may be demonstrated in a very instructive way by comparison of its height with the height of the cirrus clouds. In my opinion, as indicated below, the base of the cirrus fairly well represents the height of the hypothetical dividing surface between the cooling and heating effect of radiation for moist air (as mentioned in (1)). This surface is one of nearly uniform temperature, as shown by the temperatures of the cirrus level :—

Bossekop (70° N.L.),	height of cirrus 8·3 km.,	temp.	−45° C.
Potsdam (52° N.L.),	,, 9·2 ,,		−46° C.
Batavia (6° S.L.),	,, 11·4 ,,		−48° C.

Parallel to this surface runs the base of the stratosphere, the analogous dividing surface for atmospheric air (that is, for rather dry air as mentioned in (2)), with a nearly constant temperature of −55° C.

The deviation from this parallel intercourse, which appears in the tropics and subtropics, in consequence of a shifting which only affects the upper surface, gives a direct measurement of the disturbing influence of the vertical convection currents belonging to the general circulation.

In the *Meteorologische Zeitschrift* of 1913 (Heft 10, p. 493) I have already discussed the question of the cirrus level as a dividing surface for radiation effects. In this paper, which may be referred to here, attention was directed to the fact that there exists an essential difference between the cloud formation in the cirrus level and above it, as compared with the lower regions, a phenomenon very evident in the quiet tropical atmosphere. The upper part of the high cumulus clouds (their height may be estimated at about 13 or 14 km.) does not, as the lower part, dissolve rapidly, but assuming a flattened form and cirrostratus-like appearance, it remains drifting along for a considerable time. This difference I attributed to a cloud-dissipating (cooling) effect of radiation in the lower, and a cloud-forming (heating) effect in the upper levels.

As a fixed amount of water radiates and absorbs more strongly in the condensed form than in the gaseous state, in the regions where radiation has a cooling effect, as in the lower strata of the atmosphere, the cooling will be relatively strong in the clouds as compared with the surrounding air. But a heating effect will be experienced in the clouds in higher levels, where radiation is heating them more intensely than the surrounding air. When left to themselves, after convection has finished, they will descend and dissolve in the first case, but, on the contrary, will be upheld or rise, and consequently prolong their existence or develop in the second case.

At that time I had not read Emden's paper. By attributing the relatively low radiation temperatures of the air at these heights to ozone, I tried to explain the circumstance of the different radiation effect observed either with regard to the cirrus clouds or to the air in which they are floating.

Perhaps such an influence cooperates, but Emden's results mentioned above may also explain the matter.

It is very probable that his statement (1) may be applied to clouds on account of their large amount of water in condensed and gaseous form. In this case the limit above which radiation has a heating effect (8950 metres) is indeed situated just below the cirrus level, which at Potsdam has a height of 9200 metres.

As to radiation, the conditions in the surrounding air at this height approach those mentioned in (2), and the radiation effect will still remain a cooling one.

Thus the lower limit of the cirrus clouds may be regarded as the level where, for air of abundant water contents, the influence of radiation changes its sign.

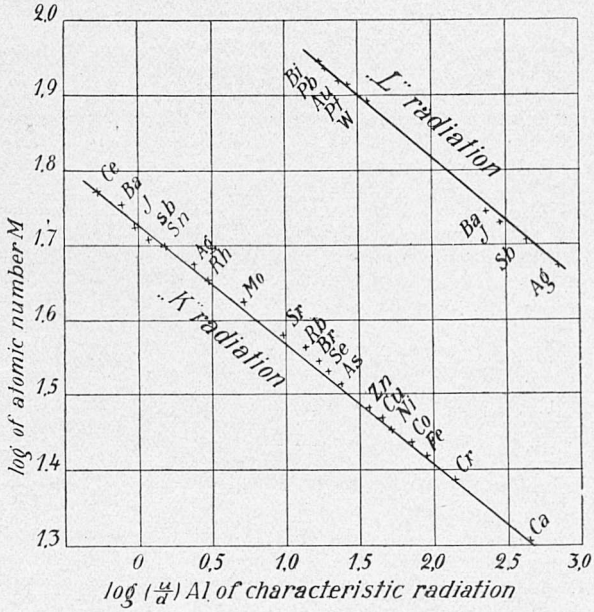
Batavia, January 23. C. BRAAK.

Atomic Models and Regions of Intra-atomic Electrons.

THAT, as concluded by Prof. Nicholson (NATURE, February 5, p. 630) the atoms of lithium, beryllium, and boron cannot consist of 3, 4, 5 electrons rotating round a nucleus of 3e, 4e, 5e, respectively, with equal angular momenta in one circular orbit, may be concluded also from the periodic system, as instead of 1, 0, 1, 2, 3 electrons of valency, we should then expect a regular increase from 0 to 5, or no valency at all. No atomic model, so far as I know, has succeeded in making this difference plausible; but it is not essential to the hypothesis, that, independently of any atomic model :—(i) Three distinct regions of intra-atomic electrons exist, the number of which (say P, Q, R) may be calculated for each atom from the periodic system; and (ii) on these numbers most, if not all, of the non-periodic properties of the elements depend, so that (NATURE, December 25, 1913, p. 476) :—

(i) M=P+Q=(1) the charge on the nucleus on Rutherford's theory; (2) the number of electrons surrounding that nucleus; (3) the atomic number of an element in Mendeléeff's series.

P=(1) the number of peripheric electrons (those of



valency included); (2) $8r+p$ (p being the maximum valency and r the number of rows preceding that of the element : rare-earth period not counted).

Q=(1) the inner electrons, giving probably the characteristic radiation; (2) the number of aperiodic elements (H, He, Co, Ni, &c., and rare-earth elements).

R=(1) the free nuclear electrons of which part can be ejected as β rays (Bohr, *Phil. Mag.*, vol. xxvi., p. 501, 1913); (2) $A/2-M$, if the positive part of the nucleus consists of α particles for by far the greatest part; (3) kP^2, as $A/2-M=kP^2$ for all elements (NATURE, December 25, p. 476); and that :—

(ii) On M, or some function of it, depend (1) the large-angle scattering of α particles (NATURE, November 27, p. 372) (on M^2); (2) wave-number of the characteristic radiation for elements from nickel to zinc (on $(M-1)^2$) (Moseley, *Phil Mag.*, vol. xxvi., p. 1024, 1913); (3) the absorption of the characteristic radiation for all elements (see figure); (4) the minimum velocity of β rays required to produce it (on M or M−1); (5) for hydrogen M only gives a possible

value for the charge, and normal values for absorption, etc., while A/2 does not.

And (iii) on P, or some power of it depend (see table) (1) the percentage of the incident β radiation reflected for UrX, RaE, Act D); (2) the absorption of kathode, or β rays (see Lenard, *Ann. d. Phys.*, vol. lvi., p. 275, 1895, and Crowther, *Phil Mag.*, vol. xii., p. 379, 1906); (3) the number of nuclear electrons and β particles ejected (see Soddy, *Jahrb. Radioakt. und Elektronik*, 1913, vol. x., p. 193); (4) quanta of energy the β particle looses on Rutherford's theory (*Phil Mag.*, vol. xxvi., p. 717, 1913) in traversing the non-nuclear electrons of the atom it came from; (5) probably the decrease of velocity of α particles traversing matter (Bohr, *Phil. Mag.*, vol. xxv., p. 27, 1913). The table gives the number of electrons, causing this decrease, in approximate values.

	P	$\frac{\mu}{D}$	$\frac{10\mu}{NP^2}$	Perc. Refl. β rad. UrX	RaE	AcD	Perc. Refl. β rad./$P^{\frac{3}{4}}$ UrX	RaE	AcD	N, Bohr
Al	11			27	30	38	8·2	9·0	(11·5)	14
Fe	24	6·4	6·2	41	41	47	8·4	8·4	9·6	
Ni	24			43	43	48	8·9	8·9	9·8	
Cu	25	6·8	6·9	43	45	52	8·5	8·9	10·4	
Zn	26	6·95	6·7	43	45	53	8·5	8·9	10·3	
Ag	41	8·3	5·3	55	57	63	8·6	9·0	9·9	
Sn	44	9·5	6·4	57	62	70	8·7	9·4	10·5	38
Pt	56	9·4	5·9	66	68	78	8·8	9·1	10·4	
Au	57	9·5	5·8	68	68	79	9·0	9·0	10·4	61
Pb	60	10·8	6·2	68	70	80	8·8	9·1	10·3	65
Bi	61			70	71	81	9·0	9·1	10·4	
			6·2				8·67	8·98	10·19	

From (ii, 2) $n=c/\lambda=2\cdot465.10^{15}(M-1)^2$; from (ii, 4) $V_{min}=2\cdot24.10^8(M-1)$. Now $V_{min}>v$ of the electron giving K-radiation, and if this $=1\cdot93.10^8(M-1)$, then $mv^2/2n=0\cdot88.1\cdot93.^2 10^{-11}/2.2\cdot465.10^{15}=6\cdot62.10^{-27}=$ Planck's h.

A. VAN DEN BROEK.

Gorsel, Holland, February 9.

An Early Slide Rule.

DE MORGAN, in article "Slide Rule" in the *Penny Cyclopaedia*, points out that though Gunter first used a logarithmic scale, the real inventor of the logarithmic slide was Oughtred. "In the year 1630 he showed it to his pupil, William Forster, who obtained his consent to translate and publish his own description of the instrument, and rules for using it. This was done under the following title, 'The Circles of Proportion and the Horizontal Instrument,' London, 1632; followed in 1633, by an 'Addition, etc.,' with an appendix having title, 'The Declaration of the two Rulers for Calculation.'" After referring to a republication of this work in 1660, he goes on:—"The next writer whom we can find is Seth Partridge, in a 'Description, etc., of the Double Scale of Proportion,' London, 1685. He studiously conceals Oughtred's name; the rulers of the latter were separate, and made to keep together in sliding by the hand; perhaps Partridge considered the invention his own, in right of one ruler sliding between two others kept together by bits of brass."

Prof. F. Cajori, in his book, "A History of the Logarithmic Slide Rule," 1909, the result of an exhaustive inquiry into the literature of the subject, quotes De Morgan, and continues (p. 17), "To Partridge we owe, then, the invention of the slide." In an addendum (p. vi.), and in NATURE, February 24, 1910, p. 489, he refers to a copy of Partridge's book in his own possession, published in 1662, in which it is stated that the book was written in 1657.

Dr. Alexander Russell, in NATURE, January 30, 1910, p. 307 states:—"A few years before 1671, Seth Partridge rediscovered the sliding principle, perfected it, and gave an almost complete specification for the slide rule which is used to-day by engineers. . . . Personally, I consider that Seth Partridge is the real inventor of the modern 10-in. slide rule."

My object in writing is to direct attention to the fact that there is in the Science Museum at South Kensington a slide rule which is inscribed, "Made by Robert Bissaker for T. W., 1654." This proves that the slide was invented and *in use* three years before Partridge wrote his pamphlet, and eight years before the earliest known date of its publication.

This very early example of the instrument is of boxwood, well made, and bound together with brass at the two ends. It is of the square type, a little more than 2 ft. in length, and bears the logarithmic lines first described by Edmund Gunter. Of these, the *num.*, *sin.*, and *tan* lines are arranged in pairs, identical and contiguous, one line in each pair being on the fixed part, and the other on the slide. As Seth Partridge describes no feature which is not embodied in this example of the instrument, it would appear that less credit is due to him for invention in connection with the slide rule than has hitherto been given.

In this year of the Napier tercentenary celebration it is interesting to know that a slide rule is still in existence which was made only forty years after the invention of logarithms. DAVID BAXANDALL.

The Science Museum, South Kensington, S.W.

The Permeability of Echinoderm Eggs to Electrolytes.

IN 1910 J. F. McClendon showed that the electrical conductivity of echinoderm eggs is considerably increased after fertilisation, and inferred from this fact that the act of fertilisation causes an increase in the permeability of the egg-surface to electrolytes. In his recent book ("Artificial Parthenogenesis and Fertilisation") Prof. Loeb suggests that the increase in conductivity is not due to an increase in permeability, but would be produced "if in consequence of membrane-formation the degree of electrolytic dissociation of the surface film of the egg should be increased" (p. 122).

I have recently found that the electrical conductivity of unfertilised and fertilised eggs is very greatly affected by the presence of very low concentrations of simple trivalent positive ions; a concentration of 0·0002M $Ce^{\cdots}$ decreases the conductivity of the unfertilised eggs of *Sphaerechinus granularis* by as much as 40 per cent. Such solutions likewise affect the conductivity of the fertilised eggs, but to a less degree. Whereas it is almost inconceivable that these phenomena are due to a decrease in the electrolytic contents of the surface-film of the egg, I have found considerable evidence in support of the suggestion that the electrical conductivity of these eggs is determined, at least partially, by the charge on the egg-surface. As Perrin, Girard, and Mines have shown, this factor also determines the degree of permeability of membranes to electrolytes. In short, McClendon's original contention, that the increase in electrical conductivity of eggs after fertilisation is due to an increased permeability of the egg-surface, is very much more satisfactory than Prof. Loeb's suggestion.

J. GRAY.

Stazione Zoologica, Napoli, Italy.
February 5.

THE BEGINNING OF ART.[1]

THE subject of prehistoric art has never failed to engage the public interest. It not only exhibits to us the beginning of all that is now embraced under the comprehensive term of Art, but it furnishes us with a more clear and precise insight into the mind of prehistoric man than can be given by any other branch of archæology. The authenticity of the records again has never, and can never, be seriously questioned by the most sceptical or the least learned in these matters.

