THURSDAY, FEBRUARY 23, 1911.

PARKER AND HASWELL'S ZOOLOGY.

A Text-Book of Zoology. By Prof. T. J. Parker, F.R.S., and Prof. W. A. Haswell, F.R.S. Vol i., pp. xxxix+839. Vol. ii., pp. xx+728. (London: Macmillan and Co., Ltd., 1910.) Price 36*s.* net, the two vols.

AFTER an interval of thirteen years, this well-known text-book has appeared in a second edition. Its merits have earned for "Parker and Haswell" a high educational rank; the clear, terse descriptions of each selected example of the various classes; the comparison of the class with its exemplar; the abundance and excellence of the illustrations; the brief but useful summaries on general topics, distribution, history, variation. Its drawback has been that whilst containing a good two years' training in the subject-matter of zoology, it does not satisfy the needs of more advanced students. In some ways the new edition makes good this defect, but we are inclined to think that it would have been a gain if a good deal of elementary descriptive matter (such as students invariably obtain in other and smaller works) could have made way for fresh and much-needed descriptions of such examples as a tortoise and a mammal other than a rabbit, or for such a topic as comparative physiology.

The most striking change in the book is the improvement, both in text and in the figures, of the volume that deals with the invertebrata. The vertebrates, on the other hand, remain essentially unaltered. This differential treatment raises an interesting point, for it corresponds very closely with the relative amount of interest taken by students in the two branches of the subject and the relative progress, both in the presentation of, and research into, the subject-matter. Every experienced teacher knows—indeed, the book before us shows—that our knowledge of invertebrates has advanced more rapidly of late years and has a more attractive appeal than our knowledge of the vertebrata. Purely descriptive anatomy takes too large a place in the presentation of the latter. The discussions upon the origin of fins or the morphology of the ear-ossicles still sound on—vague, unsatisfying, unpragmatic. We do not expect our students to know in detail the sclerites of an insect, but we do expect them to know the hard parts of vertebrates. We still regard embryology as something distinct from anatomy, and the sense of dealing with the life-history of a vertebrate in the way in which life-histories are studied among invertebrates is never realised. Embryos are still treated as rarities, the phenomena of colour are omitted or passed over briefly, the questions of heat-production and other problems of vital mechanics are not mentioned. Is it to be wondered at that our students with rare exceptions devote themselves to research on invertebrata or to questions of heredity? A fresh treatment of vertebrate zoology is required. We regret that no attempt is made in this work to put new wine into the old bottles, but we cannot wonder at it. A new bottle is required.

With regard to the changes made in the first volume, the protozoa are more fully illustrated and described, but the accounts are not equally adequate. For example, the life-histories of the Lobosa are not referred to, the sexual dimorphism in *Sporozoa gregarinida* is not mentioned, and much recent work on forms mentioned or figured is not made use of. The list of fresh-water jellyfish and hydroids on p. 167 omits some interesting recent discoveries. It is, of course, incorrect to repeat the statement of the earlier edition that Limnocodium is only found in Regent's Park. A description of the actual mode of formation of a medusa would have been very welcome. Amongst the few mistakes of nomenclature we must mention Adamsia on p. 208 and on Fig. 157. The anemone referred to is obviously not Adamsia but *Sagartia parasitica* (to use the older name). The accounts of the various worm-Phyla are much improved and will prove extremely useful. The classification of the Crustacea is quite the modern one, but we miss any account of the recent work on parasitism and sex-production in this class. Fig. 454 is still incorrectly labelled. The treatment of the insects might have been brought a little more up-to-date in view of the increased interest in and knowledge of the housefly and the tsetse-fly, neither of which are noticed. The table of mouth-parts on p. 623 is reprinted without reference apparently to the work which had led to another comparison. The Aptera, a most important order, are treated very summarily, and no mention is made of the discoveries of Silvestri and Berlese, which have revealed since 1907 a new order, the Myrientomata.

These criticisms, however, do not preclude a generous estimate of the labour which these volumes have cost, nor do they seriously diminish one's estimate of their value. Prof. Haswell is to be congratulated on the appearance of this new edition, which will be greatly appreciated by all teachers, and in the matter of typography and lithography is an excellent example of modern English work. F. W. GAMBLE.

PAINTS AND PAINTING.

The Materials of the Painter's Craft, in Europe and Egypt from Earliest Times to the end of the Seventeenth Century, with Some Account of their Preparation and Use. By Dr. A. P. Laurie. Pp. xv+444. (London and Edinburgh: J. H. Foulis, 1910.) Price 5*s.* net.

THE author of this interesting book, which belongs to a series treating of "The Arts and Crafts of the Nations," has gathered within its covers an immense amount of information concerning the materials and methods of painting in early times. Dr. Laurie has been, and is, an indefatigable investigator, especially in connection with ancient processes of mural painting and with the vehicles of mediæval and later days. His chief conclusions, some of which have been published before, as in the little volume on "Greek and Roman Methods of Painting," lately reviewed in these columns, are now made accessible to everyone interested in the subject. One has no longer to search through the back numbers of a journal

for scattered papers and lectures, but can find in the volume before us a *résumé* of his inquiries, with some additional information, as well as a list of works, old and new, which deal with some or other of the topics discussed in Dr. Laurie's pages. This list occupies nearly fifty pages, and is comprehensive if not precisely exhaustive.

Of the fourteen chapters into which this handbook is divided, not the least important is that which forms the introduction, in which a sketch is drawn of the interdependence of certain crafts, of the development of the processes of painting, of the increase in the number of available pigments, and of changes in the workshop and studio. Then in six successive chapters there are described Egyptian pigments and mediums, and classical methods, such as wax-painting, egg-tempera, and a kind of fresco-painting. The eighth chapter deals with the later history of fresco-painting, and then comes a series of discussions based on the treatises of the monk Theophilus and on the "Book of the Art," by Cennino Cennini. By means of abundant quotation from these authorities and by original comment, Dr. Laurie has certainly succeeded in reproducing "the atmosphere" described in the preface as that "in which these ancient works were carried out." As our author never loses his hold on modern science and modern practice, we commend his appreciative sympathy with the naïve descriptions and utterances of the older writers and historians of art.

"On the painting of illuminated manuscripts" is the heading of the eleventh chapter. There are here some indications of the pigments used in such wonderful productions as the "Book of Kells," and the "Lindisfarne Gospels," both of the seventh century. For instance, we learn that "the Irish monks had learned to extract the purple dye from a species of murex found on the shores of the Irish Channel." Besides Tyrian purple the early Irish illuminators had at their command red lead, several ochres, a green identical with malachite and several lakes. The ink they used is supposed to have owed its blackness entirely to carbon, but a close examination of the writing in the "Lindisfarne Gospels," recently made by the reviewer, indicates, by the presence of a multitude of reddish-brown spots, the employment of a gallo-tannate of iron, like that described by Theophilus. To the subject of lakes and other "adjective" colours, as used in ancient practice and in mediæval days, Dr. Laurie devotes a chapter of twenty-five pages; the employment of dyed cloths as sources of some pigments, as in the case of the red from kermes, or *Coccus ilicis*, is described.

The last two chapters in the book are mainly given up to the study of questions connected with the origin of oil-painting, the making and use of varnishes and the preparation of pigments and of canvas-grounds during the sixteenth and seventeenth centuries. Dr. Laurie admits that he is unable to pronounce definite judgments on all disputed points, but he has certainly contributed valuable material for a solution of some of the problems offered by pictures supposed to have been painted in oil during the fifteenth century.

In the volume under review are included thirteen illustrations, many of them in colour. They are not merely pleasing enrichments of the text, but serve the purpose of throwing light upon certain descriptive passages.

On the whole, we may consider that the aim of the author has been satisfactorily accomplished and that he has given, within reasonable compass, a fair account, in English, of the varied information scattered very widely in the literature of the art of painting.

In a second edition the author must correct a few slips. For example, the two great lunettes painted by Lord Leighton in the Victoria and Albert Museum are not in true fresco (p. 136), but in spirit-fresco, an oleo-resinous vehicle containing wax. Again, Dr. Laurie has misplaced (p. 334) the Christian names of the brothers van Eyck. Revision is needed elsewhere also, as in the recommendation to use terre verte in true fresco-painting (p. 137); it has proved very treacherous in this country. Then, too, the attribution to Mr. James Ward of the "valuable suggestion, unknown to the older painters, namely, the introduction of asbestos into the plaster to bind it together" (p. 138), does not fit the circumstances. Mr. Ward in his "Fresco Painting," published in 1909, does, it is true, recommend this use of asbestos, but it had been so employed long before, and its adoption had been urged nineteen years previously in a well-known technical manual. A. H. C.

THE COLLOID STATE OF MATTER.

Kapillarchemie, Eine Darstellung der Chemie der Kolloide und verwandter Gebiete. By Dr. Herbert Freundlich. Pp. viii+591. (Leipzig: Akademische Verlagsgesellschaft m. b. H., 1909.)

THE attention which has been directed during recent years to the colloid state of matter has led to the publication of a very considerable literature, and the subject is rapidly becoming an important section of physical chemistry. We therefore welcome Dr. Freundlich's book as perhaps the most complete attempt to deal with the subject as a whole on the lines of a definite hypothesis, and bring it into clear mathematical relation to physics.

The colloidal state is usually, and possibly always, a two-phased condition, in which one finely-divided substance is suspended in another, and ranges by imperceptible gradation from such suspensions as clay in water or butter-fat in milk to true molecular solutions which to our present means of examination are absolutely homogeneous. In such systems the surfaces of contact between the two phases are of enormous area, and the phenomena of surface-action and especially of surface-tension have an importance of quite a different order to that which they possess in single phases. Dr. Freundlich, indeed, is inclined to consider them essential causes, not merely of the peculiarities of colloid solution, but of adsorption, co-precipitation, and electric cataphoresis, which often bear the closest resemblance to ionic chemical reactions. While, however, the influence of surface or surface-action is the guiding hypothesis of Dr. Freundlich's work, we have been particularly struck with the candid and truly scientific spirit in which he admits its limitations, and states opposing views.

Beginning with a discussion of the mathematical work of Laplace on surface-tension, the author points out that while it adequately expresses the effect as observed on curved surfaces, it gives no explanation of tension on plane ones, since it assumes the internal pressure to remain constant to the surface and to react vertically to it only. A more complete theory has been developed by van der Waals and his pupils. In the gas-equation, $(P+a/v^2)(v-b)=RT$, the a/v^2 represents the increase of pressure due to the mutual attraction of the gas molecules; and this, while only a trifling correction in gases, becomes an enormous pressure in liquids owing to the closeness of the molecules. When, however, a particle lies actually on the surface, it is only attracted by those below and around it, and not compressed by others above, so that the surface-layer is not only under a much lower pressure vertically, but the surface is under actual tension from the horizontal component of the attraction of the particles around and below it. Since the liquid particles not only exert attraction on others in the surface-layer, but on those of vapour or gas immediately above it, it is clear that the layer of rarefied liquid must pass without break into a layer of compressed vapour within the very small range of molecular attraction. Substances, like most salts, which dissolve with contraction of volume, increase of internal pressure, and diminution of vapour-pressure, also increase the surface-tension, while volatile liquids and many colloid organic substances diminish it.

It was first pointed out by Willard Gibbs, and afterwards, more fully, by J. J. Thomson, that bodies which diminish the surface-tension must tend to accumulate in that surface, while the reverse is the case with those which increase it. Freundlich sees in this the explanation of adsorption, positive and negative; and as such an effect on surfaces even between liquid and vapour can be shown experimentally to occur, it must be accepted as one of the causes, though whether it plays the important part which he assigns to it must remain uncertain until means are found at least of estimating its quantitative effect. Lagergren has suggested another physical theory of adsorption based on the idea that a surface is a region not of tension but of compression, and that substances which favour contraction of volume must accumulate there. While it seems impossible to accept the idea of a compressed layer at the surface of a liquid in contact with gas, it may well be that the liquid is compressed, and its surface-tension negative on solid surfaces, just as van der Waals assumes that gas is compressed on liquid ones, since the internal pressure and surface-tension of solids must be enormously higher than those of liquids. Neither theory adequately explains many of the individualities, both of absorbent surfaces and adsorbed substances, some substances being adsorbed at surfaces both of positive and of negative surface-tension, and one is inclined to believe, what indeed Freundlich admits, that chemical forces often come into play, and that adsorption resembles in many cases a sort of contact-solution of two bodies having chemical affinities, or, what is probably the same thing, opposite electric potentials.

H. R. P.

TRAVELS IN ICELAND.

Island in Vergangenheit und Gegenwart, Reise-Erinnerungen. By Paul Herrmann. Teil iii., Zweite Reise quer durch Island. Pp. x+312+map. (Leipzig: W. Engelmann, 1910.) Price 7 marks.

THIS volume, although complete in itself, is a sequel to the two parts of "Island in Vergangenheit und Gegenwart" (1907), describing Herr Herrmann's travels four years previously. As before, the town of Torgau allowed him the long leave, provided a *locum tenens* (as schoolmaster), and relieved him of all anxiety during the illness resulting from an accident on the journey. The money was provided for the undertaking by the higher educational authorities, and we cannot wonder when he observes, "Surely few towns would act so munificently." The same guide was employed—he who accompanied Thoroddsen on his explorations—but although the surrounding circumstances were equally favourable, the book does not give quite such an impression of enthusiasm for Iceland in each and every aspect as on the former visit.

The route was by sea round the eastern, western, and northern coast, descriptions being given of all places called at, and the scenery passed. Herr Herrmann is pleased to think his former books are used as reference by tourists, and this part of the present work is specially for their benefit. He thinks the number of visitors will greatly increase when the steamship service is improved. He complains greatly of the accommodation now provided, and quotes and agrees with the opinion of another traveller (O. Komorowicz) "that if such were used in Germany for the transport of animals the S.P.C.A. would interfere"!

From Reykjavik the journey as far as Uxahryggtr was over familiar ground, but a new route was struck thence to Kalmanstunga—with an excursion to the Surtshellir caves—and westward round the Snæfellsnes peninsula, where the inhabitants were not found as lacking in progressive spirit as from other accounts was expected. Northward to Hrofberg with an appreciative allusion to the agricultural school at Olafsdalur. Then eastward to Hólar, the seat of an ancient bishopric and present agricultural school, and southward over the Kjölur to Geysir.

When the disadvantages of storms, cold, tent-life, and many minor catastrophes were overcome, and the pleasant neighbourhood of Hvitárvatn reached, an attempt to visit Frodardalur resulted, owing to an overtaking storm, in a severe fall from the pony. As a result of this accident the remaining portion of the journey, by Skalholt, Gullfoss, and round Reykjanes to Reykjavik, is undertaken with less spirit.

The author enlarges more on the geological aspect of the country than in the preceding volumes; in the meantime he has learnt much in this direction, but wishes the scientific reader to remember always that the descriptions, remarks, and conclusions are those of a layman only. The more he knows of Iceland the more his admiration of Thoroddsen, as a geologist and explorer, grows, and this appreciation is expressed in many references.

For younger geologists the entirely or partially

unexplored regions are pointed out, with hints and advice for future students. The folklore of the island is never lost sight of, and many extracts from the Sagas, and much historical matter, are interspersed in smaller print than the bulk of the narrative.

The writer's love of Iceland is not lessened by his second, and, as he regretfully remarks several times, final visit. It is interesting to note that in his opinion the union between Iceland and Denmark is political only, and that the ties between the two peoples are not likely to become deeper or closer.

The work is illustrated by many photographs and drawings, and a map of the route followed. Altogether it is interesting reading for lovers of Iceland or for prospective travellers over the same ground, although the detailed accounts, evidently intended for future tourists, of the reception, food, lodging, and cost at each stopping place are wearisome.

We regret that Herr Herrmann, with one exception, always alludes to our countrymen with some contemptuous phrase; the four years' interval has not softened his attitude towards the British traveller.

M. G. B.

HEREDITY AND ITS PHYSICAL BASIS.

Hereditary Characters and their Modes of Transmission. By C. E. Walker. Pp. xii+239. (London: Edward Arnold, 1910.) Price 8*s.* 6*d.* net.

THIS volume deals very clearly and briefly with the whole field of heredity, but perhaps its most interesting feature is the development of a theory as to the relative share borne by the chromosomes and other parts of the sexual cells in the transmission of hereditary characters. Stated somewhat crudely, the theory and the arguments which support it are as follows:—In the chromosomes are represented new characters (*i.e.* individual variations, mutations, and the like), while other parts of the cell are concerned with the propagation of old-established racial characters. That the chromosomes do not bear entities representing all the inherited characters is shown, firstly, by experimental evidence, such as the fertilisation of enucleated Echinoderm ova. For instance, Godlewski fertilised enucleated eggs of sea-urchins with the sperm of crinoids and obtained gastrulæ which possessed pure maternal characters only. Second, through the reducing divisions half the chromatin is eliminated from the mature gametes. In spite of this, all the racial characters are shown by the individual which develops from the fertilised ovum. If one half the entities representing the racial characters of the father are absent from the sperm, it is so improbable as to be almost inconceivable that exactly those characters which are unrepresented will be supplied by the mother, seeing that the entities present in the ovum have been halved in number in a corresponding way.

Further, the racial characters are blended in inheritance, while individual variations and new characters are transmitted in a Mendelian way, the mechanism for which is supplied by the chromosomes. That the sexual characters also are propagated in this manner was suggested, first by Castle, who supposed that both sexes were heterozygous in this respect; that is to say, that each individual contained both maleness and femaleness, the one latent and the other patent. Difficulties in the way of accepting this theory were removed by the suggestion that one sex was homozygous, its sexual character being recessive, while the other was heterozygous, and showed the dominant character. Credit for this emendation is given by the author to Bateson and Correns, but by right of priority it belongs to Geoffrey Smith. The latter, in his Naples monograph on the Rhizocephala (published in 1906), suggests that in the case of crabs the male is heterozygous since it exhibits female characters when castrated by the parasite sacculina, and must therefore have femaleness latent. The female, on the other hand, under similar circumstances, never shows male characters. He further surmises that in some parthenogenetic forms the heterozygous sex was the female, since from it both male and female individuals were at times produced.

The ever-present question as to the inheritance of acquired characters comes up again for discussion, and the author, who largely follows the sane reasoning of Archdall Reid, concludes that they are not inherited. Among other arguments in support of this view he includes that from the transmission of the characters of neuter individual in ants. This argument, he says, he has only met with twice before, namely, in the "Origin of Species" and in Poulton's "Essays on Evolution." He will no doubt be interested to know that it figures very largely in the controversy between Weismann and Herbert Spencer, published in the *Contemporary Review* in 1893 and 1894.

One more point must be raised, namely, the use of the word "regression" to signify something the reverse of progression, instead of in the special sense, acquired through biometry, in which it is generally used. The author has followed Archdall Reid in this respect, who, in his "Principles of Heredity," speaks of variations consisting of the addition of a character as progressive, and those resulting in the loss of a character as regressive. We hope he will also follow him in altering "regression" and "regressive" to "retrogression" and "retrogressive" in future editions.

E. H. J. S

GEOLOGY MADE EASY.

Geologie Nouvelle. Théorie Chimique de la Formation de la Terre et des Roches Terrestres. By H. Lenicque. Pp. xvi+271. (Paris: A. Hermann et Fils, 1910.) Price 7 francs.

THE book before us is the work of an engineer, who, having discovered that the received doctrines of geology rest largely on unproved hypotheses, has been impelled to frame a new geology for himself. The French scientific journals having ungratefully met this by a conspiracy of silence, it is left for us to introduce it to the public.

This new light in the dark places of the earth comes, it would seem from the acetylene lamp; for in the principle of that useful invention the author finds the clue to many phenomena which geologists have explained in ways less sensational. Silicates and

carbonates are decomposed at the temperature of the electric furnace, where the stable compounds are silicides, carbides, phosphides, and the like. We are therefore bidden to believe that the heated interior of the globe consists of such bodies as calcium carbide and carborundum; and it is clear that, when some of these substances come into contact with water, startling consequences are to be expected. Thus is explained, for instance, the origin of limestones, setting aside some of late age which the author pronounces to be organic. Eruptions of lime, in a pasty state, were forced up by the pressure of acetylene gas, and spread over the sea floor. Any creatures so unfortunate as to be living in the neighbourhood were expeditiously converted into fossils. In like manner, shales and clays were produced by the action of water on silicides of aluminium and calcium, and were poured out in successive *coulées*, with equally painful results. After this, coal presents no difficulty. It was erupted as a hydrocarbon, more or less fluid, supersaturated with carbon, and such vegetable matters as it happened to encounter were carbonised by the coal itself.

An equal boldness of conception characterises the author's treatment of other branches of geology. Elevation and depression of continents being among the unproved hypotheses, we are offered instead a submergence of the northern and southern hemispheres in turn, resulting from the precession of the equinoxes. Glaciation, of course, finds a like explanation, as Croll has already taught; but our interest is more stirred by those prodigious movements of the ocean which result from the sudden collapse of a melting polar ice-cap. To cataclysms of this kind are referred, not only the deluge in the days of Noah, but the cutting of the Straits of Dover and the severing of Madagascar from Africa, and we gather that the same dread agency may have torn the reindeer from his northern home and transported him to sunny France, where his bones still remain to tell the tale.

Here we must reluctantly take leave of M. Lenicque, while assuring the curious reader that the theories which we have noticed are chosen from many others not inferior to them in novelty and ingenuity.

A. H.

ALL SORTS AND CONDITIONS OF WOMEN.

Women of all Nations. Popular edition. Edited by T. A. Joyce. Pp xii+220+65 plates. (London: Cassell and Co., Ltd., 1910.) Price 6*s*. net.

THOSE already familar with the former edition of "Women of All Nations" will recognise with what skill Mr. Joyce has dealt with it to reduce it to the present extremely convenient and informing little volume. Naturally, the popular edition is less copiously illustrated, but the plates retained are an excellent selection. The range of the book is exceptionally vast, as the title leads us to expect; we pass from criticisms of the modern British woman almost in the vein of Pierre de Coulevain to the chapter on Africa, where we read of girls fattened to attract suitors and of widows buried alive in their dead husband's grave. Women doctors confront us in many parts of the world; in fact, among the Madi of the White Nile they are the chief medical practitioners who receive fees, while the men only act as honorary surgeons (p. 150). The Madi women, we learn, fight duels; nevertheless, they are capital wives, and married life is very happy in their country. A Zulu lady doctor of very striking appearance is portrayed opposite p. 158.

The chapters on Europe (viii. to xv.) are extremely interesting, showing as they do how gradually East merges into West, and how numerous are the backwaters of civilisation in our very midst.

"Two hundred years ago the women of Russia lived in as much seclusion as if they had been Mohammedans. It was Peter the Great who first commanded them to lay aside their veils. . . . In Russian villages there are still old women who act as professional match-makers, and the peasant women still keep their heads covered out-of-doors, even in the warmest weather" (p. 104).

Austria affords an instance of the persistence of national points of view as seen in the status of Slav and Magyar women. A Slav proverb runs:—"That household is threatened with ruin in which the distaff rules and the sword obeys," while there is a Magyar saying that "it is the chignon that must rule." Italian law is exceptionally just to women (pp. 109–10); a married woman's property is absolutely her own, "she has a right to the guardianship of her children, and, as a daughter, to an equal share with her brothers in any patrimonial inheritance in case of intestacy."

Unfortunately the space devoted to America is very brief, 34 pages, the whole of South America—all too scanty in the unabridged edition—being compressed into seven pages. We regret that Mr. Joyce has so greatly curtailed the section by himself on the Maori of New Zealand, and also the discussion of the racial, geographical, and sociological conditions affecting the position of Polynesian women. We are glad to find that the introduction is entirely omitted; it was certainly beneath the level of the rest of the book.

APPLIED MECHANICS.

(1) *Notes on Applied Mechanics.* By R. H. Whapham and G. Preece. Pp. vi+206. (London: Edward Arnold, 1910.) Price 4*s*. 6*d*. net.

(2) *Applied Mechanics, Including Hydraulics and the Theory of the Steam-Engine. For Engineers and Engineering Students.* By John Graham. Pp. viii+204. (London: Edward Arnold, n.d.) Price 5*s*. net.

(1) THIS little book is primarily intended for naval cadets, who are undergoing instruction in applied mechanics during their six months' cruise in the *Cumberland* and *Cornwall*. The examples at the end of each chapter, which are all fully worked out, illustrate, so far as possible, the application of the various principles discussed in each section to actual practical problems which are likely to be met with by the cadets in their future professional career; there is, therefore, a refreshing novelty in these examples, and they differ markedly from those usually met with in the ordinary text-books on this subject.

The first nine chapters deal with machines and such details connected with them as frictional losses, energy of moving masses, relative velocities and accelerations, and output of work. There is an excellent chapter on simple harmonic motion, in which many of the difficulties are smoothed away which generally worry the young student entering for the first time on the study of this branch of the subject. The latter half of the book is devoted to stress and strain, bending moments, shearing forces, and stresses in beams, the stresses and amount of twist in shafts when transmitting power, and the stresses in simple loaded frameworks; it is rather strange that the authors have entirely omitted to deal with the deflection of beams. The last chapter is devoted to a simple treatment of the problem of the flight of projectiles.

The two authors have succeeded in writing on a well-worn subject a text-book which will be welcomed by many young engineering students because of the clear and lucid way in which fundamental principles are explained and enforced.

(2) This book is based upon the lectures delivered by the author to the students at the Technical College, Finsbury, London, and it covers more ground than is usual in the case of the more advanced text-books on this subject.

The first thirteen chapters are devoted to a consideration of the laws of motion, work, and energy; friction; the energy of rotating masses; centres of gravity, &c. There is nothing novel in the treatment of the subject, but fundamental principles are clearly enunciated and explained, and fully worked out examples are freely used in order to illustrate the application of these principles to the many practical problems which the engineer is called upon to solve.

The next eight chapters deal with the branch of the subject usually termed "Strength of Materials." Two excellent chapters on simple harmonic motion, and the balancing of rotating masses, are included in these eight chapters; in any future edition it would be an advantage to print these chapters immediately after chapter x. of the present edition, as this is the correct sequence for them.

The remainder of the book is devoted to elementary hydraulics and to the elements of the theory of the steam engine, including in the latter case such problems as the effects produced by the inertia of the reciprocating masses, the dynamics of steam engine governors, valve gears, and their effect upon the steam distribution. A four-figure table of logarithms is printed as an appendix, and will prove useful to students who are working through the problems given at the end of the book. The book will probably prove useful to junior students in technical colleges.

OUR BOOK SHELF.

The Microscopical Examination of Food and Drugs. By Prof. H. G. Greenish. Second edition. Pp. xx+386. (London: J. and A. Churchill, 1910.) Price 12*s.* 6*d.* net.

THE general excellence of this standard work, which first appeared in 1903, is maintained throughout the second edition, and its usefulness is increased by the addition of a valuable section on adulterants and another on the practical examination of unknown powders. Other new subjects which have been introduced include notes on saffron and gentian, liquorice and calumba roots, and a description of a method of preparing fibres for cutting transverse sections. Otherwise no change has been made in the method of treating the subject-matter; and, indeed, none was necessary.

The first section deals with the various starches, complete instructions being given as to how to mount specimens for microscopic examination; the author describes the shape and appearance of the starch and explains how the grains can be sketched to their correct relative size. In subsequent chapters hairs and textile fibres, spores and glands, roots, woods, stems, leaves, flowers, barks, seeds, fruits, rhizomes, and roots are dealt with in an equally complete manner, and care has been taken to select types which will best illustrate the methods of examination described. With regard to foods, the book is essentially a treatise on practical methods rather than a complete guide to their examination.

In a future edition the inclusion of more foods would make the book of still greater use to analysts, but those at present included are well and adequately dealt with. In the very useful section on adulterants, oil cake might also have been treated from the point of view of the adulteration of oil cake itself; and, in passing, it may be noted, as a very minor point, that in giving the sources of oil cake, the author omits to mention cotton seed. The original illustrations are carefully drawn as to detail, and the drawings selected from other authorities are well chosen. The book will continue to be of great value to students and analytical chemists, as well as to those pharmacists who pursue their calling in its higher branches.

Child Problems. By Dr. G. B. Mangold. Pp. xv+381. (New York: The Macmillan Co.; London: Macmillan and Co., Ltd., 1910.) Price 5*s.* net.

IN this volume the author deals principally with facts and figures obtained from American sources, but the problems are similar to those which were brought into prominence in England in 1904, when evidence was given before the Interdepartmental Committee on the causes of physical deterioration. Prevention is better than cure, and the hope for the future must always be with the younger generation. In some respects America is ahead of England. The deplorable waste of child-life owing to preventible causes is recognised as a national concern, and in many of the States there is a more or less efficient supervision and regulation of the milk supply. Separate courts for children have been established for some years in several of the States, and the whole attitude of society towards the youthful delinquent appears to offer more chance of reforming him than does the English system. In other respects possibly America might learn from England, *e.g.* in regard to factory legislation.

Social problems appear under somewhat different aspects in different countries, but all civilised communities are beginning to realise that national efficiency depends on prevention of the causes which lead to physical deterioration, and a study of the social problems connected with childhood has world-wide application.

"The child is father to the man": the physical, moral, and intellectual welfare of the race depend on the inheritance, training and education of the children. Child problems are the gravest of our time and the present volume should prove helpful to all who are anxious to further reform. The subject matter is dealt with under five heads: infant mortality, educa-

tional reform, child labour, the delinquent child, the neglected child. The author insists on the importance of securing the cooperation of women, but he omits to point out that until they possess the power and status of citizenship their power of helping will be crippled. The volume can be warmly recommended as a wise and human study of immensely difficult and important questions. Its value is enhanced by a full biography and an index. The type is clear and the printing good.

Der Begriff des Instinktes einst und jetzt. Eine Studie über die Geschichte und die Grundlagen der Tierpsychologie. By Prof. Heinrich Ernst Ziegler. Second revised and enlarged edition. Pp. vi+112+2 plates. (Jena: Gustav Fischer, 1910.) Price 3 marks.

THIS is a revised and enlarged edition of a luminous essay which Prof. Ziegler contributed to the Weismann Festschrift in 1904. It deserves to be widely known as a terse and interesting introduction to comparative psychology. The treatment is in the main historical, and the author makes a point of showing how the conception of instinct has mirrored the progress of science.

From the views of the Greek philosophers, the Church, and the old Vitalists, the author passes to Darwin and the Lamarckians, and thence to modern comparative psychology, as represented by workers like Lloyd Morgan, Groos, and Zur Strassen. Ziegler himself, following Weismann, interprets instincts as the outcome of the selection of germinal variations; they are now part of the inheritance and are objectively represented by pre-established nerve-paths. In his discussion he insists upon keeping to an objective consideration, for it is impossible to discover how far the lower animals are conscious.

In contrast to instinctive behaviour, we may speak of intelligent behaviour when it is worked out by the individual's experiments, when it requires to be learnt, when it is individually adjusted to particular circumstances. But when we reflect how little we know, for instance, in regard to the distribution of feelings of pleasure and pain among animals, we see the advisability of trying to define the grades of behaviour as objectively as possible. The author is, therefore, resolute in leaving consciousness and feeling and perception of purpose entirely out of account in his conception of instinct. At the close of the volume —which is all too short—there is an interesting appendix showing how the brains of workers, queens, and males among ants and bees differ from one another, as their instincts do.

Licht und Farbe. By Robert Geigel. (Pp. 199. (Leipzig: Philipp Reclam, junr., n.d.) Price 60 pfennig.

THIS little book belongs to a collection of volumes on "natural science" published in the series known as the "Universal Bibliothek," which is so familiar to students of German literature in this country, and which, in Germany, by providing, at the lowest possible cost, translations of the masterpieces of foreign literature, has helped to make the best books in many languages known to all classes of readers. The price of the usual small volume or "unit" of about a hundred pages is 20 pf.: a number of such units may make one book; thus the "Nibelungenlied" extends to four "units," and may be bought for about tenpence. Three units go to make the present volume, which is illustrated by seventy-five drawings in the text, and, in addition, four coloured plates—as well as a photograph of the author—all well printed.

The aim of this volume is to give a simple, popular account of the properties of light, and especially of phenomena connected with variation in wave-lengths, or colour. From this point of view the ground covered is sufficiently extended: spectrum analysis, fluorescence, interference, polarisation, colour photography, meteorological optics, are all dealt with, in addition to the theory of instruments and photometry.

It would be idle to discuss such a book in any detail. In the nature of the case a work in German intended to give some popular account of elementary scientific ideas can have but little interest for English readers. Clerk Maxwell's "Matter and Motion" is a classic: this volume can pretend to no such distinction. We have not found it inspiring, and in lucidity it might be improved. There is a tendency to regard the general reader too much as a child, and in one instance at least the treatment is directly unscientific in giving as consequences of a law the facts which that law was invented to resume. On the whole, however, the book gives a tolerably readable elementary account of the branches of optics with which it is concerned, and no doubt will enable many a German to take an intelligent interest in matters in which he is not a specialist.