For a long time the examples of prehistoric art were limited to carvings or gravures, the medium being bone, horn, or tooth, but since 1887, and particularly since 1901, attention has been more directly focussed upon the incised figures found on rocks, usually on the walls of caves, and not infrequently coloured with ochre. The caves so decorated are chiefly found in the Dordogne district of France, and along the Cantabrian coast of Spain.

Although the honour of first appreciating the significance of these paintings belongs to the late M. Piette, it is to the enthusiasm, ability, and labours of Abbé Breuil that we are chiefly indebted for most of our knowledge regarding them. A good example of the peculiar ability of Abbé Breuil, amounting indeed to what might be justifiably regarded as genius, for seeing things which are hidden from less acute observers, is given on pp. 146–8 of the volume on "La Caverne de Font-de-Gaume." In May, 1906, Abbé Breuil on casually looking through Abbé Parat's collection of "pierres utilisées," found on one of them what he conceived to be the head and fore part of a rhinoceros. A further more minute examination led him to the opinion that there were two silhouettes of a rhinoceros almost superimposed upon each other. M. Breuil showed the specimen to M. Salamon Reinach, who, however, was only able to decipher the two outlines when they were traced for him with a pencil. M. Boule was next shown the specimen, but expressed himself as sceptical on the matter. A few days afterwards a galvano-plastic impression was obtained at the Musée de Saint Germain, which removed all question of doubt as to the accuracy of the Abbé's opinion, as M. Boule readily acknowledged.

In the present publication Abbé Breuil has had the advantage of the cooperation of MM. Capitan et Peyrony for the French caves, and of MM. Rio et Obermaier et Père Lorenzo Sierra for the Spanish caves. Mention is also certainly due to M. Lasalle, for the very valuable and highly efficient services which he has rendered under very great difficulties in photographing the "paintings." Last but not least, we are indebted to S. A. S. le Prince de Monaco, who has shown his appreciation of the value of these records in the most practical way by undertaking their publication, increasing materially thereby the great debt which all archæologists already owe him.

Those who have seen the previous publications under the same auspices will be prepared for something as near perfection as anything can well be, nor will they be disappointed, for these books in matter and form, in text and illustration, leave nothing to be desired.

The caves in which these wall paintings are found occur in Cretaceous Limestone, and are both very extensive and tortuous. The "pictures" begin only after a certain distance has been traversed from the entrance, but this is to be explained, as the authors point out, on the ground that those at or near the entrance have become blurred and effaced by atmospheric agencies.

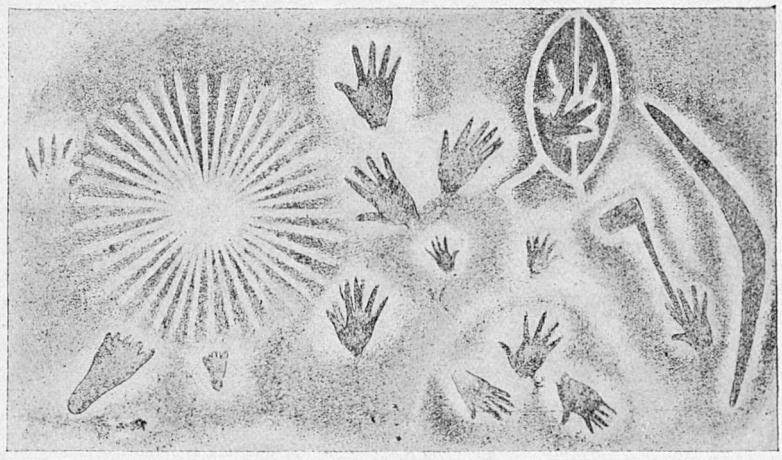


FIG. 1.—Hands, feet and weapons printed in colour on a rock in Australia (after Worsnop). From "Les Cavernes de la Région Cantabrique."

A large number of pieces of flint adapted for the purposes of drawing, and pieces of ochre suitable for colouring the figures, have been recovered from the caves, and the presumption that they were the actual instruments and material used is very strong. The date of the "paintings" may be assigned to the Aurignacian, Solutrean, and Magdalenian periods, possibly even to the end of the Mousterian. The pictures themselves are nearly all concerned with the portrayal of the larger members of the fauna existent at the period, the mammoth, rhinoceros, bison, bear, horse, deer, goat, wolf, &c. The interest attached to them is manifold. There is their intrinsic interest as works of art produced at a very remote period, there is the interest arising out of the change which takes place in the technique, and permits of our identification of no fewer than five distinct periods. Then there is the zoological interest, for the animals are so carefully drawn,

[1] "La Caverne de Font-de-Gaume aux Eyzies (Dordogne)." Par le Docteur L. Capitan, l'Abbé Henri Breuil et D. Peyrony. Pp. viii+271+lxv plates.

"Les Cavernes de la Région Cantabrique (Espagne)." Par H. Alcalde del Rio, l'Abbé Henri Breuil et le R. Père Lorenzo Sierra. Pp. viii+265+100 plates.

"La Pasiega a Puente-Viesgo (Santander)." Par l'Abbé Henri Breuil le Docteur H. Obermaier et H. Alcalde del Rio. Pp. 64+xxix plates. (Monaco: Imprimerie Artistique V^ve A. Chene, 1910–13.)

with such attention to detail, that they afford very strong evidence as to the appearance of these species now in many cases extinct. Lastly, there is the interest attached to the chronological order of the paintings as it may be determined by an examination of those examples far from rare in which one figure is superimposed on another. The evidence from this source is not, however, so complete that we can tell the order in which certain animals have become extinct. We find by a curious caprice that the mammoth, for instance, in "La Caverne de Font-de-Gaume" appears only in "paintings" belonging to the first and fifth periods.

There is naturally a special interest in those frescoes in which Man himself is the subject. Unfortunately there is no clear and full representation of Man. The figure in the cave Hornos de la Peña is almost certainly not that of a man. There is, however, a very spirited delineation of a human arm in "La Pasiega," while the number of times in which the human hand is depicted is remarkable. Representations of the left hand preponderate greatly over those of the right hand, a fact which is explained no doubt rightly by assuming that man had already ceased to be ambidextrous. It is a very curious coincidence that among the native Australians the custom of drawing or painting the hand on the wall of a cave is not infrequently practised. The accompanying figures show how closely related such examples may be. In Australia the boomerang is often found associated, while in Spain instruments of a similar shape are also sometimes introduced. Naturally there are many other markings the meaning of which it is difficult to determine, "tectiform," "scutiform," "claviform" figures. It is tempting to think that some of the former are meant to represent huts, it is at any rate difficult to know what else they could be while their resemblance to the homes of primitive people in all parts of the world is striking.

The value of these important books, the great labour they have entailed, the vast knowledge they have exacted, will be readily granted when it is further noted that they include a "description raisonée" of all the animals depicted, a description based on an examination of all the art specimens extant representing the animals, whether gravure, carving, or "painting." There is again a very careful and scientific comparison made between these old examples and those of the modern African Bushman.

The books constitute, with the archæological books already published from the Monaco press, a series of classics which mark an epoch in the history of our knowledge of archæology. They enable us to view the past as through a telescope.

WILLIAM WRIGHT.

FIG. 2.—Fresco of hands, animals and weapons (?) on the wall of the cavern at Castillo. From "Les Cavernes de la Région Cantabrique."

THE HOPE REPORTS.[1]

IF anyone would undertake the task of writing the history of zoological science during the past fifty years, an interesting chapter could be written on the attitude of the leading authorities towards the work of the pure systematist.

Fewer than fifty years ago every zoologist who ventured to express his opinions on the philosophical questions that gathered round the science was a recognised authority on the systematic zoology of some one group of animals. Haeckel had studied the Radiolaria and Medusæ; Darwin wrote a monograph on the Cirripedia; Huxley contributed to our knowledge of the systematic zoology of the Siphonophora. But the time came when, for a period, the study of a special group was discouraged, and the student, passing from his course of general study, started on his investigations on embryology or morphology, without taking the trouble to become acquainted with the difficulties of systematic work, or to train himself in the observation of minute differences of structure upon which the arrangement of animals into specific groups must, in so many cases, be based.

[1] The Hope Reports. Edited by Prof. E. B. Poulton, F.R.S. Vol. viii, Appendix, 1890–1910, Including Five Sub-families of the Blattidæ. By R. Shelford. Vol. viii., 1910–13. With a Separate Appendix. Vol lx., 1911–13. The Natural History and Description of African Insects, especially the Acræine Butterflies. (Oxford, 1913.)

The value of such work was well expressed in the letter written by Huxley to Francis Darwin ("Life of Darwin," vol. i., p. 347), which begins with the sentence:—"In my opinion your sagacious father never did a wiser thing than when he devoted himself to the years of patient toil which the Cirripede book cost him."

The three volumes of the Hope reports that have recently been issued may be regarded as an indication of the revival of systematic zoology after a period of comparative neglect, and a sign that some of our best thinkers are beginning to realise that "the great danger which besets all men of large speculative faculty is the temptation to deal with the accepted statements of fact in natural science as if they were not only correct, but exhaustive."

The entomologists who are associated with Prof. Poulton in the Hope Department at Oxford are engaged in the study of large and important speculative questions, but, as these volumes show, their work is based upon the careful detailed study and descriptive statement which pure systematic work demands. They have the great advantage which the rapid growth of the collections in the Hope department affords of basing their conclusions upon the study of a very large number of specimens that have been sent to the museum from various parts of the world by the band of skilled collectors and keen observers that Prof. Poulton has interested in his work; and whether we agree with the conclusions or not, we must feel confident that the work has been done with a thoroughness and wealth of illustration that has probably been unequalled in the history of speculative zoology.

Our interest naturally centres, in the first instance, on the progress that has been made during the period, of which these volumes form the record, in the study of mimicry and protective resemblance. It has been urged so frequently as an objection to the theories of Batesian and Müllerian mimicry that the insects that are supposed to exhibit them are not subject to the attacks of birds or other vertebrates gifted with eyes that can see or be deceived by colour patterns; and that the palatability of their flesh cannot in any way be an advantage to them in their struggle for existence; that the experiments in this connection of Mr. Pocock on the palatability of British insects, and the observations of Mr. Swynnerton on butterflies attacked by birds in Rhodesia are of special interest. The negative evidence of observers who say they have never seen a particular species of insect attacked by birds is really of very little value compared with the positive evidence that is accumulating, and the onus of proof is now shifted from those who support the theory of mimicry to its opponents.

But a still more interesting discussion for the general reader upon which these volumes throw much new light is on the question of the origin of the mimetic forms. Have, for example, the four mimetic females of the well-known African butterfly *Papilio dardanus* arisen by sudden mutations, or by the natural selection of small variations from a common type? It will be difficult for Prof. Poulton to persuade the mutationists that they are wrong, that in this particular instance the many transitional forms between the dominant mimetic forms that the Hope collections include do indicate that it is by the selection of slight variations in the right direction that the similarity between the mimics and their models has been reached, but the gradually accumulating series of facts bearing upon this discussion which these volumes contain are of extraordinary value in giving those who have not yet declared themselves on one side or the other a rich harvest for their consideration.

It is in a discussion such as this that the trained eye and detailed knowledge of the systematic entomologist is of supreme value, and the weighty article by Mr. R. C. L. Perkins on the colour groups of Hawaiian wasps, and the paper by Colonel Manders on his temperature experiments on Danais and Hypolimnas in Colombo, will be read with much interest.

It is quite impossible in a short notice to do justice to the many articles of interest that the volumes contain, but special attention may be directed to the interesting address by Dr. Dixey, as president of the Entomological Society, on the effect of external influences on the germ plasm in insects, and the evidence it affords bearing on the theories of evolution, and to the essay by Mr. Guy Marshall on the limitations of the Müllerian hypothesis. To the morphologist, Prof. Poulton's memoir on the structure of the lepidopterous pupa, and Mr. Eltringham's account of the male genital armature of the species of the genus Acraea, and to the systematist Mr. Shelford's elaborate and beautifully illustrated memoirs on the Orthoptera, Mr. Eltringham's important contributions to our knowledge of the African species of the genus Acraea, Colonel Bingham's memoir on the Aculeate Hymenoptera and other shorter papers will prove to be of interest.

Prof. Poulton and his colleagues may be heartily congratulated on the extensive and important contribution to knowledge they have made during the period that is covered by these three handsome volumes. S. J. H.

DR. MAWSON'S ANTARCTIC EXPEDITION.

DR. MAWSON has returned from the Antarctic to Australia, and readers of his message to the *Times*, recounting his wonderful escape after a month's march alone, when he had witnessed the death of two companions, will congratulate him on the courage and endurance which saved him from an end like theirs. The three were on a march of exploration south-eastward from the main base in Adélie Land, in November-January, 1912–13, when Lieutenant Ninnis fell with a loaded sledge into a crevasse. Dr. Mertz and Dr. Mawson, in the face of starvation owing to this disaster, returned to within one hundred

miles of the base, when Mertz succumbed, and Mawson was only saved by the discovery of a *cache* of food left by a search party, after he had made a long and dreadful solitary journey.