Catalogue of the Lepidoptera Phalaenae in the British Museum. Vol. x., Noctuidæ. (London: Printed by order of the Trustees, British Museum (Nat. Hist.). Price 20*s*.

THE tenth volume of this important work contains more pages than any which has yet been published, vol. vii., the largest of the preceding volumes, containing only 709 pages; and vol. ix. only 522, as against 829 pages in vol. x. The series of plates relating to vol. x. will include plates 148–173, and will be published early in 1911.

Vol. x. is devoted to the Erastrianæ, the thirteenth out of the fifteen subfamilies recognised by the author in the Noctuidæ, and contains descriptions of 1222 species (numbered from 4987 to 6197) belonging to 136 genera, a considerable number, both of genera and species, being described as new. There now remain only the subfamilies Hypeninæ and Hyblæinæ to complete the great group of Noctuidæ which, according to the provisional arrangement of families of Lepidoptera in the first volume of the present work, is only the fourth of fifty-two families, and is placed between the Agaristidæ and the Pterothysanidæ.

The Erastrianæ are moths of comparatively small size, and are very varied in their colour and markings, but the so-called "Noctud-pattern" is rarely present. "The subfamily is to a large extent confined to the tropical and warmer temperate regions, especially the more arid districts, and it has few species in the colder zones, and none in the Arctic and Alpine zones." A few species are British, but though some are abundant in special localities, they are not generally common.

The rapid progress which it has been found possible to make with so bulky and extensive a work is most remarkable, this being the second volume issued in 1910; and a volume appeared in each of the two preceding years.

Photography in Colours: A Text-book for Amateurs, with a Chapter on Kinematography in the Colours of Nature. By Dr. Geo. L. Johnson. Pp. viii+143. (London: Ward and Co., 1910.) Price 3*s*. 6*d*. net.

THE author has rewritten and enlarged the last section of his "Photographic Optics and Colour Photography," and in this volume issues it separately. Being "for amateurs," only those processes that are practically suitable for this class of workers are included, excepting the final chapter on kinematography. Indeed, the subject has been narrowed still further, for the only method treated of with any

fulness is the single-plate or screen-plate process. Here evidently the author writes with considerable experience and even enthusiasm, and as those parts that deal with the "autochrome," "dioptichrome," "Thames," and "omnicolore" plates have been revised by the respective makers of these plates, there is excellent guarantee that the details given are trustworthy.

There is always a difficulty when entering into particulars on such a subject, that commercial products are liable to vary, and it is often impossible for one person to know the extent of this variation in every section of the subject. Just one example will indicate the need for bearing this in mind. Dr. Johnson says of the "dioptichrome" plate that the "first black condition is very perfectly fulfilled." That means that the red, green, and blue patches on the colour screen are so proportioned that the general colour presented to the eye is a pure grey. We have just examined two screens of this make, and one is a rather fine green and the other pinkish. The preliminary chapters on the eye, colour vision, and colour blindness, although short, are of much interest.

Tables for Calculation of Rock-Analyses. By Alfred Harker, F.R.S. (Cambridge: University Press, 1910.) Price 1s.

CHEMICAL analyses of rocks are constantly becoming more refined and complete, and, in consequence, if accurately interpreted, are of increasing value to the petrologist. Systems of rock-classification that depend on chemical composition are also now in favour. For these and other reasons it becomes desirable that the percentages of components as stated in a rock-analysis should be translated as easily as possible into percentages of the constituent rock-forming minerals. Mr. Harker's tables are designed to meet this want, and they have so many valuable features that they should be in the hands of all teachers of petrology. They are very compact, and consequently are cheap compared with the books hitherto in use for this purpose; much time may be saved by their use and long calculations avoided. The method adopted is simple and exceedingly ingenious, and with these tables a student who has not hitherto attempted calculations of this sort may make them more rapidly and even more accurately than by any of the methods formerly in use.

Populäre Vorträge aus dem Gebiete der Entwickelungslehre. By Dr. Wilhelm Breitenbach. Pp. vi+264. (Brackwede i. W.: Verlag von Dr. W. Breitenbach, 1910.) Price 3 marks.

THIS little book consists of six popular lectures, dealing respectively with the origin of life, recent theories of heredity, fifty years of Darwinism, Fritz Müller, the prince of observers, Hermann Müller, and the history of the human race. They are written in a clear and interesting style, and, apart from their scientific value, may be strongly recommended to English students of biology who desire to improve their acquaintance with the German language.

Open-air Studies in Botany: Sketches of British Wild Flowers in their Homes. By R. L. Praeger. Second edition, revised. Pp. xiii+266. (London: Charles Griffin and Co., Ltd., 1910.) Price 6s. net.

THE first edition of this book was reviewed in NATURE of June 16, 1898 (vol. lviii, p. 150). The present issue has been revised throughout, but little alteration has been made. The nomenclature has been changed where necessary to follow that used in the "List of British Seed-plants and Ferns," published by the British Museum in 1907.

LETTERS TO THE EDITOR.

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of* NATURE. *No notice is taken of anonymous communications.*]

A Perpetual Calendar.

I CANNOT allow the article signed by "W. T. L." in NATURE of February 2 to pass without a protest. The proposal to make "New Year's Day" a *dies non*, named "New Year's Day," and not a day of the week or of the month, emanated, I believe, from Mr. Alexander Philip, of Brechin. Supposing that January 1 were a Sunday, and supposing that March, June, September, and December were given 31 days, the other months 30 each, February 1 would always fall on a Tuesday, March 1 on a Thursday, and so on. This would save much trouble in arranging dates for meetings. But, more important still, the four "quarters" of the year would be equal, instead of, as at present, consisting of 90, 91, 92, and 92 days. From testimony by railway companies, insurance offices, chambers of commerce, and business men, an alteration which would equalise terms would meet with universal approval. It is difficult to see where the trouble mentioned by your contributor would come in. It may be stated that authorities in the leading churches have been consulted, and that apparently no objection would be raised by them. I am informed that the Belgian Foreign Office has addressed a diplomatic inquiry at the Vatican, and that the Holy See is not opposed to the reform of the calendar. Surely the organ of English science is not going to oppose a useful innovation, acceptable to all practical men, which would save an enormous amount of labour in accounting and would simplify all business arrangements.

WILLIAM RAMSAY.

University College, Gower Street, London, W.C., February 3.

ALTERATIONS in so fundamental a matter as the regulation of time and of the calendar must always give trouble, and should not be adopted unless very great advantages would result from the change. Now it appears to the writer that no such advantage would be obtained by making the days of the week always correspond to those of the month; indeed, in the arrangements of life it is often found convenient that they should *not* correspond. As to the lengths of the quarters being now unequal, they could be rendered as equal as possible by the simple process of restoring the original regulation of Julius Cæsar, according to which February had 29 days in common years and 30 days in leap-years, and August had only 30 days. Very serious inconvenience would probably result from the ignoring of a day every year, particularly as this would have to be extended to two days in leap-year.

W. T. L.

The Progressive Disclosure of the Entire Atmosphere of the Sun.

SOME of the remarkable spectroheliograms which you reproduce in connection with your report of M. Deslandres' lecture, delivered by that gentleman at the Royal Institution on June 12, 1910, call for special comment. This applies more especially to the pair which represents the sun for March 21, 1910. I had the good fortune to observe spectroscopically an exceptionally fine prominence, which persisted for two entire synodic rotations. During some of the early days in March it graced the west limb, then reappeared in the east about a fortnight later, showed again in the west, reappeared in the east once more towards the middle of April, and gave a final appearance in somewhat modified form on the west limb on April 28. It is fully described and illustrated in an interesting note by Dr. F. Slocum in the *Astrophysical Journal* for September, 1910.

This prominence, while of fair altitude, was more conspicuous with regard to its latitudinal extent. But as regards altitude, it should be mentioned here that the Yerkes photographs were taken in calcium light, while my spectroscopic observations were made in hydrogen Hα light, and I have noted on many occasions, before and

since, that the calcium photographs have a hard, skeleton look about them. In hydrogen Hα the same prominences look more full, and are overlaid by extensive crowns or strata of clouds of varying brilliance, which I cannot find in the corresponding calcium pictures. Thus this prominence also appeared much higher in the radiations of Hα than the calcium spectroheliograms show. In the case under discussion, the prominence was chiefly remarkable by virtue of its enormous extent in latitude, spanning as it did right across the equatorial regions from P.A. 37 to P.A. 84, encircling thus more than 45 degrees of arc practically along an imaginary meredianal line.

It is here where the spectroheliogram taken by M. Deslandres on March 21 comes in, showing as it does this remarkable prominence as a pronounced dark calcium and hydrogen flocculus a few days distant from the east limb. This dark formation conforms in the direction and magnitude of its principal dimensions to the bright structure seen a few days before on the eastern limb. Not only this, but it shows by its pronounced convexity towards the west palpable evidence of equatorial acceleration. Furthermore, it shows along its western contour a bright ribbon, just as one would expect to see if the brighest portion of the prominence was allowed to peep from under an overlying dark or absorbent stratum for reasons of perspective, which in that longitude would be considerable. This is strikingly visible on the glass positives, a fine specimen of which M. Deslandres exhibited at London.

It remains to be recorded as another remarkable feature of this same prominence (by no means infrequently seen by me before and since) that along its top it seemed to be cut off along its entire length by an unbroken and sharp line when seen in Hα, giving the distinct impression that the entire structure was overlaid by a dense, dark, absorbently acting mass of vapours, some other outlines of which under conditions of best definition could be made out, as I pointed out in my recent contribution to solar research in *The Observatory*. The dark flocculus depicted in M. Deslandres' spectroheliogram does in the present case undoubtedly show that hypothetical dark overlying stratum, which therefore is situated at very considerable height above the sun's general surface. The prominence persisted to show this abrupt upper termination during successive appearances, but this was not so apparent when it was last seen in the west on April 28, but even then dark masses were seen projected on the luminous background afforded by the prominence itself.

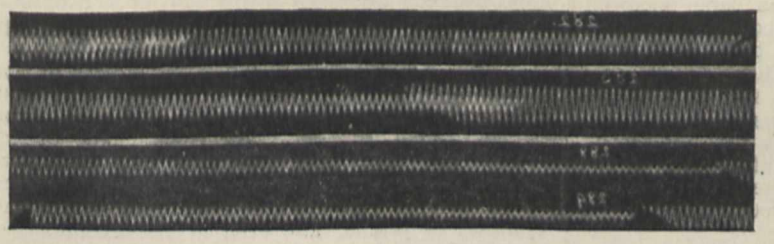
ALBERT ALFRED BUSS.

Chorlton-cum-Hardy, February 16.

Vibrations of a Pianoforte Sound-board.

WHILE investigating the vibrations of the pianoforte sound-board, a curious result was obtained a short time ago which it is perhaps worth while recording.

One leg of an optical lever was attached to the sound-board of a pianoforte at a point 3·5 cm. below the frame supporting the keys and 9 cm. on the treble side of the bridge. A beam of light from an electric arc falls on a concave mirror attached to the optical lever and is reflected to the drum of a phonograph. The combined vibrations of the beam of light, set in motion by the sound-board, and the rotation of the drum trace out a time-displacement



curve of the vibration on a strip of photographic film fastened round the drum. For a full description of the apparatus see the *Phil. Mag.* for April, 1910.

Four curves are enclosed. No. 1 was produced by striking the note *a'* on the pianoforte, No. 2 by striking *a* the octave lower. The speed of the drum was the same in both cases, 68 cm. per sec. It will be noticed that No. 2 gives only the second partial of the note struck. This was so unusual that it was thought some mistake had been made, and the apparatus was again connected with the same point of the sound-board. No. 3 shows the curve obtained for *a'* and No. 4 that for *a*, thus confirming the previous results.

It is remarkable that a point can be found on the sound-board which responds so well to the second partial of a particular note that the fundamental is apparently entirely excluded.

G. H. BERRY.

14 City Road, London, E.C., February 3.

Occurrence of *Matonia sarmentosa* in Sarawak.

WHILE resident in Sarawak I received several inquiries with regard to the conditions of growth of *Matonia sarmentosa*, Baker. As I can find no published record of this, the following note will be of interest to pteridophylogists.

It was first found by Dr. Charles Hose hanging from the roof of a limestone cave at Niah, in the Baram Residency, Sarawak; this was supposed to be the only locality in which it occurred, until it was recently discovered by myself to be growing also on the limestones at both Bau and Bidi in Upper Sarawak. Although some 300 miles of jungle separates this district from Niah, there are, I believe, isolated limestone outcrops on which, when careful search is made, it will possibly be found, thus accounting for its erratic distribution, but it has not been found on the limestone at Quop, which has been well searched.

This limestone formation is considered to be Jurassic by Mr. J. S. Gilkie, and is an extremely hard and fine-grained type, but as the fern does not grow on the original rock, this can only influence its growth by providing suitable temperature and moisture. In the immediate neighbourhood of these immense masses of limestone a cooler atmosphere is noticeable.

I have never observed this fern growing below 50 feet above the ordinary ground-level; its range may extend to an altitude of 200–300 feet, and then only on the rough and somewhat soft surface of a stalagmite or when the surface of the limestone has received a deposit of calcium carbonate from solution. The position occupied by the clumps is always open and airy; the direct sun rays do not appear to be detrimental, but it is invariably sheltered by an overhanging cliff from the rain. When the conditions are all favourable, it grows in very large masses out of all proportion to its slender root-hold; this renders its detachment from the rock easy, but its inaccessible position makes it one of the most difficult of ferns to collect, and this can only be done by the aid of Dyaks clever at constructing ladders and scaffolding.

It is interesting to note that, of all the ferns peculiar to this limestone, in its choice of situation it is the most highly developed.

CECIL J. BROOKS.

Drinkstone, Bury St. Edmunds.

Glacial Erosion.

YOUR reviewer states that "the passage of ice over the British uplands swept away all the loose rock materials and re-deposited them in the lowlands as glacial drifts." I presume that the *loose rock materials* are supposed to have been produced by pre-glacial *weathering*. Now, weathered rocks are in very many cases easily recognised, and my own experience of the rocks contained in boulder clays is that they very seldom indeed show any signs of weathering whatever. The boulders are of fresh hard rock which has been removed by the ice.

R. M. DEELEY.

Inglewood, Longcroft Avenue,
Harpenden, February 10.

MATERIALS loosened by pre-glacial weathering which are weathered throughout are naturally reduced to powder alike by glacial and by river transport; but any block which is only partly weathered through would loose its weathered crust and the nucleus would be left as a fresh hard boulder.

J. W. G.

THE ETHNOGRAPHY OF SOUTH AFRICA.[1]

MR. McCALL THEAL, the celebrated historian of South Africa, introduced into his volumes on that subject, published first of all some fifteen or more years ago, a variety of chapters and paragraphs on the traditional history, the habits and customs of the South African natives—Bushmen, Hottentots, and Bantu negroes. He considered that this work, owing to its being scattered through a number of volumes was not sufficiently useful or accessible to students of South Africa, and therefore has now selected much of his ethnographical material from the aforesaid history, and has republished it in a separate book, the volume under review. To these chapters originally written, we may suppose, about twenty years ago —or even more—he has added a good deal of recent research work, and it may be said at once that although in some respects this book is not quite up-to-date and fails to appreciate some of the newest theories and most recently discovered facts, it is likely to be essential to all students of Africa for a long time to come. It is eminently readable; and although there are a few mistakes, such as perhaps no such work could be exempt from, the slight defects of the book are rather in the nature of omission than of commission.

Perhaps Mr. McCall Theal's greatest mistake is in connection with the Bushmen and their relationships. He is apt to assume, first, that the Bushmen were the only human race in the Old World, living in a condition of absolute savagery, which at the same time was gifted with a remarkable power of design and an irresistible inclination to make pictures, and to engrave, puncture, scratch, or paint those pictures on rock surfaces. He is therefore inclined to ascribe to Bushmen the marvellously good prehistoric drawings, painting, and engravings which have been discovered during the last fifty years in the caves of France and Spain. But, in the first place, it must be pointed out that the men of the Palæolithic and Neolithic ages who did those drawings have been claimed by other ethnologists as of Eskimo race, simple because the Eskimo, like the Bushman, had the same pictorial gift. Similarly, again, they might be represented as Amerindians or Australoids. It is best to suspend judgment on this subject until we have a far more complete array of evidence. It seems probable that man very early in his history as *Homo sapiens* developed the art of drawing. This art, indeed, is present almost without exception in all savage or uncivilised races at the present day, though in some it remains dormant until a chance circumstance draws it out.