Dr. Mawson's principal object was to explore that section of Antarctica which lies due south of Australia (Fig. 1). To the east of his own field of operations lies the region opened up by the work of Scott and Shackleton; to the west of the base established by his colleague, Mr. Frank Wild, a thousand miles distant in a direct line from his own, the German *Gauss* expedition was at work in 1902–03, and gave the name of Kaiser Wilhelm II. Land to its sphere of action. The intervening area was very little known; landings had not been previously made in either of the districts covered by Dr. Mawson and Mr. Wild, and the coast-line was only known—and that, as the present expedition has proved, by no means certainly—at a few points reported by expeditions made more than seventy years ago, by Balleny, by Dumont D'Urville, and by Wilkes.

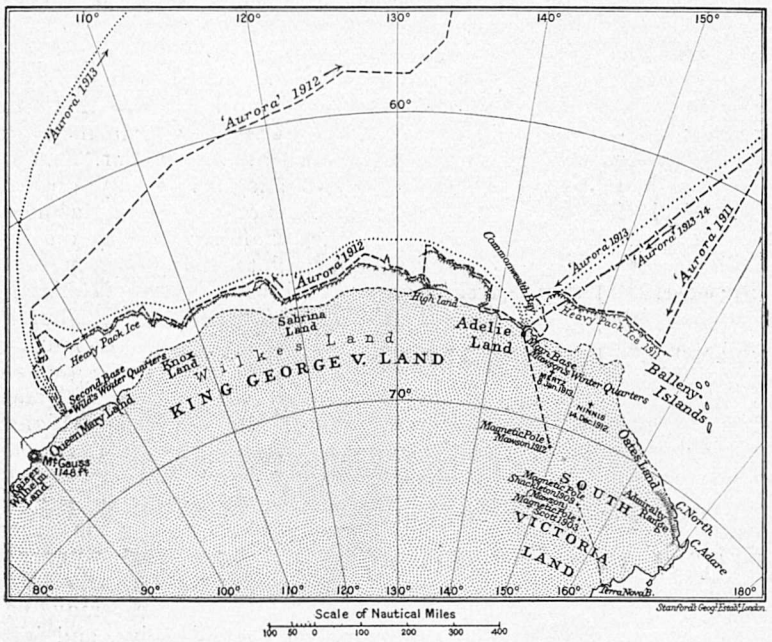


FIG. 1.—Field of operations of the Mawson Antarctic expedition.

The data are, of course, insufficient to attempt as yet any detailed estimate of the scientific value of the work of Dr. Mawson's expedition. But it must be substantial. We know something of it already from the reports of Mr. Wild and Captain J. K. Davis (who commanded the ship of the expedition), which they made on returning from the Antarctic last March.

The wireless telegraphic station established on Macquarie Island has already proved its worth, and may form the first step in a system of weather-forecasting, important not only to shipping in Australian waters, but to agriculturists and others in Australia. We hear of the discovery of minerals, including coal and copper. Exploratory journeys over the sea-ice and the continental plateau are stated to have covered 2400 miles from the main base and 800 miles from the western base. From the ship valuable results have been obtained by deep-sea dredging and other means, and the antarctic continental shelf has been traced through 55 degrees of longitude. It must also be remembered that the work of the general scientific programme has been continued at the main base through two complete years, though through one only at the western base.

NOTES.

THE following fifteen candidates have been selected by the council of the Royal Society to be recommended for election into the society:—Dr. E. J. Allen, Mr. R. Assheton, Mr. G. T. Bennett, Prof. R. H. Biffen, Dr. A. E. Boycott, Mr Clive Cuthbertson, Dr. H. H. Dale, Prof. A. S. Eddington, Prof. E. J. Garwood, Mr. T. H. Havelock, Dr. T. M. Lowry, Prof. D. Noël Paton, Mr. S. Ruhemann, Dr. S. W. J. Smith, and Dr. T. E. Stanton.

MR. J. DEWRANCE has presented the sum of 2000*l.* to the donation fund of the Royal Society. The income arising from this fund is used mainly for the promotion of experimental researches.

A YEAR ago announcement was made of a gift of 15,000*l.* to the Middlesex Hospital for the purpose of building an institute of pathology, a department greatly needed in order to raise the hospital to the standard required by modern scientific medicine. At the annual court of governors of the hospital on February 26, Prince Alexander of Teck announced that the donor was Sir John Bland-Sutton.

IN our issue of February 12 (p. 667) particulars were given of the conference of persons interested in the physical aspects of the study of the air, the earth, and the sea, to be held in Edinburgh next September. Sir John Murray is to be the president of the conference. We have since received information that arrangements are in progress for a Meteorological Congress to be held in Venice in the same month, and that meteorologists of all countries are to be invited to it. The president of the executive committee of this proposed congress is Prof. S. Urbani, director of the Patriarcal Meteorological Observatory, Venice.

THE London School of Tropical Medicine has sent an expedition to China to study the mode of dissemination of human diseases caused by trematode parasites, especially bilharziosis, and the relation of such diseases to those occurring in domestic animals. Investigations into ankylostomiasis will also be carried on. The members of the expedition are Dr. R. T. Leiper, helminthologist of the Tropical School, Surgeon E. L. Atkinson, R.N., and Mr. Cherry-Garrard. The two last-named were members of Scott's Antarctic Expedition, and the name of Surgeon Atkinson is familiar to the

public as the leader of the search party which recovered the bodies of Capt. Scott and his companions. Surgeon Atkinson also made a large and important collection of Antarctic parasites, and since his return from the expedition he has been occupied in working out the helminths in collaboration with Dr. Leiper. Drawings of the helminths collected were exhibited by Dr. Leiper and Surgeon Atkinson at a recent scientific meeting of the Zoological Society. The collection of Antarctic Protozoan parasites still remains to be worked out.

THE recent review of the position of Army aviation in a statement to Parliament by the Secretary of State for War is interesting as showing the progress of aviation in England, and also the need for further improvement before aeroplanes can be regarded as having reached a satisfactory degree of development. Six years from the date of the first successful flights in Europe, it can be said that in the year just ended there were only six flying days on which flights by officers and men of the Royal Flying Corps did not take place. This is a significant indication of the rapidity of development of the science of aviation which is made still more noticeable by the statement that during this time journeys amounting to more than 100,000 miles were made without any loss of life. It appears that aeroplanes are being taken out in stronger and stronger winds, and a record of nearly seventy miles an hour stands to the credit of one of the officers of the Royal Flying Corps. In spite of such striking performances, it is clear that there is still much to be learnt. Colonel Seely pointed out the necessity for keeping 200 machines in being, so that 100 of them may be ready for use at a given time. In other words, at least half the life of a modern aeroplane is spent in the repair shop. This fact makes it necessary to attempt to raise the factor of safety of aeroplanes, and an inspection department has been organised by the War Office to deal with this aspect of the problems relating to aviation.

THE committee of the Lister Memorial Fund has commissioned Sir Thomas Brock, R.A., to execute a medallion portrait of the late Lord Lister, to be placed in Westminster Abbey. This will form part of the international memorial to commemorate the priceless services of Lord Lister to the cause of science and the alleviation of human suffering. Further subscriptions are required to enable the committee to carry out adequately the proposed scheme for the establishment of an International Lister Memorial Fund for the advancement of surgery. Among the subscriptions recently received are the following:—American Surgical Association, 135*l.*; received through Dr. W. W. Keen, of Philadelphia, 35*l.* (second donation); Committee of Surgeons in Holland, 125*l.*; faculty of medicine, University of Copenhagen, 109*l.*; members of the medical profession in Victoria (Australia), 91*l.*; Medical and Surgical Societies in Japan, 31*l.*; Union of Swedish Hospital Surgeons, 20*l.*; Newcastle-on-Tyne committee and members of the Clinical Society, 113*l.*; City of Belfast committee, 54*l.* Donations may be sent to the honorary treasurers of the fund (Lord Rothschild and Sir Watson Cheyne) at the Royal Society, Burlington House, W.

PROF. ERNST HAECKEL'S eightieth birthday (February 16) has just been celebrated with natural enthusiasm at Jena. The heartiness of the congratulations from far and near must have delighted the veteran, who has had the great reward of seeing the successful development of the evolutionist doctrine of which he was an early champion. There were some noteworthy addresses summing up various aspects of his work, one of the weightiest being that delivered by Prof. Maurer, director of the Anatomical Institute, and published by Mr. Gustav Fischer, Jena. He refers to Haeckel's education and the influences of Leydig, Kölliker, and Virchow (then inclined to be an evolutionist), and still more of Johannes Müller, the "Origin of Species," and Gegenbaur. It was in the early days of his friendship with Gegenbaur that Haeckel wrote his monumental "Generelle Morphologie," in many ways the greatest of his works. We have become familiar with much of its teaching, *e.g.* that the individual development is essentially related to the racial evolution, or that classification is an attempt to discern a genealogical tree, and we are thus apt to forget what forceful new ideas these once were. Prof. Maurer directs attention to Haeckel's strong historical sense, so well expressed in the early chapters of "The Natural History of Creation," to the permanent influence that his radiolarian work (he described some 4000 new species) had throughout his life, to the extraordinary success of his educative expository writings, to his exceptional talent as an artist, to his unwavering consistency and courage, often expressed in polemical writing which gave little hint of the charm of his personality, and to the strenuousness with which he has realised the ever serious purpose of his life. Since an unfortunate accident a few years ago, Haeckel has not been able to go about, but it is delightful to hear that he is still youthful in spirit, able to follow the progress of science, and even to share in it. We would join in the congratulations which have been recently offered to him.

MR. W. CAMERON FORBES is about to start for Central and South America, for the purpose of collecting specimens of birds for the museum of Harvard University.

THE death is announced, in his seventy-sixth year, of Dr. L. Schöney, late professor of pathology and clinical microscopy in the New York Eclectic Medical College. He had made numerous contributions on botany and histology to scientific journals.

DR. R. K. DUNCAN, director of the Mellon Institute of Industrial Research, and professor of industrial chemistry at the University of Pittsburg, has died at the age of forty-five. He was a Canadian by birth, and was educated at the University of Toronto. After teaching science for several years in various American secondary schools, he was appointed in 1901 to the chair of chemistry in the Washington and Jefferson College. In 1906 he became professor of industrial chemistry at the University of Kansas, where he initiated a new scheme of industrial fellowships which has since grown to large proportions. His Pittsburg appointment dated from 1910. He discovered new processes for manufacturing glass and phosphorus.

He edited the "New Science Series," and was the author of "The New Knowledge," "The Chemistry of Commerce," and "Some Chemical Problems of To-day." Dr. Duncan was popularly known through his articles on radio-activity in *McClure's Magazine*, and on industrial chemistry in *Harper's*, for which he made special inquiries abroad.

AMONG the victims of the *Titanic* disaster in April, 1912, was Mr. H. Forbes Julian, whose work as a mining engineer, and for metallurgical science, was referred to appreciatively at the time in these columns (vol lxxxix, p. 325). On February 24 a memorial tablet erected by a committee which included the names of many distinguished men of science was unveiled to Mr. Julian in St. Mary Magdalene Church, Torquay, by the Ven. Archdeacon of Totnes, in the presence of a large congregation. The inscription on the tablet is as follows:—"Ad Majorem Dei Gloriam. This tablet is erected by a wide circle of friends in affectionate remembrance of Henry Forbes Julian, member of the Institution of Mining and Metallurgy, born Ascension Day, 9th May, 1861; married in this church 30th October, 1902; passed away 15th April, 1912. During the whole of his working life he laboured at the solution of metallurgical problems in three Continents, and both by his writings and practical skill exercised an influence which will long endure. He was amongst those who gave their lives for others in the disaster which befell the R.M.S. *Titanic*. This heroism and self-denial called forth admiration from the Throne to the cottage. 'Greater love hath no man than this, that a man lay down his life for his friends.'"

THE duration of bright sunshine at Greenwich in February was 106 hours, which is exactly double the average of the past thirty years, and is the brightest February on record; the highest previous record for February was ninety-nine hours in 1899. In February this year at Greenwich there were twelve days with more than five hours' sunshine, whilst in July last year there were only seven days with more than five hours' sunshine. The total hours of bright sunshine in February are ten hours more than in the whole of July last year. At Kew the duration of bright sunshine in February was eighty-one hours, at South Kensington sixty-nine hours, and in the City, at Bunhill Row, 44 hours, the latter being ten times more than in January. The following gives the duration of bright sunshine at a few stations in England, chosen promiscuously from the reports of the Meteorological Office. For the several stations the duration was:—Dover, 119 hours; Hastings, 111 hours; Yarmouth, 108 hours; Margate, 106 hours (the same as at Greenwich); Brighton, 103 hours; Torquay, about 80 hours; Bath, 70 hours; Liverpool, 66 hours; and Buxton, 55 hours. The excess of sunshine in and round London is far more striking than in other parts of England.

THE inaugural meeting of the Institution of Petroleum Technologists was held at the Royal Society of Arts on Tuesday, February 3. Sir Boverton Redwood, the president of the institution, who occupied the chair, said, in the course of his opening remarks, that the aims of the institution are to enable technologists engaged in the petroleum or shale oil industry to meet, correspond, and accumulate trustworthy information regarding the production or winning of petroleum and oil-shale, the conversion of the raw materials into manufactured products, and the characters and uses of these products, together with their transport and storage; and, in the second place, to promote the better education of persons desirous of becoming professional consulting petroleum technologists, engineers, geologists, or chemists, and to elevate the professional status of those employed in the industry by setting up a high standard of scientific and practical proficiency, and by insisting upon the observance of strict rules in regard to professional conduct.

AT the thirty-sixth annual general meeting of the Institute of Chemistry, held on Monday, March 2, the president, Prof. Raphael Meldola, who was in the chair, referred, in the course of his address, to the endeavours of the institute to secure fuller recognition for the profession of chemistry. The council of the institute, in a memorandum submitted to the Royal Commission on the Civil Service, stated that the chemical staff in the department of the Chief Inspector at Woolwich Arsenal should be controlled by a chemist of the highest efficiency. The real expert whose knowledge and experience are of most value to the community is the highly trained man who has specialised in some particular field. Surely such a man is the most competent to control the work of any public department which is concerned with his own subject. Why, therefore, should there be this tendency to subordinate expert scientific service to non-expert control? While the medical service takes army "rank," the chemist, whose services are of equal importance, not only takes no "rank" at all, but is made responsible to superiors having no special knowledge of his subject. This state of affairs, rendering as it does the public service of chemists an unattractive career to the best talent in the profession, is fraught with danger to the future well-being of the country, and is a shortsighted policy which, in time of trouble, may well lead to disaster. Prof. Meldola then dealt at considerable length with the report of the conference of professors of chemistry, held under the auspices of the institute in October last, which was attended by professors from practically all the principal educational centres of the country, the institute thus providing an arena for the free discussion of the broad question of the education of professional chemists. Sir William Ramsay, in proposing a vote of thanks to the president for his address, endorsed the views which had been expressed with reference to placing men having no technical knowledge in the control of experts, and remarked on the absurdity of requiring them to sign reports only fully understood by the specialist.

MISS M. A. MURRAY discusses, in the February issue of *Man*, the evidence for the custom of killing the king in ancient Egypt, in connection with the Osiris cult, as explained by Dr. J. G. Frazer in "The Golden Bough." She interprets the name of Isis as Isé, "the throne-woman," and Osiris, or Usiri, "the

occupier of the throne, the king." She notes that Arab legends of the ancient kings of Egypt mention the disappearance of two monarchs, and thus seem to preserve the tradition of the divine spirit leaving the world. The art evidence begins only from Roman times, and the ceremonial record is less conclusive, being connected with the obscure Sed festival, of which she offers a new explanation. It seems to be connected with a fertility cult. But the Egyptian evidence, though when the details are taken together, it is suggestive, is far from being so clear as the practice of king-killing among the Shilluks of Fashoda, which was fortunately recorded in time for its use by Dr. Frazer in the new edition of his great work.

THE January number of *Eugénique*, which is the monthly journal of the Société française d'Eugénique, is largely occupied by Dr. Saleeby's lecture on the progress of eugenics, which was delivered before the society on January 7. In the discussion which followed it, M. March, the head of the French Government Statistical Department, made some interesting observations on the relations between biometry and Mendelism. He pointed out that Mendel's laws themselves are statistical laws based on the theory of probabilities, while biometry is simply the application of statistical methods to biological problems. With regard to the controversy concerning the effect of alcoholism on the offspring, M. March condemns those as unscientific who criticise the results obtained by the Galton Laboratory, on the ground that they render weaker the struggle against alcoholism, and says further :—"Temperance societies know well the eternal objection made by peasants, 'Look at my neighbour; he is eighty years of age, in splendid health, and has always drunk.' On this point, as on all others, numerous observations, well conducted and well analysed, are the best means of reaching the truth."

FROM an article in the *Journal of Heredity*, vol. v., No. 2, we learn that, as the result of experiments conducted by Mr. Alexander Graham Bell in Nova Scotia, high feeding of ewes just before the autumn pairing season results in the production of a much higher percentage of female lambs than ordinary, the proportion of this sex in his flock being 72 per cent., whereas in those of neighbouring farmers there was a percentage of 88½ males.

THE first number of a new monthly journal devoted to microscopy has been issued. It is entitled *The Journal of Microscopy and Natural History Mirror*, and is edited by Mr. Edwards, the secretary of the Postal Microscopical Club, Reading. Its object is to foster the study of natural history with microscope and camera, and to help and instruct the amateur microscopist. The present number contains short articles on photomicrography, pond-life, mounting, and so on.

BULLETIN No. 36 of the Agricultural Research Institute, Pusa, India, contains a note by Major Holmes, on the McFadyean staining reaction for anthrax bacilli. This consists in staining under-fixed films with methylene-blue, by which procedure the bacilli are stained blue, and appear to be surrounded with a pale purple capsule. Major Holmes confirms the diagnostic value of this reaction, and makes the interesting observation that cattle in India rarely die of anthrax, even if inoculated with it.

IN *The American Naturalist* for February, Prof. W. E. Castle directs attention to the interest—from the point of view of Mendelian colour-inheritance—of two new colour-phases of the brown rat, respectively known to breeders as the pink-eyed yellow, fawn, or cream, and the black-eyed yellow, fawn, or cream. The former seems to have first appeared about 1910 or 1911, while the originator of the second strain, as we learn from an appendix to the paper, was brought to Liverpool by a ship in 1912. Their special interest lies in the fact that yellow phases—due to the suppression of black and brown pigment—has hitherto been unknown in this species.

A REMARKABLE instance of the needless multiplication of technical names in zoology has recently occurred in the case of Grévy's zebra. Some years ago Mr. R. I. Pocock pointed out that this species was so markedly distinct from other Equidæ as to be worthy of subgeneric separation, although he did not suggest a new subgeneric title. In 1912, Dr. Max Hilzheimer (*Abh. Senckenberg Ges.*, vol. xxi., p. 85), proposed for this species the subgeneric name, Megacephalon, which is preoccupied (1846) by a well-known genus of birds. In the same year Mr. N. Heller (Smithsonian Misc. Collect., vol. lx., No. 8, p. 1), apparently without knowledge of Dr. Hilzheimer's work, proposed the name Dolichohippus, in a generic sense. Unaware of this, Dr. A. Griffini, in an article on zebras and quaggas, orginally published in vol. iv. of *Natura* (Padua), but of which separately paged reprints have just reached this country, suggests the name, Ludolphozecora (from "Zecora," the designation by which Ludolphus alluded to the species), to replace the preoccupied Megacephalon.

A COPY has been received from Washington of the report of the secretary of the Smithsonian Institution for the year ending June 30, 1913. We learn from it that a plan has been formulated and some progress has been made in certain lines of field work for a geological survey of Panama, under the joint auspices of the Isthmian Canal Commission, the United States Geological Survey, and the Smithsonian Institution, and a grant has been made from the institution's funds toward the expenses of such investigation. The general plan of the survey comprises a systematic study of the physiography, stratigraphy, and structural geology, geological history and correlation, mineral resources (including coal, oil, and other fields), petrography and palæontology of the canal zone, and of as much of the adjacent areas of the isthmian region as is feasible. The biological survey of the canal zone, organised by the institution in 1910, was brought to a close during the year so far as field work was concerned, and some of the results have been referred to in these columns.

IT has long been recognised that a necessity exists for the improvement of the important medicinal plants.

One of the first steps necessary to inaugurate such work is to determine the variation of the active constituents in individual plants and the extent to which such variation is influenced, if at all, by the various factors affecting the growth and cultivation of the plant. Investigations in this direction have been carried out with belladonna recently, and are reported by Mr. A. F. Sievers to the new *Journal of Agricultural Research* (vol. i., No. 2). The variation in the alkaloidal content of the leaves throughout the season was determined, but no relation appeared to exist between the physical appearance of the plant and the amount of alkaloid present. It was found advisable, however, to aim for a greater yield of young leaves of rather lower content than to delay picking until higher content and lower aggregate yield is only obtainable. The plants experimented with show, among themselves, a very great variation in alkaloidal content, separation into two groups being possible, the content of the one being twice that of the other. By selection and cultural means the total production of alkaloids ought to be capable of great increase.

A REPORT by Dr. J. V. Eyre on the possibility of reviving the flax industry in Great Britain has been published as a supplement to the Journal of the Board of Agriculture. A brief historical review of the subject is given, followed by a discussion of the effect of soil, manure, climate, and cultivation, on the crop. Harvesting, retting, and subsequent treatment are described in detail, and the whole forms a valuable guide to the condition of the industry in this country. The crop has many advantages to recommend its more general adoption, especially by the small holder, provided that efforts are directed to the preparation of high grades of fibre. There certainly is reason for believing that the judicious revival of the industry, managed according to improved methods, would be productive of benefit to British agriculture, and would induce people to find regular employment in rural districts by creating a demand for skilled labour.

THE indexes to the Physics and Electrical Engineering volumes of *Science Abstracts* for 1912 have reached us. The former volume extends to 750 pages, with more than 2000 abstracts, and the latter to 670 pages, with nearly 1300 abstracts. The greater average length of the electrical engineering abstracts appears due to descriptions of installations and appliances. The initials of the abstractor at the foot of each abstract and a reference to the list of abstractors at the beginning of each volume, show that in nearly all cases the abstract has been written by one who has a special knowledge of the subject, and so long as this characteristic of Science Abstracts is maintained, so long will it continue to enjoy the confidence of those who make use of it. The indexing appears adequate, the name-index in the physics volume covering thirty and the subject-index fifty-six pages.

WE have received from the Reichsanstalt a number of memoirs dealing with the work done there, which have appeared in recent numbers of the *Annalen der Physik*, the *Zeitschrift für Instrumentenkunde*, and other periodicals. One by Dr. F. Henning deals with new determinations of the boiling points of oxygen and carbonic acid, and the freezing points of mercury and other liquids. The temperatures were measured by five platinum resistance thermometers, which had been previously compared with the constant volume hydrogen thermometer. The static method was used for the boiling points. The results are:—Normal boiling points: Oxygen, $-182{\cdot}97°$, carbonic acid, $-78{\cdot}53$; freezing points: mercury, $-38{\cdot}89$, ethyl ether, $-123{\cdot}6$; melting points, carbon bisulphide, $-112{\cdot}0$, chloroform, $-63{\cdot}7$, chlorobenzene, $-45{\cdot}5°$ C. Others by Drs. W. Jaeger and H. von Steinwehr deal with comparisons of various copies of the ohm amongst each other and with the mercury standard, and with current measurements with the silver voltameter. They show that the German ohm agrees with the English to within a few hundred thousandths, and that the electromotive force of a Weston cell is 1·01829 volt at 20° C.

THE White Star liner *Britannic* was launched from Messrs. Harland and Wolff's yard at Belfast on February 26. The following particulars of this vessel are taken from illustrated articles in *Engineering* and the *Engineer* for February 27. The principal dimensions are:—Length over all, about 900 ft.; breadth, extreme, about 94 ft.; depth moulded, 64 ft. 3 in.; total height from keel to navigating bridge, 104 ft. 6 in.; gross tonnage, about 50,000 tons; propelling machinery—reciprocating engines of 32,000 i.h.p. exhausting into a Parsons low-pressure turbine of 18,000 shaft-horse-power; sea speed, 21 knots. Accommodation is provided for 2,579 passengers and 950 crew, a total of 3,529 persons. The vessel is probably the strongest passenger ship structurally constructed up to the present time, and is so amply divided by longitudinal and transverse bulkheads that her destruction by any dangers of the sea is incredible. The double system of construction is carried up the sides of the vessel to a considerable distance above the load water line, and the walls are literally honeycombed with compartments. None of these compartments will be opened on the inner side during a voyage. There are sixteen transverse bulkheads, five of which extend to a height of more than 40 ft. above the deepest load line, and all the others are carried to a height of more than 21 ft. above the water line. The bulkheads are of very heavy construction. The lifeboat arrangements will meet fully the requirements of the recent International Convention.

MESSRS. FLATTERS AND GARNETT, LTD., have issued a supplementary catalogue of the lantern slides added to their stock during 1913. Among these additions are a large number of photographs of British wild flowers and a series of slides illustrating the commercial geography of the north of England, arranged by Dr. A. Wilmore.

AMONG recent additions made by Messrs. Jack to their "People's Books" are "Applications of Electricity for Non-Technical Readers," by Mr. A. Ogilvie, and "Wild Flowers," by Mr. M. Skene. The first book explains in simple language, which takes no

previous knowledge of the science for granted, the elementary facts upon which the chief everyday applications of electricity are based. The volume on wild flowers contains two hundred black and white illustrations of common flowers, and descriptions of these and others arranged in chapters according to their colours. Thus we have chapters on white, yellow, red, blue, flowers, and so on. The price of each volume in the series is 6*d.* net.

OUR ASTRONOMICAL COLUMN.