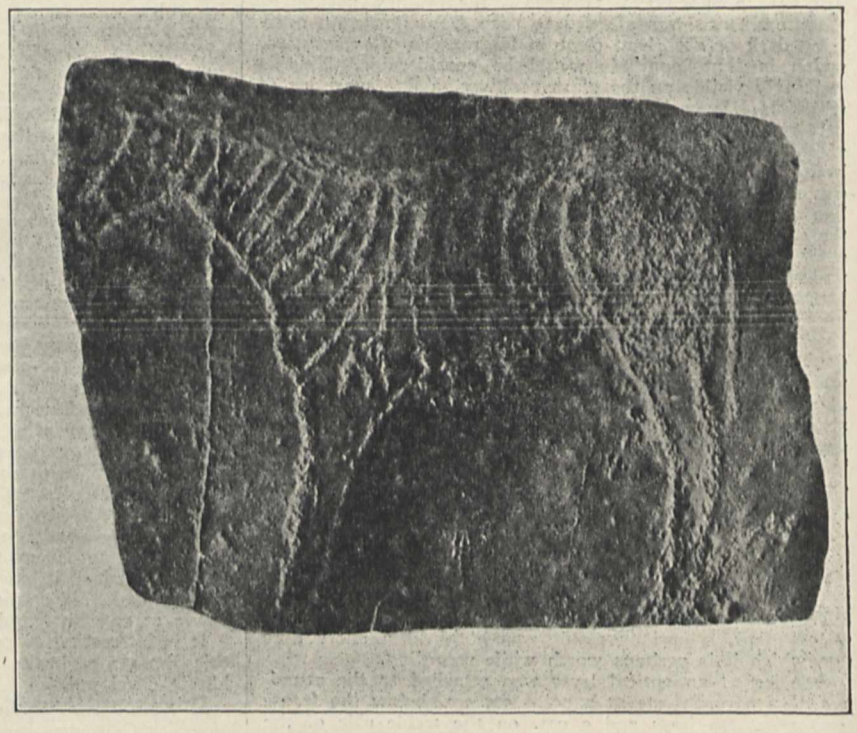


FIG. 1.—Engraving of a Zebra on a Rock in the District of Vryburg. The original is 13 inches in length. From "The Yellow and Dark-skinned People of Africa, South of the Zambezi."

Mr. McCall Theal is also in error when he continues (in spite of all that has been written and published on this subject during the past ten years) to identify the Bushmen with the Congo pigmies, and with other stunted negro races of equatorial or tropical Africa. Dr. F. C. Shrubsall, in reviewing the collections of the present writer, Dr. Arthur Keith, Prof. Duckworth, Dr. Elliot Smith, to say nothing of various German and French anthropologists, have during the past ten years conclusively shown that there was no connection (other than that they were both members of the negro subspecies) between the Bushmen and the Congo pigmies. The last-named are nothing but stunted Forest negroes, whom the peculiar conditions of life in the dense forests have dwarfed. Removed from these unfavourable conditions, the Congo pigmy in the second or third generation grows to a more ordinary stature. Neither in language nor in physique do the Congo pigmies stand apart from the other black negroes.

But the Bushman is a most distinct type of the negro subspecies, due to a divergent development which may be conceivably fifty to a hundred thousand years old. The Hottentot, of course, is nothing but a cross between the black negro and the Bushman.

Mr. Theal descants on the usually hideous aspect, the ultra-negro character of the Bantu Damara (he might have added also, of the Berg-Damara or Haukwoin), but this is likewise a superficial pronouncement. Among the other Herero, and even amongst the Berg-Damara, there are types (some of which the present writer has illustrated through the kindness of the Royal Geographical Society) which might be selected as those of the ideal Bantu, faces almost Hamitic in profile, and even in the abundance and length of head hair. Yet the same tribal designations will cover creatures that might be mistaken for Congo pigmies or the most debased and animal-looking type of Forest negro.

Likewise, amongst the Kafirs and Zulus, the aristocratic types are constantly being given as illustra-

[1] "The Yellow and Dark-skinned People of Africa, South of the Zambezi." A Description of the Bushmen, the Hottentots, and particularly the Bantu, and numerous Folklore Tales of these different People. By Dr. G. McCall Theal. Pp. xvi+397+15 plates. (London: Swan Sonnenschein and Co., Ltd., 1910.) Price 10s. 6d.

tions of the degree of physical beauty to which the negro can attain: yet even amongst these tribes and peoples there are Forest negro types of simian ugliness.

Mr. Theal is conscious himself of the extraordinary mixture of racial types amongst the Bantu, and gives us a vivid picture of their inextricable maze of wanderings in past times. But, of course, all the races of South Africa descended from the north at one time or another. Whether the first arrival of the Bantu-speaking negroes south of the Zambezi was as late in the world's history as Mr. Theal surmises, is a question as to which we cannot arrive at a very precise decision, though he is more likely to be right in his approximate dates than some of his earlier critics. But, of course, it is *inconceivable* that the Bantu invaders, if they came so late in history, found that the southern third of Africa was merely sparsely populated with Bushmen and a few Hottentot hybrids, or the lingering Strandloopers (who may have been more of the forest negro type and are alleged to have preceded the Bushmen). There must have been a fairly abundant negro population in the fertile regions of South-East Africa. To what group or groups did this belong? What language families did they represent? With this again is mixed up the mystery of Zimbabwe. Prof. Randall McIver's researches and criticisms have badly damaged the theory which seemed at one time such a convenient one to explain Zimbabwe and similar ruins: that South-East Africa was colonised perhaps two thousand years ago or earlier, by a foreign, Semitic people—possibly the Arabs of southern Arabia. Prof. von Luschan, of Berlin, has gone into this subject more recently than Prof. McIver, and feels bound to endorse his objections to the art and architecture of Zimbabwe being of extra-African origin. Yet the art and architecture are profoundly unlike anything which has hitherto been developed by the typical Bantu peoples of East or South Africa; and the Makaranga peoples, who are still the principal indigenes of all this region of ruins between the Limpopo and the Zambezi, contain, as Mr. Theal points out quite truly, so many individuals of semi-Caucasian lineaments.

FIG. 2.—Portrait of Herero Men. From "The Yellow and Dark-skinned People of Africa, South of the Zambezi."

Of late, one or two German ethnologists have pointed out the remarkable resemblance between the soapstone birds, and some other emblems of Zimbabwe, and the art of north-western Kamerun, the interior of the Cross River district (see for further light on this the remarkable paper on the Ekoi by Mr. P. A. Talbot in the December number of the *Geographical Magazine*), and even of Benin and Yoruba. The influence of this particular West Africa culture certainly penetrated, athwart all Bantu linguistic influence, down the Congo coast to the mouth of the Congo and to the western parts of the Congo Basin. Can it possibly have traversed Central Africa to reach a great isolated development in the region between the Zambezi and the Transvaal? The physical type of the negroes associated with this Yoruba-Kamerun art is typically negro, but would not differ very markedly in skull formation from that of the average Bantu negro. So far, no skull remains dug up in or near any of these "Zimbabwe" ruins are other than negro of the Bantu type.

Mr. Theal is not able in this book to throw any fresh light on another South African mystery: the place of origin of the Zulus, that is to say, of the dominating tribes or castes in southernmost Africa, which created the present Kafir-Zulu language or group of dialects. Far from this Zulu-Kafir language being what in earlier days was styled by various writers the Sanskrit of the Bantu (that is to say, the Bantu language most nearly representing the original mother tongue, and the most archaic in its features), the contrary is the case. Zulu-Kafir is in some respects a widely aberrant member of the Bantu family: the most aberrant, if one exclude from purview certain worn-down forms of speech in the heart of the Congo Basin or the Kamerun. It has probably adopted its three clicks from the Bushmen, but the clicks matter little in comparison with the large proportion of the word-roots which have been—one might think—specially invented and are without any known relationships in other Bantu tongues. The culture of the Zulu recalls strikingly that of the Masai, the most southern in its

range of the Nilotic negro peoples of East Africa. But, so far as I know, not a single Masai, Gala, or Nilotic negro word-root has yet been discovered in the Zulu speech. The main relationships of this very isolated language are with the East African Bantu, though there are strands of West African Bantu in its composition. It has, of course, affinities with the Herero group, and this again is related almost equally to the West African, the East African Bantu, and to the archaic forms of Bantu speech still existing in and about the Victoria and Albert Nyanzas.

Mr. Theal's book has some excellent examples of southern Bantu folklore, though a few of these stories have been so often repeated by other writers (borrowing from him) that they are a little stale. So also are the illustrations, which may be said to have become common property, being derived from early photographs and drawings going back to the 'seventies and even 'fifties. But a very important (and it seems to the reviewer more or less novel) part of the book is that which deals in pp. 264–73, and in chapter xxiv., with the growth in mental development of the South African Bantu and their increase in numbers under a civilised *régime*. On the whole, Mr. Theal's observations would seem to point to a very decided and more or less permanent improvement in mental development and well-being; while as to their increase in numbers under the *Pax Britannica*, there can be no question whatever.

His observations on monogamy *versus* polygamy would seem—whether he intends it or not—to bear out in a moderate way the opinions of various missionaries and students of Africa, that under monogamy the rate of increase is at least as great as that which prevails under the conditions of polygamy, and perhaps is greater; while the improvement in morals and the well-being and bringing up of children under the system of "one husband, one wife," can no longer be disputed. H. H. JOHNSTON.

PHOTOGRAPHIC BIOGRAPHY OF BIRDS.[1]

THE present volume is a companion to the "Home Life of a Golden Eagle," noticed in NATURE of May 26, 1910. It is about the same size, but four biographies instead of one are contained in it. The "Home Life of a Golden Eagle" as a *vie intime* will be difficult to excel. It admitted us; by means of that impersonal spy, the camera, to the closest intimacy with the entire domestic arrangements, and to the unbroken succession of parental duties of the royal birds. Mr. Beetham has attempted to do for the spoonbill, the white stork, and the common and the purple herons, what Mr. Macpherson did for the eagle. We have to confess with regret that he has succeeded only "*multum post intervallum*. Both watchers employed from an ambush the same methods of the masked camera; but we have from Mr. Beetham fuller details of the methods than of the object for which they were the end. Both were experts in picture-taking, and our author's results are in no way inferior to those of Mr. Macpherson. The methods they employed are, it seems to us, those by which the accurate life-histories of our birds up to the standard of that of the golden eagle can be obtained. It will take a long time before they can all be biographed, but it will eventually be accomplished so long as among the photo-ornithologists are to be numbered men like Mr. Beetham, who despise the unnumbered difficulties, discomforts, and often very real dangers necessary to securing unimpeachable records.

[1] "The Home-life of the Spoonbill, the Stork, and Some Herons." Photographed and Described by B. Beetham. Pp. viii+47+32 mounted plates. (London: Witherby and Co., 1910.) Price 5s. net.

To be of real value, however, the observations must be a continuous series of the same subject taken at carefully chosen intervals, accompanied by detailed descriptions of careful personal observations. In this respect the present budget of biographies leaves much to be desired. Instead of a connected diary we have disconnected glimpses into the different households through swings of the door. The "Home Life of a Spoonbill" can hardly be called more than a passing "look in" at the nursery. Yet the peeps we do get are not without value, and many are very interesting, but they are solitary episodes in the bird's history. Plates i. and ii. refer to one home; there its story ends. The remaining nine are pictures of another home. Plate iii. was photographed on June 17, iv. and v. on June 19, and the remaining six on June 23. We are introduced to the young spoonbills when they are ten days old; we next re-visit their home

FIG. 1.—The claw of each toe has a strong hooking action. From "The Home-life of the Spoonbill," by Bentley Beetham.

when their age is twelve and fifteen days respectively, when this second biography—which had no beginning—also ends.

This is a very great contrast to the absorbingly interesting development of the golden eagle's nestling in unbroken sequence, from its birth to its coming of age. Not more satisfying is the record of the white stork, which begins when the storklings are fully fledged, and though we have eight very excellent photographs of them, we learn nothing about their plumage changes and little about their upbringing and education by their parents. We are equally disappointed with what can hardly be called the "home-life" of the common and the purple herons. We are brought on the scene when the first chick of the former emerges on April 11; then the door is closed for six weeks—the most interesting period of the

babe's life—to re-open on the final scene, when the nestlings are ready to escape, and really do so on the approach of the observer.

The story of the purple heron contains many interesting observations on the habits of the half-fledglings, which we believe to be, if not new, at least not widely known. It seems that during the intervals between their meals they descend from the nest and disport themselves on the ground, to re-occupy it when the mother is heard approaching. Usually when a nestling leaves its nest it is difficult if not impossible to induce it to remain in it, even if replaced. Although the promise of its title-page is hardly fulfilled, the book is interestingly written, and will be read through when once taken up. As a photographer, Mr. Beetham has been most successful, and his pictures (two of which, by the courtesy of the publishers, we reproduce here) have a high value independently of their use as illustrations to his present book, which seems to be produced at an astonishingly low price.

FIG. 2.—A Bittern-like attitude, with the bill held vertically. From "The Home-life of the Spoonbill," by Bentley Beetham.

THE CONSERVATION OF NATURAL RESOURCES.[1]

THE two men who have played the largest part in the conservation movement that has now assumed such great importance in the United States are probably Gifford Pinchot and President Roosevelt. Pinchot was primarily responsible for the forests, but he saw that the conservation of forests could not be dealt with satisfactorily by itself, but was intimately bound up with the conservation of water, of the soil, and of mineral resources. It was this flash of genius that founded a new branch of economics, and the strong personality of the President brought the subject at once into the region of practical politics.

In the volume by Mr. Van Hise, which contains the substance of lectures given at the University of Wisconsin, he traces the history of the famous conference held in the East Room of the White House on May 13, 1908. For the first time in the history of the country the governors of the various States were called together to consider a national question. The President's letter of invitation, and the declaration passed, are both recorded in the second book on our list, and are both weighty documents, worthy of a great occasion. The first outcome has been to take an inventory of the natural resources. The second, and much more difficult, has been to start a great educational campaign to bring home to the individual citizen his responsibility in the matter, and to point the way of reform.

The report of the Conservation Commission of Maryland deals with the mineral resources, soils, forests, waters, fisheries and oysters, game, scenery, public health, and roads, thus giving a more complete picture of the State than has hitherto been available in any one volume. The account of the mineral resources resembles in a general way our own geological survey memoirs, and the treatment of the other subjects is not dissimilar. Mr. Van Hise's book may be regarded as representative of the educational outcome of the movement. He discusses the minerals, forests, soils, and waters, and finally proceeds with a series of recommendations calculated to carry out the objects of the conservation movement.

Dealing first with the mineral resources, it is pointed out that they are far greater than those of any other nation, and they bring in some $2,000,000,000 per annum, an amount only exceeded by the returns from agriculture. Coal is by much the most important, but it is being mined at an astonishing rate; in 1846 only five million tons were

[1] "The Conservation of Natural Resources in the United States." By Charles R. Van Hise. Pp. xv+413. (New York: The Macmillan Co.; London: Macmillan and Co., Ltd., 1910.) Price 8s. 6d. net.

"Report of the Conservation Commission of Maryland for 1908-9." Pp. 204. (Maryland, Baltimore, 1909.)

raised, while in 1907 more than 480 million tons were got. The consumption per head of population rose twentyfold during this period. If this rate of increase of exploitation went on the whole coal supply would be exhausted in 150 years, but reasons are adduced against so short a life. The exact period is unimportant. "So far as our responsibility is concerned," says the author, "it is immaterial whether the coal will be exhausted in 150 years, 1500 years, or 15,000 years. Our responsibility to succeeding generations demands that we reduce its use to our absolute necessities, and therefore prolong its life to the utmost." The waste in mining must be reduced; it varies from 50 to 150 per cent. of the total amount sold, and is often irrevocable. Many thousands of tons of slack are thrown out and burnt in heaps simply to get rid of it. The beehive coke ovens, of which there are said to be some 95,000 in the States, are declared to waste fully $50,000,000 worth of material every year in comparison with the more modern types that might be introduced. Mechanical stoking effects a great economy. Finally, there is the waste owing to imperfect combustion, neglect of waste heat, and so on. Cheaper substitutes might often be got; gas engines are more economical than steam engines, while great improvements are possible in lighting. Two lines of reform are suggested: an educational campaign, and legislation to control mining rights and to make waste an offence.