STARS WITH VARIABLE RADIAL VELOCITIES.—In the *Astrophysical Journal* for January (vol. xxxix., No. 1, p. 39) Mr. Oliver J. Lee contributes numerous measures of variable radial velocities of stars determined in the course of measuring Bruce spectrograms. Of the twenty-eight stars to which reference is made, eighteen have been previously announced as spectroscopic binaries, but the remaining ten are new. The following table is abstracted from the information given in the paper, and indicates the star in question, position, magnitude, and class :—

Star	R.A. h. m.	Dec. ° ′	Mag.	Class
89*f* Piscium ...	1 13	+ 3 5	5·3	A_2
73 ξ^2 Ceti	2 23	+ 8 1	4·3	A
125 Tauri	5 34	+25 50	5·0	B_3
40 Aurigæ... ...	6 0	+38 30	5·3	A
24 Can. Ven. ...	13 30	+49 32	4·6	A_3
33 Boötis	14 35	+44 50	5·4	A
27 β Libræ ...	15 12	− 9 1	2·7	B_8
BD 25°4165 ...	20 11	+25 17	4·8	B_3
33*i* Aquarii ...	22 1	−14 21	4·4	B_8
18 λ Piscium	23 37	+ 1 14	4·6	A_5

SUN-SPOTS : THEIR INTERNAL MOTION AND SHORT-PERIOD VARIATIONS.—The fifth volume of the *Publikationen der Sternwarte des Eidg. Polytechnikums zu Zurich* contains two contributions, the first by William Brunner, on the investigation of the internal motions in sun-spots, and the second by Elsa Frenkel, on short-period variations in the frequency of sun-spots. The former is a detailed research, carried out in a systematic manner, on the internal motions, chiefly divergent. The chief result leads the author to associate this divergent motion with the origin and development phases of spot groups. The data employed were those of the period between January 1, 1887, and January 1, 1905, and were the result of observations made with the refractor of the Zurich Observatory. Numerous plates accompany the text. The second paper involves the discussion of the Zurich observations made during the period 1876–1911. Readers must refer to the original publication for the detailed account of the research, but the chief conclusions may be stated briefly as follows. The author finds a probable period of 200 days, but this is not apparent during the last three eleven-year periods, when the spot activity went below a certain limit. The length is not constant, but varies about a mean value of 150 to 200 days. The ordinate of the periodigram is about 100 times smaller than the eleven-year period, and the amplitude about ten times smaller than that of the eleven-year period. Another period of 68·5 days was indicated, but this will be investigated again at a later date. Attention is directed to the lengths of these two periods, namely 200 and 68·5 days, and the sidereal times of revolution of the two inner planets, namely Mercury, 87·9 days, and Venus, 224·7 days. The text is accompanied by a large number of plates showing the observed and smoothed curves of the daily relative numbers.

DETERMINATIONS OF GRAVITY IN EGYPT AND THE SUDAN.—Survey Department Paper No. 18 (Cairo) contains details of the determination of "g" at eight stations in Egypt and the Sudan, carried out by Mr. P. A. Curry, in connection with the geodetic survey. Almost the whole of the observations and the whole of the computational work have been done by Mr. Curry himself. The stations range from Helwân to Khartoum, nearly 15° of latitude, and the height above sea-level varies from 42 to 383 metres, but the topographical correction has been *nil* for each of the stations. The Stuckrath pendulum apparatus employed was borrowed from the South Kensington Museum, where it had been deposited after the return of Captain Scott's first Antarctic Expedition. This instrument provides essentially for the determination of the time of oscillation of each of a number of invariable pendulums swinging in separate cells of a vacuum chamber. Besides the correction due to the rate of the chronometer, *four* instrumental corrections need to be determined, namely, for temperature, pressure, amplitude of vibration, and flexure of pillar. Kew was taken as the base and Helwân was made the primary Egyptian station. 981·201 cm./sec.^{2} (based on the Potsdam system) was adopted as the value of "g" at Kew, and from a discussion of *ninety-eight* separate determinations 979·295 cm./sec.^{2} was obtained as the final value of this constant at Helwân, the probable error being ±0·0027. The values obtained for each of the stations have been reduced to sea-level and compared with the theoretical value for the latitude of the station given by Helmert's formula (1901). Remarkably close agreement obtains, ranging only between +0·009 and −0·013, whence it is concluded that there is nothing very abnormal about the values of gravity at these eight stations.

THE COBAR COPPER FIELD.

COBAR, on the western plains of New South Wales, 464 miles by railway from Sydney, is one of the most important, though not most profitable, of the copper fields in Australia; it yielded 6500 tons of copper in 1911, and has produced more than 90,000 tons since its discovery in 1869. The development of the field was hampered by its remote position and its semi-arid climate, for with a rainfall of only 15 in. it is surrounded in dry seasons by a wide, waterless tract. In its early days, however, the export of ore was once stopped by floods, which inundated the plains beside the Darling River for a width of fifty miles. Another trouble was an invasion in 1890 by millions of rabbits, which destroyed the vegetation by devouring the shrubs and ring-barking the trees.

The rocks of the mining field belong to three main divisions.[1] The oldest is the Cobar Series, which comprises semi-metamorphic sediments of perhaps pre-Silurian age; its most important member consists of thick beds of chert, which Mr. Andrews regards as a recrystallised organic precipitate. The account of these beds suggests their resemblance to the Heathcotian Series of Victoria, which are of Cambrian age. The middle division, the Mallee Tank beds, includes fossiliferous limestones, and its age is certainly Silurian. The upper division is Devonian, and includes a varied series of quartzites, shales, and claystones. The rocks of all three divisions have been disturbed by intense compression due to earth movements at the beginning and at the end of the Devonian period. The pressure was so powerful that the minimum dip observed in the Silurian rocks is 30°, and the Devonian

[1] E. C. Andrews : Report on the Cobar Copper and Gold-field. Part i. (Department of Mines, New South Wales, Mineral Resources, No. 17). 1913, xi. Pp. 207+xlv plates+19 maps in separate portfolio.

rocks have been overthrust and the pebbles in the conglomerates sheared and shattered. One striking feature of this mining field is the rarity of igneous rocks; they are represented only by two small pipes of orthoclase-porphyry, which appear to have no connection with the ores. The mineral deposits are attributed by Mr. Andrews to the post-Devonian earth movements. Certain features suggested that they might be bedded ores; but, as so often happened with ores so regarded, more detailed study has shown that they are of secondary origin. They have been formed in connection with great fault movements and by the replacement of slate by sulphides. This conclusion is definitely established by Mr. Andrews's excellent monograph, which includes a detailed account of the geology, history, and mines of this field.

The chief copper-bearing mineral is chalcopyrite, and it is associated with pyrrhotite, ordinary iron pyrites, and a silicate of iron, which is identified by Mr. Card as ekmannite. The ores have undergone great secondary concentration, which Mr. Andrews attributes, with great probability, to the arid climate and prolonged stability of the field. Ever since the post-Devonian disturbances the country does not appear to have been affected by any earth movements except some minor oscillations; and the level has only been lowered by denudation about 200 ft., according to Mr. Andrews's estimate, during all later geological times. The chemical analyses are of especial value owing to the determination of an unusually large number of constituents. The description of the field is illustrated by a series of plates, some of which are coloured, showing the intimate structure of the ores and the relation of their constituent minerals; and the memoir is accompanied by a portfolio of maps and mine plans. All the separate mines are described in detail. The discussion of the ores shows wide acquaintance with the recent literature on the subject, and the author's conclusions command respect owing to the obvious care and accuracy with which the work has been conducted. The author's view that magnetite is formed only under conditions of great heat is perhaps too general, and the remark that the Murray River enters the sea near Adelaide might mislead a reader who is not used to judging proximity by Australian standards of distance. J. W. G.

PUBLIC HEALTH.

WE have received the report, for 1912–13, of the Medical Officer of the Local Government Board. There is no greater authority than Dr. Newsholme on all matters of public health, and every page of his report should be read by all who care for our national health and efficiency. Among many other subjects of interest, he directs attention to the practical problems of "typhoid carriers," the present rather threatening facts of cerebro-spinal fever and poliomyelitis, and the contrast of the steady decline of scarlet fever, diphtheria, and typhoid, with the obduracy of measles. Of smallpox, 121 cases were notified during 1912 in England and Wales, but only nine died. It may be worth noting that, in one household, three small children died, whose parents had declined vaccination for them.

Tuberculosis, naturally, occupies a great part of Dr. Newsholme's report. For, beside the grant of some 60,000*l.* annually for research, the year 1912–13, as Dr. Newsholme says, "will always stand out as a landmark in the history of the administrative control of tuberculosis. During this year the Board made all forms of tuberculosis compulsorily notifiable; the provisions of the National Insurance Act, 1911, as to sanatorium benefit, came into operation; the capital grant under the Finance Act, 1911, of 1½ millions sterling for the provision of institutions for the treatment of tuberculosis in the United Kingdom, became available; and the important offer was made by the Treasury to defray one-half of the annual cost of schemes for the treatment of tuberculosis, proposed by local authorities and approved by the Local Government Board, which are available for the entire population, after deducting any contribution received from the local insurance committee or from other sources." Other points of interest, in Dr. Newsholme's report, touch the work of the Medical Department of the Board; the work of the International Health Office, the International Sanitary Conference in Paris, 1912, and other services rendered to the public by the Medical Department.

After Dr. Newsholme's report, come Dr. Bruce Low's admirable and authoritative monographs on plague, cholera, and yellow fever, giving a full account of the incidence on the world, during 1911 and 1912, of these three scourges. Then comes a great number of shorter reports. Altogether, this volume is of singular value to all who are concerned—and who is not?—with the health and safeguarding of our country.

FORTHCOMING BOOKS OF SCIENCE.

AGRICULTURE.

A. and C. Black.—The World's Cotton Crops, Prof. J. A. Todd, illustrated. *Crosby Lockwood and Son.*—Agriculture: Extensive and Intensive, Prof. J. Wrightson, in conjunction with J. C. Newsham.

ANTHROPOLOGY AND ARCHÆOLOGY.

John Bale, Sons and Danielsson, Ltd.—Hausa Folk-Tales, Major A. J. N. Tremearne. *Chatto and Windus.*—A History of Babylonia and Assyria from Prehistoric Times to the Persian Conquest, L. W. King, illustrated, vol. ii., A History of Babylon from the Foundation of the Monarchy to the Persian Conquest, vol. iii., A History of Assyria from the Earliest Period to the Fall of Nineveh. *Constable and Co., Ltd.*—Amulets, Prof. W. M. Flinders Petrie, F.R.S., illustrated; Kinship and Social Organisation, Dr. W. H. R. Rivers, F.R.S. *Macmillan and Co., Ltd.*—Knossian Atlas, edited by Sir A. J. Evans, F.R.S., vol. i., The Wall Paintings, including coloured lithographic plates i.–xiii., from drawings by E. Gilliéron, with short descriptive sketch by the editor (to which are appended Lumière illustrations), and Notes on the Technique of the Frescoes by N. Heaton; The Nine Minoan Periods, a Summary Sketch of the Characteristic Stages of Cretan Civilization, from the Close of the Neolithic to the Beginning of the Iron Age, Sir A. J. Evans, F.R.S., illustrated; The Eastern Libyans, O. Bates, illustrated; Marriage Ceremonies in Morocco, Prof. E. Westermarck; The Native Tribes of the Northern Territory of Australia, Prof. W. B. Spencer, C.M.G., F.R.S., illustrated. *The Medici Society, Ltd.*—Mexican Archæology: An Introduction to the Archæology of the Mexican and Mayan Civilizations of Pre-Spanish America, Thomas A. Joyce, illustrated. *Methuen and Co., Ltd.*—The Nomads of the Balkans, A. J. B. Wace and M. S. Thompson, illustrated. *Oxford University Press.*—Contributions to Anthropology: vol. i., Coos Texts, J. Frachtenberg, vol. ii., The Ethnology of the Salish Tribes, J. A. Teit. *G. P. Putnam's Sons.*—The Folk-Ballads of Southern Europe, S. Jewett. *Williams and Norgate.*—The Antiquity of Man, Prof. A. Keith, F.R.S.

BIOLOGY.

F. Alcan (Paris).—Transformisme et Créationisme, Prof. J. L. de Lanessan. *D. Appleton and Co.*—Plant Breeding, J. M. Coulter. *A. and C. Black.*—Wild Life in the Woods and Streams, C. A. Palmer, illustrated; Common British Beetles, Rev. C. A. Hall, illustrated (Peeps at Nature Series). *Cambridge University Press.*—The Cambridge British Flora, Dr. C. E. Moss, assisted by specialists in certain genera, illustrated, vol. ii., The Earlier Dicotyledonous Families; The Philosophy of Biology, J. Johnstone; Bird Studies, W. P. Westell (Cambridge Nature Study Series); Pond Problems, E. E. Unwin (Cambridge Nature Study Series); The Annals of the Bolus Herbarium, vol. i., part 1, edited by Dr. H. H. W. Pearson. *Cassell and Co., Ltd.*—The Progress of Eugenics, Dr. C. W. Saleeby; Rock Gardening for Amateurs, H. H. Thomas, illustrated; Wild Flowers as They Grow, H. E. Corke and G. C. Nuttall, illustrated, Series vi. and vii.; Dogs and All About Them, R. Leighton, illustrated. *J. and A. Churchill.*—The Horticultural Record, R. Cory, illustrated. *J. M. Dent and Sons, Ltd.*—A History of Botany, Prof. J. R. Green, F.R.S. *Duckworth and Co.*—Glossary of Botanical Terms, Jackson, new edition. *W. Engelmann (Leipzig).*—Die Vegetation der Erde, edited by Profs. A. Engler and O. Drude, Band ix., A. Engler, Die Pflanzenwelt Afrikas insbesondere seiner tropischen Gebiete, Band iii., Charakterpflanzen Afrikas II., Archichlamydeen, Dikotyledoneen, Angiospermen, Heft. 1. *G. Fischer (Jena).*—Die Entstehung der Pflanzengallen, Prof. W. Magnus, illustrated; Tafeln zum Vergleiche der Entstehung der Wirbeltierembryonen, Prof. A. Greil. *W. Heinemann.*—Animal Life in Africa, Major Stevenson-Hamilton, four parts, illustrated, part i., Carnivora. *H. Holt and Co. (New York).*—Essentials of College Botany, Profs. C. E. Bessey and E. A. Bessey, eighth edition, entirely revised and rewritten of Bessey's Essentials of Botany; Students' Handbook of Botany, F. L. Sargent; General Zoology, Prof. E. G. Conklin; Economic Zoology and Entomology, Prof. V. L. Kellogg and R. W. Doane. *Hutchinson and Co.*—Insect Artisans and their Work, E. Step, illustrated. *C. H. Kelly.*—Sea-Side Wonders, and How to Identify Them, S. N. Sedgwick, illustrated. *Longmans and Co.*—Flowering Plants of the Riviera, H. S. Thompson, with an introduction on Riviera Vegetation, by A. G. Tansley, illustrated. *Macmillan and Co., Ltd.*—The History and Theory of Vitalism, Prof. H. Driesch, authorised translation by C. K. Ogden, revised throughout and in part rewritten by the author for the English edition; The Problem of Individuality, lectures delivered before the University of London, Prof. H. Driesch; A Treatise on Embryology, edited by W. Heape, F.R.S., vol. i., Invertebrata, Prof. E. W. MacBride, F.R.S., illustrated; Physiological Plant Anatomy, Prof. G. Haberlandt, translated by J. M. F. Drummond, illustrated; Cocoa, Dr. C. J. J. van Hall, illustrated. *Methuen and Co., Ltd.*—Diversions of a Naturalist, Sir E. Ray Lankester, K.C.B., F.R.S., illustrated; Some Minute Animal Parasites, Dr. H. B. Fantham and Dr. A. Porter, illustrated; Spade-Craft, H. A. Day. *John Murray.*—Trees and Shrubs Hardy in the British Isles, W. J. Bean, 2 vols., illustrated; Concerning Animals and other Matters, E. H. Aitken, with a memoir of the author, illustrated; The Genus Rosa, Ellen Willmott, illustrated, concluding part. *Quelle and Meyer (Leipzig).*—Fauna von Deutschland, edited by Dr. P. Brohmer, illustrated; Lehrbuch der allgem. Botanik, by R. Heuer, illustrated; Leitfaden für biolog. Schülerübungen, by Dr. R. Rein, illustrated; Biologische Beobachtungs-aufgaben, by Dr. L. Spilger, illustrated; Garten und Landwirtschaft, Prof. E. Hahn, Die Süsswasserflora, by Prof. H. Glück, illustrated. *Williams and Norgate.*—All About Leaves, the late F. G. Heath.

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MATHEMATICAL AND PHYSICAL SCIENCE.

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MISCELLLANEOUS.

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UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—An exhibition of 50*l.* a year tenable for two years is offered each year by the governing body of Emmanuel College to a research student commencing residence at Cambridge as a member of Emmanuel College in October. Applications should be sent to the master of Emmanuel not later than September 24.

It is proposed to confer the following honorary degrees on June 9, on the occasion of the opening of the new physiological laboratory:—Doctor of Law: Prince Arthur of Connaught, Viscount Esher, Baron Moulton of Bank, and Col. S. M. Benson; Doctor of Science: Sir William Osler, Bart., Sir David Ferrier, Sir Edward A. Schäfer, and Prof. E. H. Starling.

Dr. Norman Moore has been appointed to the office of reader on Sir Robert Rede's foundation for the present year.

Mr. J. M. Wordie has been appointed demonstrator of petrology.

SHEFFIELD.—Mr. L. Southerns has been appointed assistant lecturer and demonstrator in physics, in succession to Dr. R. T. Beatty, resigned; and Mr. A. Pringle Jameson has been appointed assistant lecturer and demonstrator in zoology, in succession to Mr. T. J. Evans, resigned.

MR. J. ADAMS, assistant in botany in the Royal College of Science, Dublin, has recently been appointed to a position under the Canadian Government.

LORD CHELMSFORD will present prizes and certificates to students of evening classes and day college at the South-Western Polytechnic Institute, Chelsea, on March 27. Laboratories and workshops will be open to public inspection about 9.15 p.m. Tickets of admission may be obtained on application at the institute.

BY the will of the late Alderman H. Harrison, Blackburn, legacies amounting to 82,600*l.* are bequeathed to public objects, among which are the following:—1000*l.* each to the Imperial Cancer Research Fund, the Cancer Investigation Department of the Middlesex Hospital, and the Cancer Hospital for cancer investigation; 5000*l.* to Manchester University for general purposes, and 1000*l.* for the Chinese chair; 2000*l.* to Blackburn Grammar School for playing-fields, and 1000*l.* for university scholarships.

IN the House of Commons on February 25 Sir P. Magnus asked the Prime Minister whether the Government intended to introduce this session a Bill for the reorganisation of the University of London, and, if so, whether that Bill would be presented as a separate measure or as part of the measure for the development of a national system of education. In reply, Mr. Asquith said:—"Pending the report of the Departmental Committee on the University of London, I am not in a position to announce the intentions of the Government. It will probably be convenient and desirable to deal with this question in a separate measure."

A SERIES of conferences on the educational value of the kinematograph was held in connection with the recent International Exhibition in Glasgow. The inaugural address at the opening of the exhibition by Sir John Ure Primrose was largely devoted to the educational possibilities of the kinematograph. The educational conferences were begun on February 19, under the presidency of the Lord Provost of Glasgow by an address from Prof. J. W. Gregory on the kinematograph as an educational medium, in which he described its value in many fields of educational work, and notably in geography and technology. In later sessions of the conference Mr. J. Cuthbertson, of the Glasgow High School, opened a discussion on the kinematograph as an aid to literary studies, Mr. G. Eyre-Todd on its use in the teaching of history and geography, Mr. D. B. Duncanson, of the Glasgow Provincial Training College, on its scientific and industrial applications, and Dr. John Smith, chairman of the Govan School Board, on its value in nature-study. At the close of the conference a resolution

directing the attention of the Scottish Board of Education to the educational value of the kinematograph was adopted unanimously.

IN a pamphlet entitled "Some Roads Towards Peace," a report to the trustees of the Carnegie Endowment for International Peace, Mr. Charles W. Eliot gives an open-minded and businesslike account of his sojourn in China and Japan in 1912. The keynote of the report is education, modern scientific education, such as Japan has developed and China would fain see established. According to his report, the well-known and often repeated taunt that the Japanese tradesmen are untrustworthy in commercial dealings is now quite out of date; and this is plainly due to the enlightened educational policy of the leaders of Japan during the last generation. His picture of the evils attending the introduction and development of factories is not pleasing; but it is certainly no worse than in Western lands. The influence for good of the missionary, and especially the medical missionary, is strongly emphasised. Among some of the immediate outcomes of Mr. Eliot's official visit to the far Orient may be mentioned three memorials which appear among the six appendices to the pamphlet. One is an appeal from prominent Chinamen to the trustees of the Carnegie Endowment for a free public library in Peking; the second is an appeal to the same trustees for an international hospital for Tokyo, signed by leading Japanese and European and American residents; and the third is a memorial on the subject of the education of the children of foreign residents in the Far East—the great need of a well-endowed school to take the place of the present inadequate Tokyo Grammar School. There is little doubt that by supporting such educational and medical needs the trustees of the Carnegie Endowment would do effective service in the cause of international peace.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, February 26.—Sir William Crookes, O.M., president, in the chair.—Lord **Rayleigh**: The diffraction of light by spheres of small relative index. —Prof. H. E. **Armstrong** and Prof. F. P. **Worley**: Studies of the processes operative in solutions. XXXI. —Sulphonic acids and sulphuric acid as hydrolytic agents: a discussion of the constitution of sulphuric and other polybasic acids and of the nature of acids. XXXII.—The influence of sulphonates on the hydrolytic activity of sulphonic acids: a contribution to the discussion on the influence of neutral salts.—Prof. H. E. **Armstrong,** R. T. **Colgate,** and E. H. **Rodd**: Morphological studies of benzene derivatives. V.—The correlation of crystalline form with molecular structure: a verification of the Barlow-Pope conception of "valency-volume."—Prof. E. **Wilson**: The magnetic properties of iron when shielded from the earth's magnetism. When iron is subjected to a considerable magnetising force, a species of polarisation is produced which has the effect of reducing the permeability and increasing the dissipation of energy due to magnetic hysteresis for given values of the magnetic induction. The residual effects can be removed by careful demagnetisation or annealing. It was thought by analogy that the earth's magnetic force would also have a polarising influence upon exposed iron, and this is the subject of the present paper. An effort has been made to remove the residual effects of the earth's magnetism by placing the specimen, which is of ring form, in a magnetic shield, and carefully demagnetising it. The magnetic properties of the material were then examined in the usual manner with a ballistic galvanometer, and a comparison made with those obtained from the exposed or unshielded specimen. It has been found that the permeability of *freshly* demagnetised and shielded iron, corresponding to a given value of the magnetic induction, is considerably larger than in the case of the unshielded specimen.—Dr. J. N. **Pring**: The occurrence of ozone in the upper atmosphere. In the Alps, at an altitude of 2100 metres, the mean concentration of ozone is about 2·5 parts by volume in one million of air, and at an altitude of 3600 metres, about five parts in one million of air. In this country the *mean* quantity found between ground-level and an altitude of 20 kilometres was about two parts by volume in one million. No trace of either hydrogen peroxide or nitrogen peroxide could be detected in these cases. Measurements made in the laboratory on the action of ultra-violet light on air showed that a definite equilibrium amount of ozone is obtained, and that this value increases with fall in temperature, but decreases rapidly with fall in pressure. The formation of hydrogen peroxide or nitrogen peroxide by ultra-violet light radiation could not be detected.—W. A. D. **Rudge**: A meteoric iron from Winburg, Orange Free State. In this paper some account is given of the structure, and mechanical and magnetic properties, of the Winburg meteorite, which is stated to have fallen in 1881. It appears to be composed of large crystals of ferrite with veins and crystals of an iron nickel alloy. The total amount of nickel is not more than 3 per cent.—W. A. D. **Rudge**: The electrification produced during the raising of a cloud of dust. During the raising of a cloud of dust a considerable amount of electrification occurs. Insulated conductors held in a stream of dust become charged to a potential of some hundreds of volts. The dust particles seem to be charged by friction amongst themselves, some with positive, others with negative, electricity.—Prof. W. M. **Thornton**: The electrical ignition of gaseous mixtures. This is an experimental examination of the mechanism of ignition of gaseous mixtures by electric sparks. It is found that there are two distinct types of curve connecting percentage of gas in air and the least current which, when broken, causes ignition by the break-spark. In one, characteristic of continuous currents, the current required is proportional to the percentage of gas present; in the other, of the alternating-current type, it is a quadratic function of the percentage, having a minimum, at the mixture giving combustion, midway between CO and CO_2. Ignition by continuous-current break-sparks is largely ionic or electronic, but by alternating currents is more nearly a simple thermal process. The gases examined were hydrogen, carbon disulphide, benzene, alcohol, and the paraffin series up to pentane.

Linnean Society, February 5.—Prof. E. B. Poulton, president, in the chair.—J. **Davidson**: The mouth-parts and mechanism of suction in *Schizoneura lanigera,* Hausm. The object of this paper is to give a detailed description of the anatomy and relations of the mouth-parts of aphids, with special reference to the working of these structures during the processes of feeding.—Dr. L. **Cockayne**: The vegetation of White Island, New Zealand.—W. E. **Collinge**: The range of variation of the oral appendages in some terrestrial Isopods. After carefully examining and considering the variations described, the conclusion is reached that the oral appendages are subject to a considerable amount of variation, and for purposes of specific distinction are not of the value generally supposed, and certainly not so constant as to the form of the head, the mesosomatic segments, the antennæ, the telson, uropoda, and thoracic appendages; they may, however, serve to characterise the larger divisions of the group.

February 19.—Prof E. B. Poulton, president, in the chair.—Dr. J. P. **Lotsy**: The origin of species by crossing. In all questions of evolution facts are gathered from individuals, because species as well as varieties are abstractions, not realities. Nobody is able to show a species or a variety; all he can do is to show one or more individuals which he believes to belong to the species or variety under discussion. Of *individuals* we know two kinds: homozygotes and heterozygotes. The first are stable, the latter segregate, earlier or later, into new homozygotes. The offspring of a homozygote is identical with its parent with the exception of mere temporary, non-transmittable modifications. If this be true, selection in the progeny of a definite homozygote can have no effect. That it *has* no effect has been proved by Johannsen. A homozygote consequently is absolutely stable and produces offspring which is genetically identical to it. Different kinds of homozygotes may be called genotypes, because they differ in genetical constitution, and we can then say that the world is populated—with the exception of heterozygotes—by a large number of sharply defined absolutely stable genotypes. Under such conditions evolution may well seem impossible; fortunately, the behaviour of the heterozygotes shows us that it is very well possible. A careful study of the descendants of a heterozygote shows us that it segregates in the next or later generations in a number of individuals, part of which are heterozygous, but part of which are homozygous, and that these homozygotes belong to different genotypes. It was submitted that the real units of the living kingdom are genotypes; that such genotypes can, under proper precautions, be kept pure for an indefinite time; and that there is no certain evidence that they can be changed in any other way than by crossing. What then is *the reason of the apparent variability of a species in the Linnean sense?* In the first place the fact that a Linnean species is a *collection* of independent stable Jordanian species. The author expressed his firm conviction, as explained before, that no transmittable variation exists, and that all apparent variability is due to an original cross. Finally, the author proceeded to the origin of species before sexual reproduction took place.