The increase in the output of petroleum has been enormous. During the first nine years of this century more than 1,155 million barrels of 42 gallons was got, this being more than 50 per cent. of the *entire output* since it was first taken from the ground. If the present annual output continues it is estimated that the supply will give out in about ninety years. Much of the oil is exported, and a fair proportion is used for power. It is suggested that exportation should be forbidden, and the home consumption should be restricted to lubrication and lighting. About natural gas the author has some very strong things to say; the waste, he tells us, has been appalling. Gas has often been tapped when oil was sought; instead of closing up the bores or utilising the gas the wells were lighted and allowed to burn. "In some cases a well has been thus allowed to burn for twenty years. . . . Some of the wells have been allowed to burn until the rock has caved in so extensively as to have become veritable flaming lakes. It is estimated that in the Saddo field alone of Louisiana some 70,000,000 cubic feet per day of gas are wasted, burned without doing any good in any way to anybody." Legislation to stop the waste never gets through; attempts are regularly made, but "some unseen power greater than Governor or Legislature has so far thwarted and palsied every effort."

Turning now to iron ore, most of this occurs in the region of Lake Superior, and at least half is in the hands of one corporation. If the rate of exploitation during the three past decades is maintained the high-grade ores will be exhausted in about three decades more. But the author has no special anxiety for the future; the ore is handled economically, low-grade ores not yet profitable are stored instead of being wasted, new deposits will probably be found as the survey becomes more complete, and stone and cement are being used in place of iron.

With water the principles of conservation are different. So vast a quantity of water falls on to the land every year that absolute exhaustion is out of the question; what is needed is to utilise the supply more fully. Water that has been used for domestic purposes may be used for irrigation with great advantage, as it now contains fertilising material. Water used for power may later be used for domestic purposes, for navigation, or for irrigation. At present, however, there is an actual exhaustion of the water supply. In some parts of the States the level of the underground water has fallen ten to forty feet. We ourselves are in a similar situation; the water level in the chalk round London is known to be falling, and great drafts are being made on the water in the lower strata.

The original forests of the United States are estimated to have covered some 1000 million acres, of which one-half has gone. The amount of wood used is enormous, but so great is the waste that only three-eighths of what is cut appears in the final product. Loss by forest fires is appalling. "Boxing" the trees, *i.e.* cutting cavities in them for the purpose of collecting turpentine, kills many of them. It is estimated that the average growth on the forest land is 12 cubic feet per annum per acre, while the amount taken is 40. The waste of timber is attributed at least in part to the feeling that the natural resources were illimitable, and could never in any circumstances give out.

Lastly, the author deals with the conservation of the soil. First of all, there is the trouble due to land speculation, which no legislation has ever been able to get over. Then there is the question of improper cropping. No "one crop" system can last without an adequate expenditure on manure, and whether the one crop has been cotton, as in the south, or wheat, as in parts of the north, the result in the end is disastrous unless proper manure is added. Now all experience is that sufficient manure is not added, and so we find in parts of the States that most terrible of all sights—derelict land. Spillman considers that in more than half of the area of the States the fertility of the soil has fallen. Recourse has been had in the dry regions to irrigation, with the inevitable result that trouble has arisen through "alkali," *i.e.* an accumulation of salts in the soil to such an extent that the plant suffers. Methods of control are slowly being worked out, but for a long time to come difficulties will arise from this source.

Depletion of soil nitrogen is serious, but not beyond remedy; thanks to the work of Sir William Crookes and others nitrogenous manures are now being made from atmospheric nitrogen. Depletion of soil potassium compounds is also serious, but again, is not beyond remedy. The disquieting feature is the depletion of the phosphates. Every year this goes on; whatever the crop and whatever the treatment a certain amount of phosphate is taken up and sold off. Phosphatic manures are required and are being used at an enormous rate. Fresh deposits are being made by birds on the guano islands off Peru, but how are the birds treated? Coker in 1908, in his report to the Peru Government, speaks of "the robbery of eggs on a large scale in past years, the destruction of young and old birds, and the disturbance of the birds in their nesting grounds by the extraction of guano." We are not surprised when he goes on to say that there "has been a great diminution in number."

Some of Mr. Von Hise's data may be wrong—he always gives his references—but it is incontrovertible that we are taking but little thought for the morrow. No doubt we in Great Britain have not wasted natural gas, but what about our coal? Who can defend our Victorian grates—still much the commonest form, in spite of better types recently introduced—and our utter neglect of waste heat in our houses? There is no evidence that our soils are becoming exhausted; much of the land is left in poor pasture, and gives us little return, but at least it is storing up fertility for a future generation. But then we are importing enormous quantities of foodstuffs from abroad, some of which, being fed to cattle, helps to fertilise the

land, and we also import much manure. Our great waste in this direction is our failure to recover the fertilising material from sewage; at present this may be unavoidable, but there are other wastages—loss of manures from our farms—that might be remedied. We are far from blameless in the matter of forestry also. The conservation movement is attracting attention in Canada, and it will, let us hope, become a power there and also in the other dominions beyond the seas. First of all, however, the great educational crusade must come to impress upon the present generation that our patrimony is not to be squandered but to be used wisely, and handed on to our descendants in as good a condition as possible.

E. J. R.

INDIAN WHEAT FOR THE BRITISH MARKET.[1]

THE last seven years have seen a rapid development of the Indian wheat trade with the United Kingdom. For the ten years ending 1902, when our average annual import of wheat and flour was 99 million cwt. from all countries, we received an average of 5 million cwt. from India; for the past seven years, however, our total import has been 114 million cwt. on the average, of which 16 million cwt. have come from India. The increase is due to several causes. Cultivation and irrigation have extended in India; the seasons in the northern provinces have, on the whole, been more favourable since 1903 than they were in the eight years following 1894; there has been a great improvement in the means of communication by ship, railway, and road, and, finally, the rupee has been maintained at the uniform rate of sixteenpence since 1898. For the past seven years the area sown with wheat in India has been more than 26 million acres, or about one-ninth of the world's wheat area (estimated at 240 million acres), and the average yield has been 11·6 bushels, one-eleventh only of the world's output, since this yield is lower than in many other countries. It is chiefly in the Punjab that the increase has taken place, and, as larger areas come under irrigation, this province will assume more and more importance as a producer of the world's food.

Great Britain takes more than 90 per cent. of the Indian exports of wheat, and the conditions obtaining in our markets have therefore to be studied seriously by the Indian producer, or rather by his expert adviser. At present Indian wheat does not come here in the beautifully clean, well-graded state in which Canadian wheat arrives, and it therefore commands a shilling a quarter less price. It is, however, more valuable than English wheat, and usually fetches about 2*s.* 6*d.* a quarter more, chiefly on account of its lower moisture content. The reason for its inferior condition is to be found partly in the circumstances in which the wheat is grown; most of the Indian wheat is grown on small peasant's holdings, and is threshed by being trodden out by bullocks on an earthen threshing-floor, and winnowed by hand in the wind, so that there is some mixing of varieties and a certain amount of dirt naturally gets in. Sir James Wilson states, however, that the wheat as it leaves the farm contains only about 1 per cent. of dirt, whereas when it reaches London the various handlers have contrived to dilute it 6 per cent., so as to increase their profits. It is considered that a revision of the terms of contract would get over this difficulty. The other questions—the mixing of varieties, and the low average yield—are matters for the experiment stations, but it seems probable that they can be satisfactorily dealt with.

[1] Memorandum on Indian Wheat for the British Market. By Sir James Wilson, K.C.S.I., late Financial Commissioner, Punjab. (Agricultural Research Institute, Pusa.)

NOTES.

THE portrait of Sir William Crookes by Mr. E. A. Walton, to which reference was made in our issue of February 9 (p. 481), was presented to the Royal Society before the ordinary meeting on Thursday last, February 16. In the absence of the treasurer of the fund, Lord Avebury, the presentation was made on behalf of the subscribers by Prof. Meldola, who acknowledged the active cooperation of his colleague, Prof. Pope. The necessary fund was contributed by about 130 Fellows of the society. Sir Archibald Geikie, as president, accepted the portrait on behalf of the society in a graceful speech. Sir William Crookes also expressed his thanks to the subscribers for the honour they had conferred upon him. In the course of his remarks he said that in two years he hoped to celebrate the jubilee of his fellowship, as his election dated from 1863.

SIR JOSEPH LARMOR, secretary of the Royal Society, has been elected a member of Parliament to represent the University of Cambridge, in the seat rendered vacant by the death of Mr. S. H. Butcher. Sir Joseph is Lucasian professor of mathematics in the University, and his election as one of its two parliamentary representatives places in the House of Commons a man of distinguished eminence who should command attention in that assembly, and be able to do something for the development of scientific method in national affairs.

H.R.H. THE DUKE OF CONNAUGHT has been elected president of the Royal Society of Arts.

The British Medical Journal announces that the Fothergillian gold medal of the Medical Society of London, given triennially, has been awarded to Dr. F. W. Mott, F.R.S., for his researches on the nervous system.

AT a meeting of the executive committee of the British Science Guild, held on February 15, it was agreed that the Guild and the British Empire League should dine together, and it is hoped that it may be possible to entertain the Colonial Premiers when they are over for the conference. It was also reported that the Guild's committee on the coordination of charitable effort was in communication with the Social Welfare Association for London to see if it might not be possible for them to work together.

DR. J. C. BRANNER, professor of geology at the Leland Stanford Junior University, California, is starting on April 15, with six assistants, on an expedition to explore the western part of the north coast of Brazil. Its special object will be to determine how far the distribution of Brazilian fauna is affected by the obstruction of the Amazon River. The Government of Brazil has offered the explorers the use of a gunboat.

DR. EDWARD G. JANEWAY, one of the foremost diagnosticians in the United States, died at Summit, New Jersey, on February 10, in his seventieth year. At Bellevue Hospital Medical College, New York, he was professor of pathology and practical anatomy from 1872 to 1879, professor of diseases of the mind and nervous system from 1881 to 1886, and professor of medicine from 1886 to 1892. From 1898 to 1905 he held the chair of medicine at the medical school of New York University. He was health commissioner of New York City from 1875 to 1882.

THE recent death-roll in America includes the name of Dr. Leonard Parker Kinnicutt. He was born in 1854, and spent his student period at the Massachusetts Institute of Technology, the Universities of Heidelberg and Bonn, and Johns Hopkins University, Baltimore. He held a

junior post at Harvard from 1880 to 1883, since which year he had been connected with the Worcester Polytechnic Institute as assistant-professor and professor of chemistry successively. His chief work was done as an expert on sewage disposal and water supply, and he had acted as consulting chemist to the Connecticut Sewage Commission.

The Times announces the death of Dr. C. Alexander MacMunn, of Wolverhampton, at fifty-nine years of age. Dr. MacMunn was a member of the Physiological Society, the Marine Biological Association, and other bodies, and he devoted himself largely to research, mostly in physiological chemistry and animal pigments. He published numerous works, some of which were translated into foreign languages, and at the time of his death was engaged on "Outlines of Clinical Chemistry," which was nearing completion.

THE death of Dr. William Williams, an authority on sanitation, is announced in *The Times*. Dr. Williams was president of the Sanitary Inspection Association of South Wales and Monmouthshire, and held public appointments in Glamorgan, including that of school medical officer and director of the County Public Health Laboratory. He was a Fellow of the Society of Medical Officers of Health and the Royal Sanitary Institute, and ex-president of the South Wales branch of the British Medical Association. He delivered the Milroy lectures at the Royal College of Physicians in 1904. He wrote works on sanitation, water supplies, and milk adulteration.

IN pursuance of the powers conferred on them under a section of the Development and Road Improvement Funds Act, 1909, the Development Commissioners have appointed an advisory committee to advise them on applications for advances and schemes for the development and improvement of fisheries. The committee is constituted as follows:—Mr. H. J. Tennant, M.P. (chairman); Dr. A. E. Shipley, F.R.S.; Prof. G. C. Bourne, F.R.S.; Prof. D'Arcy Thompson, C.B.; and Mr. D. H. Lane, formerly Inspector of Irish Fisheries. In addition, the Fishmongers' Company has been asked to nominate a representatie.

ON Tuesday next, February 28, Dr. A. E. H. Tutton will begin a course of three lectures at the Royal Institution on "Crystalline Structure: Mineral, Chemical, and Liquid," and on Saturday, March 4, Sir J. J. Thomson will commence his course of six lectures on "Radiant Energy and Matter." The Friday evening discourse on March 3 will be delivered by Dr. F. A. Dixey, on "Scents of Butterflies"; on March 10 by the Hon. Charles A. Parsons, on "Recent Advances in Turbines"; and on March 17 by Mr. John H. Balfour Browne, on "Water Supply."

SIR WILLIAM H. WHITE, K.C.B., F.R.S., has been awarded the John Fritz medal for 1911, for "notable achievements in naval architecture," by the special board of award appointed by the four leading American societies of engineers—the Civil, Mining, Mechanical, and Electrical. The John Fritz medal is recognised as the highest distinction which American engineers can bestow. It was established in August, 1902, by the professional associates and friends of the engineer and metallurgist whose name it bears. The award of the medal is made on the ground of "notable scientific or industrial achievement," with "no restriction on account of nationality or sex." The first award was made in 1905 to Lord Kelvin. In subsequent years the medal has been given to Alexander Graham Bell, Thomas A. Edison, George Westinghouse, Charles Porter, and Alfred Noble.

THE anniversary meeting of the Geological Society of London was held on Friday, February 17. The officers were appointed as follows:—*President*, Prof. W. W. Watts, F.R.S.; *vice-presidents*, Dr. C. W. Andrews, F.R.S., Mr. Alfred Harker, F.R.S., Dr. J. E. Marr, F.R.S., Prof. W. J. Sollas, F.R.S.; *secretaries*, Prof. E. J. Garwood and Dr. A. Smith Woodward, F.R.S.; *foreign secretary*, Sir Archibald Geikie, K.C.B., president R.S.; *treasurer*, Dr. A. Strahan, F.R.S. The following awards of medals and funds were made:—Wollaston medal, Prof. Waldemar C. Brögger; Murchison medal, Mr. R. H. Tiddeman; Lyell medals, Dr. F. A. Bather and Dr. A. W. Rowe; Bigsby medal, Prof. O. Abel; Wollaston fund, Prof. O. T. Jones; Murchison fund, Mr. E. S. Cobbold; Lyell fund, Dr. C. G. Cullis; Barlow-Jameson fund, Mr. J. F. N. Green. The president delivered his anniversary address, which dealt with the evolutionary aspects of geology, more especially with the mode and order of deposition of the various formations.

AN International Congress of the Applications of Electricity is to be held in Turin, Italy, on September 9–20. This congress, as its title implies, will deal with questions of practical import, so that electrical engineers will be able to participate largely in the discussions. The chief endeavour of the organising committee, which is under the chairmanship of Prof. Luigi Lombardi, has been so to draw up the programme that the congress may be international in character as well as in name. To attain this object, the cooperation of the International Electrotechnical Commission, with its local committees now established in many countries, has been obtained, as well as the assistance of the societies and associations in all countries dealing with electrical matters. With the help of these organisations, official reporters have been selected, and already many assurances have been received that numerous papers will be presented to the congress from all parts of the world. The initiators of the congress are the Italian Electrotechnical Society and the Italian local committee of the commission mentioned above. The congress is under the patronage of H.R.H. the Duke of the Abruzzi, who is the president of the committee of honour, upon which Prof. Elihu Thomson and Colonel Crompton, the president and honorary secretary respectively of the commission, have been elected members. Papers are to be presented in French, English, German, and Italian, and the discussions will be carried on in all these languages. The subjects to be discussed, the attractions which Italy itself presents, both as regards scenery and electrical development, in addition to the fact that the first official meeting of the whole Electrotechnical Commission is to take place in Turin about the same time, is bound to make this congress a memorable occasion in the history of electrical engineering.

WE regret to record the death, on February 8, of Mr. P. D. Scott-Moncrieff, assistant in the Department of Egyptian and Assyrian Antiquities in the British Museum. The cause of death was heart failure, after an operation for appendicitis. Mr. Scott-Moncrieff was educated at Charterhouse School, at St. Andrews University, and at Christ's College, Cambridge. At Cambridge he took the Oriental languages tripos, and in December, 1903, he was appointed to an assistantship in the British Museum. His official duties brought him in contact chiefly with the Egyptian side of his department, and in the winter of 1905 he paid a visit to the Sudan to undertake archæological work for the Sudan Government. In October and November of that year, in conjunction with Mr. J. W. Crowfoot, he cleared out the eighteenth dynasty temple

at Wady Halfa, of which he afterwards published an account, with plan and photographs, in the Proceedings of the Society of Biblical Archæology. After finishing his work on the temple, he assisted in arranging the monuments in the newly-founded Egyptian Museum at Khartum. As a result of his work at the British Museum, Mr. Scott-Moncrieff had completed the first part of an official publication of hieroglyphic texts from Egyptian stelæ, which it is hoped will shortly appear. He had devoted considerable study to the archæology of the later periods of Egyptian history, and, as first-fruits of his work, he contributed a critical discussion of Plutarch's treatise "De Iside et Osiride" to the *Journal of Hellenic Studies*. For several years past he was also engaged on an examination of the problems presented by the early developments of Christianity in Egypt. He approached the subject from the archæological side, and, at the time of his death, he had nearly completed the MS. of a volume which he proposed to call "Paganism and Christianity in Egypt." His friends hope that arrangements will be made for the publication of this work in the manner and form which he desired.

THE Maya hieroglyphs still await complete decipherment. Some progress towards their interpretation has recently been made by Mr. W. E. Gates, who describes his methods in part i., vol. vi., of the archæological and ethnological publications of the Peabody Museum. The famous Perez Codex, accidentally discovered about fifty years ago in the Bibliothèque Impériale, Paris, has been reproduced by Prof. de Rosny. But these facsimiles are scarce, expensive, and not easily accessible to students. Mr. Gates has now succeeded in reproducing the hieroglyphs in a form of type, of which examples are given in his paper, and has thus greatly facilitated the study of this obscure series of pictorial documents.

IN his treatise on the people of Hungary, "Ethnographie von Hungarn," published in 1877, Paul Hunfalvy describes a race known as the Ishmaelites, whom he identifies with the Mohammedans. Mr. Leo Wiener, in an article in the number of the *Gypsy Lore Journal* for last October, reviewing the original authorities on which Hunfalvy relied, shows that there is much to be said against this identification. He comes to the conclusion that these people were gypsies, the original name Ishmaelite becoming merged with Saracen, and the latter in its turn giving way to the more popular appellation Cigan, which, by the beginning of the fifteenth century in southern Europe, completely overshadows every other designation of the gypsy race.

THE possibilities of the Tuantepec Isthmus as a rival to Panama are seriously engaging the attention of American geographers. The character of the country, its people, and resources are described in a well-illustrated article, by Miss H. Olsson-Seffer, in the December (1910) issue of the *National Geographic Magazine*. The native Indian tribes are a singularly fine race, and the beauty of their women, dress, and ornaments is remarkable. As the Tuantepec route reduces the distance, as compared with that *via* Panama, to Honolulu by 1273 miles, it may become a serious competitor for traffic between the Atlantic and Pacific Oceans.

TO the current number of *Scientia* Signor Rignano contributes an article (in French) on "The Mnemonic Origin and Nature of the Affective Tendencies." The author points out that in every living organism there are physiological systems in a state of rest, which it is always tending to maintain or, when disturbed, to return to. He cites various biological instances showing that, when an organism adapts itself to a changed environment, the altered conditions at once tend to become the "optimum" for that organism. Thus he deduces a basis of memory, a mnemonic origin, for every such optimum, to attain which the organism is always reacting, and subjectively experiences an affective tendency of want, appetite, or desire.

IN the third part of "Zur historischen Biologie der Krankheitserreger," published at Giessen in 1910, Prof. G. Elliot Smith and Dr. M. Armand Ruffer give an account of Pott's disease of the spine in an Egyptian mummy belonging to the time of the twenty-first dynasty about 1000 B.C. The paper is illustrated with two plates, showing a drawing and a photograph of the angular curve of the spine as seen from without and from within the body. The authors claim no novelty in the discovery of a case of Pott's disease in the remains of the ancient Egyptians. They believe it of importance, however, as being the first case which has been thoroughly investigated and proved to be tuberculous in nature, and their case has led to the detection of tubercle as the cause of abnormal conditions found in other bodies since examined. Many ancient Egyptian bodies have shown abnormal curvature of the spine, and some of these have been described as instances of Pott's disease. On examination, however, they have been found to be in reality typical examples of osteo-arthritis, or the disease described and illustrated by Dr. Wood Jones under the name of "spondylitis deformans." This disease was extremely widespread in upper Egypt, particularly in the predynastic age, so much so that signs of it are to be seen in practically every body raised from a common burial ground of that time. This disease was also widespread in the time of the Persian dynasties, about 525–332 B.C., and in lower Egypt the skeletons of Macedonian soldiers and their families frequently show unmistakable signs of spondylitis deformans. The mummy described by the present authors shows a very typical angular curvature of the spine, while the interior of the body shows the remains of a psoas abscess, a very frequent complication of tuberculous disease of the spine at the present day.

AN illustrated account, by Mr. W. H. Mullens, of the two Tradescants and the famous Tradescant Museum—which once contained the whole skin of a dodo—forms the first article in Witherby's *British Birds* for February.

VOL. vii., No. 2, of the Zoological Publications of the University of California is devoted to an account of the birds and mammals collected during the Alexander expedition to Alaska in 1909, two rodents being described as new.

THE fifteenth instalment of the report on the zoological results of Dr. Franz Werner's expedition to the Egyptian Sudan and northern Uganda in 1904 appears in vol. cxix., part vi., of *Sitzber. Acad. Wissenschaften*, Vienna. In this contribution Dr. E. von Daday commences an account of the microfauna of the Nile and its tributaries, as exemplified by plankton collected by the traveller at a large number of localities, but actually deals only with the Egyptian forms. Many of these have been previously identified in other parts of Africa, but half-a-dozen crustaceans are described as new.

THE Biological Survey Division of the U.S. Department of Agriculture has issued (as Bulletin No. 36) an illustrated pamphlet on the practicability and possibilities of breeding deer and other big game in confinement in the United States in such a manner as would make the experiment

remunerative. The author, Mr. D. E. Lantz, states that, were it not for prohibitive laws, there would be a large and constant demand for venison in the country, and that it could be placed on the market at a lower price than beef, owing to the facility with which deer can make a living on poor pasture. Both the wapiti and the white-tailed deer are rapidly diminishing in numbers, and since both kinds can be easily tamed and bred in confinement, there is every inducement for trying the experiment, which, if successful, would prove a lasting benefit. For a time, the rearing of both species for stocking parks ought to be more profitable than the sale of the venison. Schemes for domesticating the caribou and the moose as beasts of draught, as well as for introducing Indian and African antelopes into the United States, are likewise mooted.

THE Journal of the College of Science of the Imperial University of Tokio (vol. xxvii., article 17) contains an interesting account by N. Yatsu of his experiments on germinal localisation in the egg of Cerebratulus. These experiments afford a typical illustration of the manner in which experimental methods are now being applied to the study of animal development. Ovisection in various planes, and separation or dislocation of the blastomeres by mechanical or chemical means are employed, and though the results obtained cannot, perhaps, be regarded as very definite, they are certainly very suggestive. The author concludes that the egg contains "organ bases," but that these have no hard and fast lines of boundary between them; still, there is "something" for each larval organ. He also concludes that there must be a regulating "factor" which in some way brings back shifted blastomeres to the normal position, or, at any rate, to such a position that they are able to produce a larva which differs but little from the normal.

THE problem of sex-determination is just now receiving a good deal of attention from students of heredity, and an interesting controversy has arisen with regard to the Mendelian interpretation of sex ratios. Russo maintains that he is able to alter the proportion of the sexes in the case of rabbits by injecting lecithin into the female parent before the eggs have arrived at maturity. Two kinds of eggs are said to occur in the ovary, one of an anabolic or constructive type, containing globules of lecithin, and the other of a katabolic type, containing crystals of acid fat. The former are believed to give rise to females and the latter to males, and the injection of lecithin into the parent increases the proportion of females. Russo's results have been criticised by Punnett, and more recently by Castle (*American Naturalist*, July, 1910), and Russo replies in the *Biologisches Centralblatt* (January 1, 1911). He points out that Punnett, in repeating the experiment, only administered the lecithin by the mouth of the rabbit, instead of by injection, and that it is decomposed in the alimentary canal. It is obviously very important that Russo's experiments should be repeated by an impartial observer, and that the methods employed by him should be strictly followed.

A CATALOGUE of botanical books, chiefly secondhand, comprising floras of all countries, has been recently published by Messrs. John Wheldon and Co., Great Queen Street, London. The fullest sections are those enumerating general and local British floras, and systematic publications dealing with the plants of India, North and South America, and Australasia.

THE fifth number of last year's botanical volume of the *Philippine Journal of Science* contains the conclusion of the article, by Mr. E. D. Merrill and Mr. M. L. Merritt, on the flora of Mt. Pulog, and a revision of the Philippine Piperaceæ, by Dr. C. de Candolle. The latter paper raises the total number of Piperaceæ known to exist in the Philippines from thirty to one hundred and twenty-five, all referable to the two genera Piper and Peperomia.

Two articles on the subject of pansies and violas, published in the Journal of the Royal Horticultural Society (vol. xxxvi., part ii.), cannot fail to interest growers, as they are contributed by Mr. J. Grieve and Mr. Wm. Cuthbertson, experts of many years' standing. Mr. Grieve explains that he originated his violas by applying pollen from "show pansies" to the stigma of wild species, *V. lutea*, *V. cornuta*, *V. stricta*, and *V. amoena*; the reverse cross did not give any good results. Hints on culture are supplied by Mr. Cuthbertson, who remarks that many of the best varieties raised years ago still continue to maintain their position.

SOME historical notes, compiled by Mr. H. B. Watt, with reference to early tree planting in Scotland appear in the *Glasgow Naturalist* (vol. iii., No. 1). The introduction of fruit-bearing trees during the period of Roman occupation, and plantations round monasteries and ecclesiastical establishments, are suggested as the earliest beginnings. Historical references date from the fifteenth century, and the first plantations at Inveraray appear to have been about the year 1600. Evidence for computing the ages of the oldest trees, chestnuts, sycamores, and beeches, is presented; the Kippenross sycamore and Corstorphine "plane" are referred to the fifteenth century. A list of trees enumerates twenty native and fifty introduced species.

IN many countries at the present time the detailed investigation of their geographical conditions attracts as much attention as the study of distant lands, and has the advantage of being based on much fuller and more accurate information; moreover, the period over which such data are spread enables comparisons to be made between the conditions which existed at different periods. In the December (1910) number of *Petermann's Mitteilungen* Prof. H. Hassinger presents a brief study of the geography of towns and cities, indicating in a systematic manner the lines of investigation which may be followed in order to show the influence that their surrounding and the requirements of the population have had on their development. Dr. Maull in the same number discusses a more localised subject, the zone of the northern limestone Alps, and traces the settlements and lines of communication as they occur in forest belt and neighbouring region, as well as their gradual development. A more specialised type of study is that of Dr. K. Schneider (*Mitt. k.k. Geog. Gesell. Wien*, Nos. 11, 12, 1910), wherein he discusses at some length the geographical relations of the German and Czech peoples in Bohemia, the development of towns and cities, communications, and commercial intercourse.

THE meteorology of the future is the subject of an instructive lecture delivered some time since by Prof. C. Abbe at Columbia University, and printed in the *Popular Science Monthly* for January. The author admits that the question is a very difficult one, and that it is impossible to foresee in detail the problems of the future. Long ago mariners took advantage of the knowledge of trade winds and monsoons, but it took two more centuries to acquire a knowledge of whirlwinds as they advance over the globe, and we are not yet able to speak of weather forecasts as more than probabilities. Some very interesting experiments were arranged, illustrating the formation of cloud and rain, and, with reference to ineffectual attempts made in some countries, it was shown that if we wish to avert

rain or hail, we must be able to cut off the supply of moisture, or prevent rapid expansion. The most important problem at the present time, and in future, will be to attain a clear idea of the mechanics of the atmosphere as a whole, comprised under the technical terms hydro-mechanics, aëro- and thermo-dynamics, and another century may elapse before all these questions can be solved. When meteorology has become more truly deductive, the author further remarks, then we can pass to the satisfactory discussion of the great problems that we now can merely toy with.

In an address delivered on December 29, 1910, as retiring vice-president of Section B (Physics) of the American Association for the Advancement of Science, Dr. L. A. Bauer deals with some problems of terrestrial magnetism, especially with the question whether the sudden commencements of magnetic storms are simultaneous in occurrence at different places. The views which he expresses on this subject are similar to those already given by him in NATURE. Dr. Bauer also refers to a different type of storm having effects appreciable over only limited areas, but does not say explicitly whether the type is essentially different from the "polar elementary" storms described by Prof. Birkeland in the Arctic or the "special type of disturbance" recorded in 1902–3 in the Antarctic. Towards the end of his address, Dr. Bauer states that modern researches point to the conclusion that attempts to represent the earth's magnetic field by a Gaussian potential are of doubtful value, owing to the enormous number of Gaussian constants required to represent anything beyond the more general features.

The annual report of the council of the Institution of Mechanical Engineers for the year 1910, which was adopted at the general meeting on February 17, deals with the chief directions of the progress and work of the institution. The work of the alloys research committee has been continued at the National Physical Laboratory, and it is expected that the tenth report will be presented for discussion during the current session. It will deal with the binary system of alloys of aluminium-zinc, together with some preliminary results obtained in a ternary system of aluminium-zinc-copper, the quantity of copper being limited in amount. The work of the gas-engine research committee has been continued at the University of Birmingham, and Prof. F. W. Burstall is preparing a report dealing with a new series of tests on the experimental engine at the University, varying only the ratio of air to gas, dealing also with the composition of the charge during expansion. Prof. H. C. H. Carpenter has concluded his research, referred to in the 1907 report, upon the production of castings to withstand high pressures. Of the remaining researches in the hands of special committees, that on the value of the steam-jacket is in abeyance at present, while that on the friction of various gears is awaiting the publication of the results of some experiments in the United States. It has been decided not to undertake experiments on "heat transmission" at present.

In the November (1910) number of the Bulletin of the Bureau of Standards Mr. B. McCollum describes and investigates the theory of a new form of dynamometer for the measurement of the quantity of electricity which flows through the instrument. It consists of a relatively large fixed coil with its axis horizontal, at the centre of which is suspended, by a long vertical wire, a smaller coil with its axis parallel to that of the larger coil. Attached to the moving coil is a cylinder of some homogeneous material with its axis coincident with that of the suspension. When the current is sent round the coils, a magnetic couple acts on the moving coil, tending to hold it with its axis parallel to that of the fixed coil, and if the moving coil is displaced it will oscillate about its axis of suspension. The quantity of electricity which passes through the coils during n swings of the coil is equal to

$$2\pi n\sqrt{K(1-T^2/T_0^2)}/C,$$

where K is the moment of inertia of the moving system, T the time of swing with, T_0 the time without the current, and C is the constant of the coils which can be calculated from their dimensions. The investigations of the author appear to promise a degree of accuracy in the measurements comparable with that of the current balance.

The Central of January contains an article on "Crystal Structure and Chemical Composition" from the pen of Prof. W. J. Pope, F.R.S. It is no exaggeration to say that the theory which has been so admirably developed in recent years by Mr. Barlow and Prof. Pope is likely to prove equal in value with the work of Pasteur, van 't Hoff, and Le Bel, which culminated in the enunciation of the theory of the tetrahedral arrangement of the valencies of the carbon atom. The systems of close-packed spheres devised by Messrs. Barlow and Pope certainly give a more realistic picture of the actual arrangement of the atoms in the molecules of a crystal than the wide-spreading models which are commonly used to represent the tetrahedral theory, although the latter are of greater service in interpreting the chemical changes which the molecules may undergo. The widespread appreciation of the new theories of crystal structure has been hindered by the scanty distribution of crystallographic knowledge and by the difficulty of visualising the diagrams by which its essential features are expressed; a popular and simple exposition of his views by one of the authors of the theory is therefore doubly welcome. The same issue contains articles by Prof. Dalby on "The New Engineering Laboratories of the Central Technical College," by Mr. Tripp on "Cross-Channel Steamers," by Mr. Branch on "The Bonus System in a Machine Shop," and by Mr. Montgomery on "The Development of the Humphrey Pump."