Physical Society, February 13.—Prof. C. H. Lees, vice-president, in the chair.—R. Ll. **Jones**: The moving coil ballistic galvanometer.—A. **Campbell**: Vibration galvanometers of low effective resistance. The mathematical theory of the motion of the moving coil of a vibration galvanometer is first given (partly following Wenner), and simple relations are shown to hold between the two resonance frequencies, the free frequency, and the amplitude time constant. It is also shown how all the constants of the equation of motion can be deduced from observations of the direct- and alternating-current sensitivities, the alternating voltage sensitivity and the "dead" resistance. A complete table of the observed and deduced constants is given for a series of very small coils, the number of turns in these varying from one to forty.—Dr. H. J. S. **Sand**: Vacuum-tight lead seals for leading-in wires in vitreous silica and other glasses. The author has found that lead which has been allowed to solidify in contact with glass will, if free from oxide, form a vacuum-tight joint with the latter. Owing to the very great firmness with which the metal adheres, and owing to its great plasticity, these joints can stand temperature changes without damage.

Zoological Society, February 17.—Prof. E. A. Minchin, vice-president, in the chair.—Dr. R. T. **Leiper** and Surgeon E. L. **Atkinson**: The Helminthes collected by the British Antarctic Expedition (*Terra Nova*), 1910–13. The collection contained nine forms previously recorded from the Antarctic zone, three previously recorded only from the Arctic regions, and one other previously recorded elsewhere and now found in the Antarctic zone, and fifteen new species and four new genera. Of the forms obtained in tropical and temperate zones during the voyage, three had been recorded previously and five were new species.—C. G. **Seligmann** and S. G. **Shattock**: The seasonal assumption of the "eclipse" plumage in the mallard (*Anas boscas*) and the function of the testicle. Though the seasonal change of plumage did not correspond with the spermatogenic function of the testicle, its connection with the production of an internal secretion could only be settled by castration followed absolutely without regeneration; this could be ensured only by reopening the abdomen under an anæsthetic and removing any reproduced tissue found.—Dr. F. **Wood-Jones**: Some phases in the reproductive history of the female mole (*Talpa europea*).—H. C. **Chadwick**: Notes on an imperfectly developed specimen of the sea-urchin (*Echinus esculentus*).—C. F. U. **Meek**: The possible connection between spindle-length and cell-volume. In *Forficula auricularia, Helix pomatia,* and man the ratio between the lengths of the mitotic spindle in the two spermatocyte metaphases seemed to be identical or almost identical with the ratio between the radii of two spheres, of which the volume of one is equal to twice that of the other; and, since the volume of the primary spermatocyte cell in the metaphase is presumably equal to twice that of the secondary spermatocyte, connection was suggested between the spindle-length and cell-volume at this stage.—F. E. **Laidlaw**: A further contribution to the study of the dragon-fly fauna of Borneo. The paper dealt with the Gomphinæ and Chlorogomphinæ, of which a number of new species and subspecies was described.

Royal Anthropological Institute, February 17.—Prof. A. Keith, president, in the chair.—S. Hazzledine **Warren**: The experimental investigation of flint fracture and problems of early man. The paper describes experiments conducted for the purpose of investigating the chipping properties of flint, when operated upon by forces of measured strength. In the case of mechanical concussions the chief method employed was by the impact of bodies of known weight falling under the acceleration of gravity from a measured height. Some striking illustrations of the lines of least resistance in flint were thus obtained. As an instance of this, free chipping was obtained by blows of an energy of 0·8 foot-pounds, delivered at a velocity of 15 ft. a second, in one direction upon a flint. But, at the same time, blows of an energy of 22 foot-pounds, delivered at a velocity of 18·8 ft. a second, upon the opposite side of the same flint, had no effect except to continue chipping in the original direction by the back-pressure of the support on which the flint was placed for experiment. The lines of least resistance depend very largely upon the original shape of the piece of flint used for the experiment. It is argued that these properties must also have their influence in the chipping of flints by natural agencies, and may well induce a deceptive appearance of purposeful blows having been delivered in one direction only. A series of experiments showing the effects of differential movement under loads of from 14 to 250 lb. are also described. The similarity of these mechanical effects to the "eoliths" of Kentish type is pointed out.

Royal Meteorological Society, February 18.—Mr. C. J. P. Cave, president, in the chair.—Dr. W. N. **Shaw**: The interpretation of the results of soundings with pilot balloons. The author dealt with the calculation of the distribution of pressure and temperature from the observed horizontal wind velocity at different heights and gave examples of the application of this method to certain types of atmospheric structure repre-

sented in Mr. Cave's book. When we find irregular fluctuations in the wind velocity we must look for corresponding irregularities in temperature and pressure differences at the several levels. These irregularities are obvious characteristics of the observations of wind velocity, pressure difference, and temperature difference.—G. M. **Dobson**: Pilot balloon ascents at the Central Flying School, Upavon, during the year 1913. These balloon ascents are made with the object of obtaining information which will be of use for pilots in flying. The results given in this paper are based upon ninety-seven ascents. It is found that the direction of the wind veers from, and its velocity increases with, increasing height above the ground, until the gradient direction and velocity are reached. The gradient velocity is usually reached at a height of 300 metres, though the gradient direction is not found until a height of about 800 metres. At higher altitudes the velocity tends to increase, and the direction continues to veer, slightly beyond the gradient velocity and direction.

CAMBRIDGE.

Philosophical Society, February 9.—Prof. Seward, vice-president, in the chair.—A. S. **Marsh**: The history of the occurrence of Azolla in the British Isles and in Europe generally. *Azolla filiculoides* has recently been found in Jesus Ditch, Cambridge. This species, which is now common in the Norfolk Broads, has been several times wrongly described as *A. caroliniana*, an earlier introduction, from which it is distinguished by its larger size, different habit, and the microscopic characters of the reproductive organs.—R. C. **McLean**: Amitosis in the parenchyma of water plants. The author described the occurrence of the direct or amitotic form of nuclear division in the cortical parenchyma of certain water plants. The nuclei show peculiar sigmoid forms and remain associated in pairs in the cells. The phenomenon is most frequent in actively growing regions, so cannot be due to senility.—Agnes **Arber**: Root development in *Stratiotes aloides*, L., with special reference to the occurrence of amitosis in an embryonic tissue. An account is given of certain features of the general development and the cytology of the adventitious roots of *Stratiotes aloides*. The various points dealt with include the nature of the root-cap, the origin of the lacunæ of the middle cortex, &c. The greater part of the paper, however, is concerned with an account of amitosis in the root-cap, cortex, and stele of the immature root.

DUBLIN.

Royal Irish Academy, February 23.—Rev. Dr. Mahaffy, president, in the chair.—M. W. J. **Fry**: Extension of number by the introduction of the symbols $+$, $-$, and i. Recognising that quantities of the same kind are divisible into two groups, usually styled positive and negative quantities, to distinguish the author called a unit to measure quantities of one group α, and a unit to measure quantities of the other group β. Two quantities, such as 12α and 9β combine to give 3α, and so on. Denoting ordinary numbers by a, b, c, he defined $+a$ written in front of any quantity $b\alpha$ or $b\beta$, to mean that the quantity is to be multiplied by a and the unit not altered, and by $-b$ that the quantity is to be multiplied by b and the unit altered to the other unit, so that $+ba\alpha = ba\alpha$, $-ba\alpha = ba\beta$, $-ba\beta = ba\alpha$, $+ba\beta = ba\beta$. The rule of signs in this generalised multiplication is then obvious, and as $b\beta = -b\alpha$, the symbol β may be dispensed with, and any quantity may be expressed in the form $x\alpha$, where x is an ordinary number with the sign $+$ or $-$ prefixed to it, and forms a generalised number, or real number. From these definitions he developed the algebra of real numbers, which is incomplete in the well-known ways. To generalise number further so that all operations may be performed, he began with a group of four fundamental units α, α', β, β', arranged in cyclical order instead of two. Of these four an opposite pair, α, β, are a pair of units considered before, and the other pair are any other similarly related pair whatsoever. Defining ia written in front of any quantity $b\alpha$ or $b\alpha'$, or $b\beta$ or $b\beta'$ to mean that the quantity is to be multiplied by a and the unit altered to the next in cyclical order, it follows that $i^2 = -1$, $i^3 = -2$, $i^4 = 1$, and that any quantity $a\alpha + b\beta + c\alpha' + d\beta'$ can be written in the form $(x+iy)\alpha$. Thus the further generalised quantity is $(x+iy)\alpha$, and further generalised number $x+iy$. From these definitions he developed the algebra of complex numbers.

PARIS.

Academy of Sciences, February 23.—M. P. Appell in the chair.—E. **Guyou**: The homogeneity of equations and the simplification of problems when certain quantities become small.—Paul **Sabatier** and M. **Murat**: Contributions to the study of benzhydrol: the preparation of benzhydrol and tetraphenylethane. In the preparation of benzhydrol by the Grignard synthesis from benzaldehyde or ethyl formate and phenylmagnesium bromide the yield of benzhydrol is poor, symmetrical tetraphenylethane appearing as the main product of the reaction. This has now been traced to the conditions of hydrolysis of the organo-magnesium compound. During the fractional distillation of the ether solution of the reaction products decomposition of the benzhydrol takes place, and this has been shown to be due to the catalytic action of small proportions of impurities in the liquid, since a similar change does not occur when pure solutions of benzhydrol are distilled. The conditions for obtaining a good yield of the benzhydrol are given.—A. **Véronnet**: The cooling of the earth: its evolution and duration. The formula established is similar to that of Fourier, but the proof is simpler. The time is 2·46 times that given by the Fourier hypothesis, but it remains of the order of millions of years.—M. **Fessenkoff**: The capture of comets by Jupiter.—J. **Guillaume**: Observations of the sun made at the Observatory of Lyons during the fourth quarter of 1913. Tables are given showing the number of spots, their distribution in latitude, and the distribution of the faculæ in latitude.—J. **Darmois**: The method of Laplace.—G. **Pick**: The evaluation of distances in functional space. Ph. **Franck**: The approximate evaluation of the smallest characteristic value of some integral equations.—G. **Kowalewski**: Intrinsic geometry and the first fundamental proposition of Sophus Lie.—Alfred **Rosenblatt**: Certain integrals of a system of two ordinary differential equations of the first order satisfying initial singular conditions.—Louis **Benoist** and Hippolyte **Copaux**: Some new proofs of the laws of transparency of matter for the X-rays in the special case of complex mineral salts. The substances examined included potassium ferrocyanide, cobaltic chloropentammine and potassium silocomolybdate. There was a good agreement between the found values and those calculated on the assumption that the transparency to the X-rays is an atomic property.—B. **Szilard**: The measurements of electrical potentials at a distance without wires. A disc coated with 0·1 milligram of radium bromide is insulated and connected with a static electrometer. When the disc is placed facing a charged conductor it acquires a potential varying with the distance, and this potential as read off on the electrometer can be used to measure the potential of the charged conductor. For the instrument described, the disc being at a distance of one metre from the charged plate, the voltage shown by the electrometer was about one-twentieth of that of the plate. Various practical applications of the method

are indicated.—S. **Ratner**: A new form of electric breeze.—Jean **Bielecki** and Victor **Henri**: The influence of the ethylene linkage and the carbonyl and carboxyl groups on the absorption of ultra-violet light. Ten substances were studied and the results summarised on three diagrams.—Eugène **Wourtzel**: The decomposition of gaseous ammonia under the influence of the radium emanation and the influence of temperature on the chemical effects produced by the radiations of radio-active bodies. Ammonia is decomposed solely into hydrogen and nitrogen by the radium emanation. The quantity of gas formed per unit of emanation destroyed increases with the pressure. Rise of temperature favours the destruction of the ammonia. The number of cubic centimetres of ammonia destroyed per unit of radiation is nearly doubled at 108° C., and more than tripled at 220° C.—F. **Leprince-Ringuet**: Experiments on the absorption of gases by coal. Three kinds of coal were treated with a gaseous mixture approximating to the fire-damp of a coal mine, and the absorption studied at varying pressures. The results afford no explanation of the sudden disengagement of marsh gas in fiery mines.—F. **Ducelliez** and A. **Raynaud**: The bromination of manganese in ethereal medium. Finely divided manganese and bromine, if dry, do not react at the ordinary temperature: in presence of ether the compound,

$$MnBr_2.(C_2H_5)_2O,$$

is readily formed, and this when heated loses ether and yields the anhydrous manganese bromide. When the bromine is in large excess another bromide is formed having the composition $MnBr_3(C_4H_{10}O)_3$.—Maurice **Billy**: Improvement in the preparation of some pure metals. A description of the preparation of pure titanium free from iron, by the interaction of titanium tetrachloride and sodium hydride. The use of sodium hydride as a reducing agent possesses the advantage that the reduction takes place at about 400° C., and consequently the whole apparatus can be constructed of ordinary soda glass.—J. B. **Senderens** and Jean **Aboulenc**: The esterification of glycerol by acetic acid in the presence of catalysers. As catalytic agents potassium bisulphate, anhydrous aluminium sulphate, and 1 per cent. sulphuric acid were used, the latter being found to give the best yields.—E. **Gourdon**: The mineralogical constitution of the southern Shetlands (Deception Island).—Miramond de **Laroquette**: Variations of food ration and the weight of the body under the action of solar radiation at various seasons of the year.—G. **Marinesco** and J. **Minea**: Culture of the spinal ganglia in heterogeneous media. Spinal ganglia from the dog and cat were cultivated in the plasma of the rabbit, and the mode of growth studied.—A. **Moutier**: Arterial hypertension.—Jean **Gautrelet** and Henri **Neuville**: The blood of the mammoth.