The Silica Syndicate, Ltd., 82 Hatton Garden, London, E.C., has issued an illustrated descriptive catalogue of its transparent quartz-glass apparatus. Transparent quartz glass does not crack on subjection to violent and sudden changes of temperature. Its melting point is indefinite, but may be taken at about 1600° C.; there is, however, no trace of fusion at 1555° C. Above 1000° C. it is permeable to hydrogen. Its expansion up to 1000° C. is regular; above 1100° C. it contracts. The catalogue gives particulars of the numerous pieces of apparatus obtainable in this useful material, together with the current prices.

Bulletin No. 43 of the University of Illinois contains an account, by Prof. E. C. Schmidt, of experiments on freight-train resistance and its relation to average car weight. The tests were conducted by the Railway Engineering Department of the University of Illinois in 1908 and 1909; all were made by means of a dynamometer car owned jointly by the University and the Illinois Central Railroad, and were carried out on the Chicago division of this road. Results of tests on thirty-two ordinary freight trains are discussed; the average weight per car ranged from a minimum of 16·12 tons to a maximum of 69·92 tons, and the number of cars in the train varied from twenty-six up to eighty-nine. The results may be expressed by an equation

$$R=a+bS+cS^2,$$

in which the coefficients a, b, and c depend on the average weight W of the cars in the train in tons; S is the speed in miles per hour, and R is the resistance in pounds per

ton weight. A table of values of the coefficients is given for values of W from 15 tons up to 75 tons. This formula shows a maximum error of half of 1 per cent. when compared with the experimental results. Another empirical formula is given which has a maximum error of 9·5 per cent., viz.

$$R=\frac{S+39\cdot6-0\cdot031\ W}{4\cdot08+0\cdot152\ W}.$$

The formulæ are limited to conditions similar to those prevailing during the trials, viz. straight and level track of good construction, temperature above 30° F., wind velocity not more than 20 miles per hour.

In our notice of the fourth edition of "Les Roches et leurs Éléments minéralogiques," by the late M. Ed. Jannettaz, in December last (vol. lxxxv., p. 166), we complained of the description of the work as a revised and enlarged edition (Quatrième édition, revue et augmentée). We have now to acknowledge the receipt from the publishers, MM. Hermann et Fils, Paris, of another copy with modified cover and title-page, in which it is now described correctly as "Quatrième édition, conforme à la Troisième et augmentée de huit planches." The publishers assure us they had no intention of misleading purchasers by the wording of the former description. The work has at least the merit of cheapness, the price being only eight francs.

We have received from the Board of Agriculture and Fisheries a memoir of the Geological Survey, Scotland, entitled "Catalogue of Photographs of Geological Subjects," which has been prepared by the Geological Survey and Museum. The catalogue enumerates the first 1913 photographs taken to illustrate subjects of geological interest in Scotland. The number, subject, and locality of each photograph are given, and the number of the 1-inch map in which each locality occurs. The districts illustrated lie chiefly in the north-west Highlands, Skye, in the counties of Argyll, Perth, Aberdeen, Kincardine, Fife, Haddington, and Mid-Lothian. Copies of the catalogue, price 6*d*., can be obtained from any agents for the sale of Ordnance Survey maps, or through any bookseller.

OUR ASTRONOMICAL COLUMN.

Nova Lacertæ.—*L'Astronomie* for February contains a number of observations of Nova Lacertæ, and includes a reproduction of a spectrogram secured by Dr. Max Wolf, at Heidelberg, on January 2. In addition to the broad bright hydrogen lines, the outstanding features are the band at λ 463, several emission lines between Hβ and Hγ, a conspicuous break in the continuous spectrum on the more refrangible side of Hγ, and the strong emission line near λ 4056.

Nova Sagittarii, No. 3, H.V. 3306.—While examining a plate taken at Arequipa on September 6, 1899, with the 1-inch Cooke lens, Miss Cannon found a star image which appeared to be that of a nova in the position (1900) R.A. = 18h. 13m. 47·5s., dec. = −25° 13·5′; this is about 1′ north of the C.D.M. tenth-magnitude star −25° 13020.

The customary investigation of past plates revealed the fact that the light-curve of the star had the characteristics of the curves of novæ. A large number of photographs were examined covering the period June 7, 1889, to September 3, 1910, and many of them showed no trace of the nova. On plates taken on August 5, 6, 7, and 9, 1899, it is not shown, although the last-named shows a neighbouring star of magnitude 11·4, yet the photograph of August 10, 1899 (G.M.T. 12h. 28m.), shows it at full brightness, viz. magnitude 8·5; this photograph was taken with the 13-inch Boyden telescope, the exposure being 100m. Seven plates, taken for the cluster N.G.C. 6266, show a star of magnitude 15·6 in the position of the nova, within the limits of measurement, but this object exhibits no variability on five earlier plates or on five plates taken since 1905. Since August 10, 1899, the nova has appeared on twenty-six plates taken with various instruments at Cambridge (Mass.), and Arequipa, and on the last of these, taken on October 3, 1901, its magnitude was 13·3. The light-curve shows that the brightness decreased rapidly at first, but was nearly stationary, at magnitude 12·0, from April to July, 1900. A plate accompanying Circular 183 of the Harvard College Observatory reproduces the photographs of the nova's region taken on August 3 and 10, 1899.

The Satellites of Mars.—Observations of Phobos and Deimos during the opposition of 1909 are recorded by Prof. Lowell in No. 50 of the Lowell Observatory Bulletins. Several interesting observations relating to the apparent magnitudes of the two satellites are described, Phobos generally appearing the brighter. Thus on September 16, 1909, it was half a magnitude brighter than Deimos, although with reduced apertures—6 inches being the limit—it was the fainter.

From a discussion of the data obtained, Prof. Lowell finds that Phobos is probably 2·48 times the diameter of Deimos, has 6·15 times the visible surface, and, if the densities are equal, has 15·25 times the mass. The data are too meagre to give a definite conclusion, but, so far as they go, they suggest that there is a difference of brilliancy in one, or both, of the satellites, dependent on their orbital positions; this suggests that each satellite has different local albedoes, or an irregularity of shape, and that it always keeps the same face towards Mars.

The Spectra of some Wolf-Rayet Stars.—Bulletin No. 182 of the Lick Observatory contains a note by Mr. J. C. Duncan describing the spectra of seven Wolf-Royet stars photographed by him, with the one-prism spectrograph mounted on the 36-inch refractor, during the summer of 1908.

Many of the lines and bands shown on these photographs exhibit no notable differences from those published by Prof. Campbell in 1894, but those given in the following table did not appear in the earlier publication:—

λ of centre of line or band	Star B.D.	Description of line or band
4120·84	+35°3953	Narrow dark line
4068·40	+30°3639	,, bright ,,
4630	+36°3956	,, faint band
4058	+36°3987	Fairly bright band 15 A.U. wide
4099	+36°3987	,, ,, 34 ,,
4628	+36°3987	Faint band 54 A.U. wide
4056	+37°3821	,, ,,

Southern Nebulæ.—Two notes describing remarkable southern nebulæ appear in No. 5 of the Transvaal Observatory Circulars.

The first deals with a great ring nebula in Aquarius (N.G.C. 7293, Harding; 22h. 23m., −21° 26′), which is nearly circular and has a diameter of 11′. Mr. Innes describes it as a remarkable object, looking like a ring nebula superimposed on a planetary nebula, and states that it was first seen in the 2-inch finder. This points to the description "very faint" in the N.G.C. being incorrect, or the nebula is variable; it is difficult to account for its being missed, with its present brightness, by Messier and the Herschels. From a photograph taken on October 4, 1910, with 60m. exposure, Mr. Woods describes the nebula as a broad, continuous ring extending across 52s. in R.A. and 12·6′ in declination, and appearing slightly fainter in 135° and 315° than at other parts.

The second object was discovered on a plate taken by Mr. Mitchell on August 1, 1910, with the Franklin-Adams star camera, with an exposure of 2 hours. This is a large, irregular nebula, around and preceding π Scorpionis, which is not mentioned in any of Dreyer's three catalogues. Its position is 15h. 53m., −25° 50′, and it extends over 1° in a north and south direction, its other diameter being about ½°.

A Slowly Moving Meteor.—A fairly bright meteor, remarkable for the leisurely rate at which it moved, was seen by Mr. F. E. Baxandall, at Putney, at 9 p.m. on February 19. It first appeared in about 169°, +39°, and, travelling very slowly, passed through 211°, +28°, finally disappearing below the north-east horizon after a flight lasting fully 15 seconds.

GEOLOGICAL WORK IN BRITISH LANDS.

I.—IN ASIA AND IN AFRICA.

PART iv. of vol. xxxviii. of the Records of the Geological Survey of India (1910) contains two papers by Mr. Murray Stuart on the oil-bearing beds of western

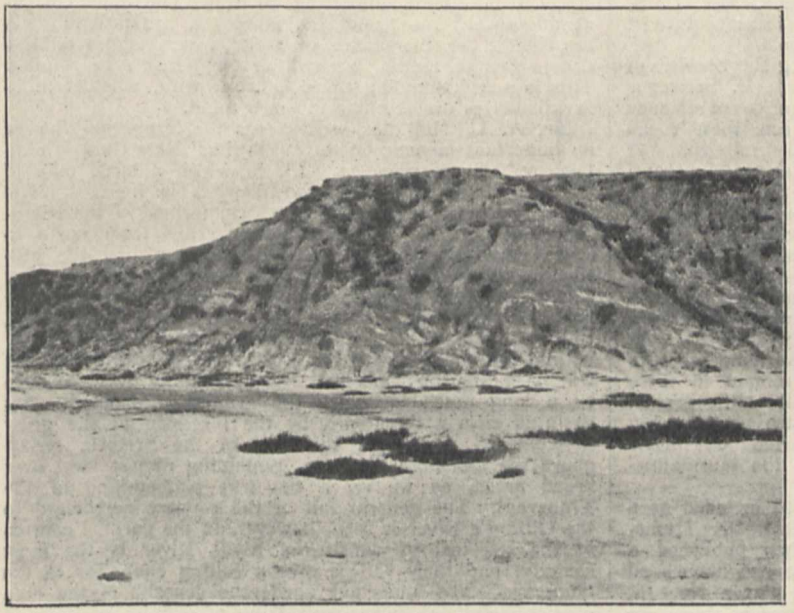


FIG. 1.—Silt-beds uptilted by recent earth-movements, near head of Son-Sakesar Lake, Punjab.

Prome and Kama, in Lower Burma. Maps and an ideal section are provided. The strata of economic interest, the Kama clays, are of Miocene age, ranging from Burdigalian to Pontian. The author considers the palæontological evidence in some detail, following the determinations of Dr. Noetling. Mr. Cotter treats of part of the Yenangyat oilfield, of which a special map is given. Mr. Datta describes siliceous hæmatites from Chanda, in the Central Provinces, some of which are already used as iron ores. One would like to hear something of the relations of the lodes to the surrounding rocks, for comparison with similar materials in South Africa. The remainder of part iv. is occupied with the results of Captain R. E. Lloyd's visit to the Aden Hinterland, a country rarely visited. The author was able to travel ninety miles inland along a line due north from Aden, terminating at the town of Dala. Here bedded lavas and ashes cover much of the country, and Mr. Vredenburg (p. 322) suggests that these are representatives of the Deccan Trap. Captain Lloyd shows them to be younger than certain Jurassic strata, and they have been carved out by denudation into plateaus. These lie (p. 317) as much as 6000 feet above sea-level. The volcanic rocks are mostly basalts and dolerites without olivine, in this recalling the Deccan series. A curious rock is described on p. 330, consisting of minute augite prisms in a green ground of devitrified glass, with spherical vesicles infilled by zeolites, triclinic felspar, and epidote. It may be of interest to remark that a precisely similar infilling of vesicles is found in an andesite from Brighton, Massachusetts. Mr. G. H. Tipper describes (p. 336) the Jurassic fossils collected by Captain Lloyd, which agree with a series previously described by Messrs. Newton and Crick as indicating a fairly high horizon. Perisphinctes is the prevailing ammonite.

Vol. xxxix. of the Records is occupied by a review of mineral production from 1904 to 1908. In vol. xl. (1910) Mr. F. R. Cowper Reed, of Cambridge, discusses (p. 1) the distribution of life in pre-Carboniferous life-provinces, with especial reference to recent work in Asia. "It is no longer possible," as he usefully remarks, "to maintain that the diffusion of Lower Palæozoic life was uniform." Mr. La Touche (p. 30) very interestingly shows that recent beds of silt, laid down in some cases in old channels of overflow, have been tilted by earth-movements in the lake-district of the Punjab Salt Range (Fig. 1). The hollows of the lakes themselves are, with one exception, due to faults or synclinal basins in nummulitic limestone. Among the plates from this area is a fine one (Plate x.) showing a "bad land" produced by the erosion of æolian loess. Mr. La Touche also illustrates excellently "certain glaciers in Sikkim" (p. 52, and Plates xv.–xxiv.). These glaciers show marked features of retreat during the last fifty years. One of them is formed from snow-slides already charged with débris, and is choked from its very beginning "to its fullest capacity with moraine stuff" (Fig. 2). It thus becomes almost a rock-flow, in which the stones are held together by ice, and no ice is visible except where it breaks into cliffs (p. 56). Mr. G. E. Pilgrim (p. 63) describes several new genera and species of mammals, mostly from the Siwalik beds. A giraffoid skull in the British Museum is now styled Indratherium.

On p. 185 Mr. Pilgrim summarises his present results as to the correlation of the tertiary fresh-water deposits of India. He points out that more than a hundred species of vertebrates from N.W. India have been assigned to no special horizons, though derived from a series of beds some 20,000 feet in thickness. He therefore supplies a table showing their vertical distribution, which should do much

FIG. 2.—Part of the stone-filled Alukthang Glacier, Sikkim, showing ice only where fracture occurs.

to clear the way for an appreciation of the successive faunas. The Lower Siwalik Beds, with *Deinotherium indicum* and *Tetrabelodon angustidens* are classed as Tortonian and Sarmatian; the Middle Siwalik Beds, with Mastodon, Stegodon, Hipparion, and Helladotherium, as Pontian; and the Upper Siwalik Beds, with Equus, Bos, Elephas, and Sivatherium, as truly Pliocene. Mr. C. S. Middlemiss (p. 206) revises the "Silurian-Trias sequence" in Kashmir, in a paper covering a wide field.

In the Quarterly Journal of the Geological Society of London, vol. lxvi., part iii., p. 420, Mr. J. B. Scrivenor describes the relations of the igneous rocks of islands between Johore and Singapore, and connects these rocks successfully with types in Borneo and Amboyna. A granite has caught up masses from a gabbroid magma, while this magma has in turn invaded the consolidated granite. The paper is important for those who have to consider the question of segregation-patches as against inclusions brought up from below. In a subsequent paper (p. 435) Mr. Scrivenor describes a number of remarkable rocks from the Kinta Valley of Perak, consisting of tourmaline and corundum. These mostly contain carbon as a separate constituent, and are "evidently derived from certain beds forming part of a series overlying massive beds of limestone." Residual structures remain in these highly altered rocks which strongly suggest oolitic grains. The mineralisation is believed to have taken place during extensive intrusions of granite in the district. Cassiterite "frequently occurs in schists with which the tourmaline-corundum rocks are associated."

If Egypt, for geological purposes, may be included as a British land, it should be mentioned that Dr. Hume, the director of its Geological Survey, has published a memoir on "The Building Stones of Cairo Neighbourhood and Upper Egypt" (Survey Department Paper No. 16, 1910, price 150 mmes.). Maps of the quarry-areas are given, with names in Arabic and English. Analyses of many of the limestones are quoted, and their durability and power of absorbing water are considered. Much of the information was collected by the late Mr. T. Barron.

Dr. Hume also states his views on "The Origin of the Nile Valley in Egypt" (*Geological Magazine*, 1910, p. 385). He believes that the dome-structure of the strata in the Gulf of Suez has been cut across by notable fractures, of which there is still more marked evidence in Sinai. But the main structure of Egypt and of the Nile Valley lying in it has been determined by folding and erosion rather than by trough-faulting. Egypt is formed by a synclinal following on the "wave-crest" that is revealed by the Eastern Desert and Sinai. The Nile ravine follows the axial line of the centre of the synclinal trough, and has been assisted by the presence of easily eroded Cretaceous and Middle Eocene strata. A transverse system of folds, fairly east and west, is also traceable. The oases seem to be due, in the first instance, to the main north and north-west folding.