BOOKS RECEIVED.

A Laboratory Manual of Organic Chemistry for Beginners. By Prof. A. F. Holleman. Edited by Dr. A. Jamieson Walker. Second edition. Pp. xvii+83. (New York: J. Wiley and Sons, Inc.; London: Chapman and Hall, Ltd.) 4*s*. 6*d*. net.

Deutsches Meteorologisches Jahrbuch für 1911. Elsass-Lothringen. Pp. viii+59. (Strassburg i.E.: G. Fischbach.)

De la Pirotechnia. By V. Biringuccio. Pp. lxxxv+198. (Bari: Società Tipografica Editrice Barese.) 3 lire.

Kaiserliche Marine. Deutsche Seewarte. III. Nachtrag zum Katalog der Bibliothek der Deutschen Seewarte zu Hamburg. 1 April, 1899, bis 31 Dezember, 1912. Pp. viii+341. (Hamburg.)

Government of India. Department of Revenue and Agriculture. Agricultural Statistics of India for the Years 1907–08 to 1911–12. Vol. i., British India. Pp. iii+420. (Calcutta: Superintendent, Government Printing, India.) 3*s*. 9*d*.

Canada. Department of Mines. Geological Survey. Memoir No. 30. The Basins of Nelson and Churchill Rivers. By W. McInnes. Pp. vii+146+xix plates. (Ottawa: Government Printing Office).

The Currents in Belle Isle Strait. From Investigations of the Tidal and Current Survey in the Seasons of 1894 and 1906. By Dr. W. Bell Dawson. (Ottawa: Government Printing Office.)

The Co-operation of Science and Industry. By S. Roy Illingworth. Pp. 91. (London: C. Griffin and Co., Ltd.) 1*s*. 6*d*. net.

A Text-Book of Physics: Electricity and Magnetism. By Dr. J. H. Poynting and Sir J. J. Thomson. Parts i. and ii., Static Electricity and Magnetism. Pp. xiv+345. (London: C. Griffin and Co., Ltd.) 10*s*. 6*d*.

Chemistry and its Borderland. By Dr. A. W. Stewart. Pp. xii+314+ii plates. (London: Longmans, Green and Co.) 5*s*. net.

Union of South Africa. Department of Agriculture. Report with Appendices for the Period January 1, 1912, to March 31, 1913. Pp. 373+plates. (Cape Town: Cape Times, Ltd.) 9*s*. 6*d*.

Meteorological Office. Geophysical Memoirs Nos. 5, 6, and 7. (London: H.M. Stationery Office; Meteorological Office, South Kensington.)

The Change in the Climate and its Cause. By Major R. A. Marriott. Pp. 94. (London: E. Marlborough and Co.) 1*s*. 6*d*.

County Borough of Halifax. Bankfield Museum Notes. Second series. No. 3, The Letter Books of Joseph Holroyd (cloth-factor) and Sam Hill (clothier). Transcribed and edited by H. Heaton. Pp. 41. (Halifax: F. King and Sons, Ltd.) 2*s*.

The Mechanical Engineer's Reference Book. A Handbook of Tables, Formulas, and Methods for Engineers, Students and Draftsmen. By H. H. Suplee. Fourth edition, revised and enlarged. (London and Philadelphia: J. B. Lippincott Co.) 18*s*. net.

Textiles: a Handbook for the Student and the Consumer. By Mary S. Woolman and Ellen B. McGowan. Pp. xi+428. (New York: The Macmillan Co.; London: Macmillan and Co., Ltd.) 8*s*. 6*d*. net.

Engineering Workshop Exercises. For Technical Students and Apprentice Engineers. By E. Pull. Pp. viii+80. (London and New York: Whittaker and Co.) 2*s*. net.

Wireless Telegraphy: a Handbook for the Use of Operators and Students. By W. H. Marchant. Pp. xi+241. (London and New York: Whittaker and Co.) 5*s*. net.

Test Papers in Elementary Algebra. By C. V. Durell. Pp. viii+233. (London: Macmillan and Co., Ltd.) 3*s*. 6*d*.

Le Leghe Metalliche ed i Principii Scientifici della Metallografia Moderna. By Prof. D. Mazzotto. (Modena, Italy: G. T. Vincenzi e Nipoti.) 6 lire.

My Garden in Spring. By E. A. Bowles. Pp. x+308+plates. (London and Edinburgh: T. C. and E. C. Jack.) 5*s*. net.

Sexual Ethics: a Study of Borderland Questions. By Prof. R. Michels. Pp. xv+296. (London and Felling-on-Tyne: Walter Scott Publishing Co.) 6*s*. net.

Ministry of Finance, Egypt. Survey Department. Meteorological Report for the Year 1911. Part ii., Climatological and Rainfall Observations. Pp. xvi+198. (Cairo: Government Press.) P.T.15.

The Carnegie Trust for the Universities of Scotland. Twelfth Annual Report (for the Year 1912–13) submitted by the Executive Committee to the Trustees

on February 25, 1914. Pp. iv+188. (Edinburgh: T. and A. Constable.)

Wissenschaft und Methode. By H. Poincaré. Autorisierte deutsche Ausgabe mit Erläuternden Anmerkungen von F. and L. Lindemann. Pp. v+283. (Leipzig und Berlin: B. G. Teubner.) 5 marks.

Darstellende Geometrie des Geländes. By Prof. R. Rothe. Pp. 67. (Leipzig und Berlin: B. G. Teubner.) 80 pfennigs.

Beobachtungen über Strandverschiebungen an der Küste des Samlands. By Dr. R. Brückmann. iii., Palmnicken. Pp. 117–144+plates. (Leipzig und Berlin: B. G. Teubner.) 3 marks.

Handwörterbuch der Naturwissenschaften. Edited by E. Korschelt and others. Lieferung 72 and 73. (Jena: G. Fischer.) 2.50 marks each Lief.

Text-Book on Railroad Surveying. By G. W. Pickels and C. C. Wiley. Pp. ix+263. (New York: J. Wiley and Sons, Inc.; London: Chapman and Hall, Ltd.) 10*s*. 6*d*. net.

Canada. Department of Mines. Geological Survey. Memoir No. 23. Geology of the Coast and Islands between the Strait of Georgia and Queen Charlotte Sound, B.C. By J. Austen Bancroft. Pp. viii+146+xvii plates. (Ottawa: Government Printing Bureau.)

India-Rubber Laboratory Practice. By Dr. W. A. Caspari. Pp. viii+196. (London: Macmillan and Co., Ltd.) 5*s*. net.

Some Fundamental Problems in Chemistry Old and New. By Prof. E. A. Letts. Pp. xiii+235+plates. (London: Constable and Co., Ltd.) 7*s*. 6*d*. net.

DIARY OF SOCIETIES.

THURSDAY, MARCH 5

ROYAL SOCIETY, at 4.30.—The Action of Light on Chlorophyll: H. Wager.—Formaldehyde as an Oxidation Product of Chlorophyll Extracts: C. H. Warner.—The Controlling Influence of Carbon Dioxide in the Maturation, Dormancy, and Germination of Seeds: F. Kidd.—The Functional Correlation between the Ovaries, Uterus and Mammary Glands in the Rabbit, with Observations on the Œstrous Cycle: J. Hammond and F. H. A. Marshall.—The Chromaffine System of Annelids and the Relation of this System to the Contractile Vascular System in the Leech, *Hirudo medicinalis*: Dr. J. F. Gaskell.

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

CHILD STUDY SOCIETY, at 7.30.—The Sense of Humour in Children: Miss C. C. Graveson.

LINNEAN SOCIETY, at 8.—Results of Crossing *Euschistus variolarius* and *E. servus* with Reference to the Inheritance of an Exclusively Male Character: The Misses K. Foot and E. C. Strobell.—Short Cuts by Birds to Nectaries: C. F. M. Swynnerton.—Buprestidæ: Ch. Kerremans.—Platypodidæ and Ipidæ from the Seychelles: Lieut.-Col. Winn Sampson.—Scatopsidæ and Simuliidæ: Dr. G. Enderlein.—Heteroneuridæ—Milichiidæ: C. G. Lamb.

FRIDAY, MARCH 6.

JUNIOR INSTITUTION OF ENGINEERS, at 8.—Maihak Indicator and Bottchers Power Counter: F. E. Rainey.

GEOLOGISTS' ASSOCIATION, at 8.—A Study of Ballstone and the Associated Beds in the Wenlock Limestone of Shropshire: Miss M. C. Crossfield and Miss M. S. Johnston.

SATURDAY, MARCH 7.

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

MONDAY, MARCH 9.

ROYAL GEOGRAPHICAL SOCIETY, at 8.30.—The Nigeria-Kamerun Boundary Commission of 1912–13: Capt. W. V. Nugent.

TUESDAY, MARCH 10.

ROYAL INSTITUTION, at 3.—Modern Ships. II. Ocean Travel: Sir John H. Biles.

ROYAL ANTHROPOLOGICAL INSTITUTE, at 8.15.—The Magical Siege of Troy: A. Upward.

INSTITUTION OF CIVIL ENGINEERS, at 8.—*Further Discussion*: Rail-steels for Electric Railways: W. Willox.—Rail-corrugation and its Causes: S. P. W. D'Alte Sellon.

WEDNESDAY, MARCH 11.

ROYAL SOCIETY OF ARTS, at 8.—Bacterial Treatment of Peat, and its Application as a Fertiliser: Prof. W. B. Bottomley.

GEOLOGICAL SOCIETY, at 8.—An Apparently Palæolithic Drawing on a Bone from Sherborne (Dorset): Dr. A. Smith Woodward.

THURSDAY, MARCH 12.

ROYAL SOCIETY, at 4.30.—*Probable Papers*: Note on a Functional Equation Employed by Sir George Stokes: Sir James Stirling.—The Mercury Green Line $\lambda=5461$ as Resolved by Glass and Quartz Lummer Plates and on its Zeeman Components: Prof. J. C. McLellan and A. R. McLeod.—The Electrical Condition of a Gold Surface During the Absorption of Gases and their Catalytic Combustion: H. Hartley.—The Diffusion of Electrons through a Slit: J. H. Mackie.—The Rate of Solution of Hydrogen by Palladium: Dr. A. Holt.

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

CONCRETE INSTITUTE, at 7.30.—Forms for Concrete Work: A. Graham.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—The Design of Rolling Stock for Electric Railways: H. E. O'Brien.

FRIDAY, MARCH 13.

ROYAL INSTITUTION, at 9.—An Indian State: Sir Walter R. Lawrence, Bart.

MALACOLOGICAL SOCIETY, at 8.—Diagnosis of Four New Land Shells from German New Guinea: C. R. Boettger.—Characters of Three New Species of Ennea from Southern Nigeria: H. B. Preston.—A Synopsis of the Family of Veneridæ. II.: A. J. Jukes-Browne.

ROYAL ASTRONOMICAL SOCIETY, at 5.

JUNIOR INSTITUTION OF ENGINEERS, at 8.—Lightning Conductors and their Tests: F. H. Taylor.

ALCHEMICAL SOCIETY, at 8.15.—Roger Bacon: R. Rowbottom.

PHYSICAL SOCIETY, at 8.—Time Measurements of Magnetic Disturbances and their Interpretation: Dr. C. Chree.—The Ratio of the Specific Heats of Air, Hydrogen, Carbon Dioxide and Nitrous Oxide: H. N. Mercer.—The Asymmetric Distribution of the Secondary Electronic Radiation produced by X-Radiation: A. J. Philpot.

SATURDAY, MARCH 14.

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

CONTENTS.

	PAGE
Radio-Active Elements and the Periodic Table. By W. R.	1
Technical Mycology. By Prof. R. T. Hewlett	2
Human Mathematics. By D. B. M.	2
Our Bookshelf	4
Letters to the Editor:—	
Active Nitrogen.—Prof. H. B. Baker, F.R.S.; Hon. R. J. Strutt, F.R.S.	5
Remarkable Upper-Air Records at Batavia.—Dr. W. van Bemmelen	5
The Vertical Temperature Distribution in the Atmosphere.—Dr. C. Braak	6
Atomic Models and Regions of Intra-atomic Electrons. (*With Diagram.*)—Dr. A. van den Broek	7
An Early Slide Rule.—David Baxandall	8
The Permeability of Echinoderm Eggs to Electrolytes.—J. Gray	8
The Beginning of Art. (*Illustrated.*) By Dr. William Wright	9
The Hope Reports. By S. J. H.	10
Dr. Mawson's Antarctic Expedition. (*With Map.*)	11
Notes	12
Our Astronomical Column:—	
Stars with Variable Radial Velocities	17
Sun-spots: Their Internal Motion and Short-period Variations	17
Determinations of Gravity in Egypt and the Sudan	17
The Cobar Copper Field. By J. W. G.	17
Public Health	18
Forthcoming Books of Science	18
University and Educational Intelligence	21
Societies and Academies	22
Books Received	25
Diary of Societies	26

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