The Cairo Scientific Journal for September, 1910, contains a general review of the origin of petroleum, by Dr. Hume, with special bearing on the Egyptian oil-area at Gebel Zeit. The author inclines to the view that the Egyptian oil is derived from animal matter included in the deposits of a drying Mediterranean Sea, and points out that the associated gypsum supports this theory. Major H. de Lotbinière (p. 221) shows how the clays in the Nile Valley bear up the water now introduced by irrigation into the overlying sands and the cracked clays of the surface. This rise in the water-table, discussed by Mr. Ferrar and others, is one of the newest agricultural problems that Egypt has to face.

South Africa continues to produce a wealth of geological memoirs. The Transvaal Mines Department issues an explanation of Sheets 5 and 6 of the large-scale geological map, covering the country round Zeerust and Mafeking (price 2*s*. 6*d*.). The Geological Commission of the Cape of Good Hope has allowed the use of its map to complete the Mafeking sheet drawn up by its neighbour. Messrs. Hall and Humphrey, authors of the memoir, point out the large part played by contact-metamorphism in the rocks of the Pretoria series of the Transvaal system. The Bushveld plutonic complex is held to be responsible for the widespread production of slates with biotite, cordierite, and andalusite. The gold-bearing quartz-reefs along the Malmani River near Ottoshoop are reported on, and it is suggested that work in them was abandoned when the water-level in the adjacent dolomite was reached. Hill-shading has been added to these maps, which is a great improvement. It is doubtful, however, if the rivers on a heavily coloured geological sheet should be shown in blue, since it is always important to trace out their courses at a glance. The geologists, moreover, are probably not responsible for the choice of scale, which is provokingly near 1 cm. to 1 mile, but still nearer 3 inches to 7 miles. This is a heart-rending thing to work with, whether miles or kilometres are familiar to one's mind.

Mr. A. L. Hall has written for the Transvaal Survey an important memoir on the "Pilgrims' Rest Gold Mining District" (1910, price 7*s*. 6*d*.), in which a large map of the Lydenburg and Barberton districts is inserted. The great escarpment of the Drakensberg, formed of the lowest sandstones of the Transvaal system, runs from north to south down the eastern part of the area, and the hill-shading portrays for the first time the numerous immature valleys dropping steeply from it to the broken granite lands of Barberton. The Blyde River has an interesting course, mainly on the Dolomite, past Pilgrims' Rest, within and parallel with the escarpment, catching the first waters on the dip-slope, and escaping finally over the edge by a long notch in which the granite is exposed. Its basin is clearly threatened by the recession of the great escarpment. Westward, the beds of the Pretoria series, above the Dolomite, come in, remaining almost level over broad areas, as we reach the true plateau-land of the Transvaal. The general fall of the country northward to the Olifant's River is seen, however, in the parallel courses of the streams, of which the Blyde River is the most easterly, and their valleys give a rolling character to the landscape. The important auriferous deposits of the area consist mainly of quartz-reefs lying at definite horizons in the Dolomite, with certain cross-reefs cutting across the bedding. An area for future prospecting is indicated towards the Olifant's River (p. 144). The handsome illustrations in this memoir will interest anyone who has stood on the Drakensberg edge in eastern Transvaal, and has seen the huge inland plains terminate suddenly against the highland air. Yet here, as Prof. Penck has urged, it is not necessary to invoke a fault to account for the rapid fall towards the Indian Ocean. Folding and erosion, the same processes that have given us our Chilterns and our Cotteswolds, seem alone responsible for the impressive margin of the veld.

The Geological Commission of the Colony of the Cape of Good Hope has published in 1910 Sheets 32 and 40 of the map on the scale of 1 inch to 3·75 miles. Here, again, the scale, 1 : 238,000, has a truly British and uncompromising air. Sheet 32 has Van Wyk's Vlei near its centre, where depressions occur on rocks of the Ecca series, between flat-topped kopjes. The dolerites in the Karroo system form characteristic ring-like outcrops. Sheet 40, showing the country around Marydale, includes the north-westerly stretch of the Orange River on the edge of Griqua Land West. It is a very interesting map for the student, as may be seen at once in the section at its foot. The contrast of the old schists on the west, invaded and almost eaten up by granite, with the undulating beds of the Transvaal system on the east, is only one of its many attractive features.

We cannot do justice to the numerous papers in the Transactions of the Geological Society of South Africa. Prof. Schwarz (vol. xi., 1909, p. 107) points out the interest of the occurrence of high Senonian or Danian beds (the Alexandria formation) on the south coast of Africa. Their age appears to be determined by Mr. W. D. Lang from the polyzoa only, and they seem to have been deposited near a shore. Their position implies an epoch of submergence after the elevatory movement that carried the Lower Cretaceous Uitenhage beds to a height of 4000 feet above the sea. The discussion on this paper will be found in vol. xii., 1910, p. xxxv. Dr. Rogers here points out that there may not be such a gap in the African Cretaceous as Prof. Schwarz suggests, if we regard the Pondoland beds as Senonian rather than Cenomanian. Mr. Recknagel (vol. xi., p. 83) has the advantage of describing a new field in his paper on some mineral deposits in the Rooiberg district, where tin-ore and tourmaline figure

largely. Yet even here (p. 89) certain unknown primitive miners sought tin in fairly deep diggings before the present natives occupied the country. The same author (vol. xii., 1910, p. 168) reviews all the occurrences of tin-ore in South Africa, and concludes that cassiterite in workable quantities is a product of differentiation in granitoid magmas, and that lateral secretion accounts for its concentration in certain veins.

Mr. A. L. Hall (vol. xii., p. 8) describes schistose structures in the Bushveld granite as having arisen marginally through pressure during consolidation. Mr. H. Merensky (p. 13), in a short but important paper, urges that the diamonds of Lüderitzland, in German South-West Africa, which occur in an æolian sandstone, must be derived from an underlying sandstone, which he proves to be of Cretaceous age. Mr. P. A. Wagner (vol. xiii., 1910, p. 56) shows that dykes of monchiquites, allied to kimberlite, occur in the Pomona district of this region, and in this district the largest diamonds have been found. Prof. R. B. Young, of Johannesburg (vol. xii., p. 82), supports the view that the gold of the banket conglomerate of the Rand was imported, with the pyrite, after the deposition of the beds. He believes that a heavy mineral, such as titanic iron-ore, was present as an original detrital constituent, and promoted the precipitation of auriferous pyrite. He traces a second generation of gold, distributed more irregularly than the first. He suggests that the gold was brought in by solutions arising from igneous rocks, both basic and acid, that penetrate the Witwatersrand series. The acid intrusive rocks have been described for the first time by Mr. M. Weber (*ibid.*, p. 67), who has detected gold in them. The future must show whether the gold in these igneous rocks has or has not been derived from other rocks through which they have passed in their ascent.

A question that attracts even more interest in South Africa is raised by Mr. H. S. Harger's paper (p. 139) on the occurrence of diamonds in Dwyka conglomerate and amygdaloidal lavas, and the origin of the Vaal River diamonds. Mr. Harger is a specialist in diamond-bearing pipes, and he believes that some of the material in old alluvial gravels above the Vaal River has been derived from local kimberlite. He regards, however, most of the blocks associated with the diamonds as torn from more distant masses by the ice of Permo-Carboniferous times. The gravels are, in fact, concentrates from lost patches of Dwyka conglomerate. He shows that the so-called "bantam" pebbles, commonly associated with diamond on account of their specific gravity of 3·3, are probably worn from a metamorphic rock rich in manganese-garnet, and he traces these pebbles to the Dwyka beds. He finds, moreover, diamonds in the andesitic lavas that are older than these strata, and urges that the gems originated in these lavas, and were carried thence into the conglomerate, and thence into the residual gravels. In the discussion reported on pp. lvii–lix of the Proceedings of the society for 1909–10, Mr. Harger defends his position by recording the occurrence of diamond in the Dwkya conglomerate at Windsorton. He does not, however, encourage the exploitation of this intractable and unconcentrated series. We do not seem nearer to the actual parent rocks of the diamond, which may well lie in some metamorphic zone, from which the gems became picked off into the lavas. Mr. C. Baring Horwood (vol. xiii., p. 29) publishes and discusses a number of analyses of typical Transvaal rocks, including the dolomite and its partly silicified varieties. In association with Mr. A. Wade, he has recently reviewed the whole series of "old granites" in South Africa (*Geological Magazine*, 1909, pp. 455 and 497), and concludes that there is a real fundamental granite-gneiss formation in that portion of the globe. The state of affairs, however, as he fairly enough points out, is somewhat suspiciously like that in Canada, where the fundamental series tends to become more and more visionary every year. Dr. Rogers, in his address to the South African Association for the Advancement of Science, in November, 1910, clearly differs from Mr. Horwood in regard to the African series, and points out that the oldest gneisses are igneous intrusions including flakes of sediments (Reports, Section B, p. 30).

Mr. F. P. Mennell (Quart. Journ. Geol. Soc. London, vol. lxvi., 1910, p. 353) claims the great mass of rocks in southern Rhodesia as "Laurentian"; but he is convinced that the granitoid mass which forms so large a part of the country is younger than the series of schists, banded ironstones, and limestones, and he holds that mixed rocks are important features of the contact-zones. The present writer has had the advantage of seeing some of these composite gneisses under Mr. Mennell's guidance near Bulawayo. Interesting cases of the absorption of granite by dolerite, recalling the reverse action near Carlingford in Ireland, are described on p. 372. Mr. Mennell, in referring to two Rhodesian examples of "blue ground" pipes containing diamonds, declines to connect the diamonds with the prevalence or non-prevalence of eclogite-fragments or of garnet. This is in contradiction to the view of the Vaal River diggers, as quoted by Mr. Harger in the paper already referred to, since the "bantams" on which they so much rely prove to be largely made of spessartine. Geologists may well envy the field open to Mr. Mennell, Mr. Molyneux, Mr. Zealley, and now to Mr. Maufe, who between them are attacking an area at least as large as the Transvaal. G. A. J. C.

THE AIRSHIP FOR THE BRITISH NAVY.

THE leading article in *Engineering* for February 17 gives some account of the airship for the British Navy built by the Vickers Company at Barrow. Trials were conducted on Tuesday, February 14, in presence of the Government's Advisory Committee on Aëronautics, these being analogous to the basin trials of a warship, and have proved to be quite satisfactory. The structure for accommodating the hydrogen reservoirs or balloons is 512 feet in length and 48 feet in diameter. It is in the form of a decagon in section, and the ten sides are built up of longitudinal lattice-girders, with vertical intercostal girders, the top and bottom boom in each case being formed of angles or tees of duralumin. Each bay has diagonal wire bracing. The form is whale-like, with a bluff entry, and a sweet run aft to a point, where, at the bottom, there is a big fin, increasing in depth aft according to the upward rise to the point of the stern. Aluminium was first tried, but the girder structure of this metal collapsed under stress. The metal adopted—duralumin—is one of the magnesium alloys of aluminium, and contains 91 per cent. of aluminium. It has a specific gravity between 2·77 and 2·84, a melting point of about 650° C., a yield point varying from 12 to 16 tons per square inch according to the hardness, and a breaking resistance from 22 to 29 tons per square inch. The elongation varies from 23 to 18 per cent., and the contraction of area from 34 to 26 per cent. It will thus be seen that, despite its lightness, it bears comparison with mild steel.

For more than half the length of the structure there is a bottom girder, or keel, of **V** shape, carried on the girder structure of the decagon. The bottom is flattened with spruce grating, laid inside to form a gangway, and serves as a means of communication between the two gondolas. The gondolas are connected to the central girder, and are constructed of timber of ship-shape form. Should the ship alight on water, the structure will float by reason of the buoyancy afforded by the hydrogen gas contents of the reservoirs. Both gondolas contain a typical ten-cylinder Wolseley marine petrol-motor with reversing clutch. The engine in the forward gondola has two propellers, each with two wooden blades. There is one on each side at a considerable elevation above the gondola, supported on duralumin raking girders. The engine in the after gondola drives a single two-bladed propeller abaft the gondola, with only a reversing coupling between propeller and engine.

To give lifting power, eighteen or twenty gas-bags are used, the structure for the hydrogen reservoirs being divided vertically into compartments by rope netting. The covering of the structure was the subject of experiments at the National Physical Laboratory, and, as a result, silk coated with a proofing by the Ioco process was preferred. This weighs about 100 grams per square metre, has fire-resisting qualities, and is of British manufacture. The upper half is coated with aluminium dust in order to reflect the sun's rays, while the lower half retains the yellow shade of the silk.

To enable the ship to rise or descend during flight there are three parallel horizontal planes on both port and starboard sides, forward and aft. These are comparatively small, pivoted in the centre at each side, with a vertical rod at each corner, and through these all are tilted to the desired angle by wire gear operated from either gondola. For lateral movement there are three groups of vertical rudders, one having four parallel planes above and a similar one below the main structure near to the stern, while abaft of the propeller, in the after gondola, there is a group of three rudders. Rudders, engines, and propellers were worked before the members of the advisory committee at the trials. The committee are to be congratulated, as well as Captain Sueter, who has had charge of the work on behalf of the Admiralty, and also the Vickers Company on the important stage which their unique work for the Navy has now reached.

INFANT AND CHILD MORTALITY.[1]

THE report before us is one of the most important studies of infantile mortality yet produced. Administratively, it will be of immense value, for it constitutes a first guide to the "dark areas" of England. Scientifically, it is also of value, for it brings actual administrative data to bear on a fundamental social question, namely, does the prevention of infant deaths tend to the deterioration of the race? Whatever be the final reply to this question, the work of prevention will certainly proceed as if the question had never been asked, because the impulse towards prevention is itself a fundamental impulse in modern society, and will realise itself against all hindrances.

It is, however, of immense importance to know whether, on the whole, the methods of prevention in this particular field are favourable to the rearing of a sound race or not. Survival of the fittest, however, is no longer to be imaged merely as survival of individuals of a single quality. Rather it is imaged as survival of fit groups, and the concept of the "group-person" is steadily gaining a place, not in biology alone, but also in economics. The preservation of the "group-person" implies that natural selection must be regarded as operating on the group, not on the mere individual considered abstractly. Consequently, it may well happen that, as the preservation of the group is the primary and immediate object of social organisation, the preservation of a certain proportion of relatively weak individuals may be ultimately harmless even on the most stringent interpretation of the Darwinian principle of natural selection. At all events, it is important to have the problem studied in detail, as is the case in this well-loaded document. If it turns out that the preservation of the individual does not, even in a minor degree, impair the fitness of the group, all the better.

It is this important consequence that Dr. Newsholme's investigation, so far as it goes, tends to establish by actual facts. The administrative results we may leave alone. One of the primary intentions of the report was "to determine, on the basis of our national statistics, whether reduction of infant mortality implies any untoward influence on the health of the survivors to later years" (p. 1). The figures of a single year, 1908, are taken and carefully analysed. The counties of high infantile mortality are compared in sufficient detail with the counties of low infantile mortality. Infantile mortality is compared and correlated with the mortality at later ages—age one to two, two to three, three to four, and four to five, and even at age-groups five to ten, ten to fifteen, fifteen to twenty. In this way, data variously presented are obtained for testing the influence that the infantile mortality has on the mortality of the survivors, even up to adult ages.

"This comparison is important, because attempts to reduce infant mortality are regarded by many as an interference with natural selection, which must be inimical to the average health of those surviving. According to this school of thought" (we think Dr. Newsholme too generous, if he is not ironical, in dignifying those somewhat casual theorists by the name of "school"), "efforts to save infant life merely prevent the weeding out of the unfit, and ensure the survival of an excessive proportion of weaklings" (p. 9). The results of the "correlations" are startling, though some of them may equally be come at by general reasoning. However we turn the figures, it remains true that "a high infant death-rate in a given community implies, in general, a high death-rate in the next four years of life, while low death-rates at both age-periods are similarly associated" (p. 13). Thus of the eight administrative counties with highest infant death-rates, the infant death-rate was 139·1 per 1000 births, and the death-rate at age one to five was 69·2, while in the eight administrative counties with lowest infant death-rate, the corresponding figures were 77·9 and 32·6.

This relationship is found also in the comparisons of the individual counties. But the correlations reveal the further fact that at the later ages the same general relation is true. "Speaking generally, it will be seen that the eight counties having a high infant mortality also had a relatively high death-rate of males during each of the four first lustra of life, and the eight counties having a low infant mortality had also a relatively low mortality at ages 0–5 and 5–10, and to a diminishing extent at 10–15 and 15–20" (p. 16). Probably at the later ages other special influences, such as migration, complicate the issue.

The problem of the "selective influence" is analysed and estimated in greater detail in a special section by Mr. Udny Yule, whose general conclusion, from somewhat inadequate data, is "that there is little definite evidence of such selection beyond the second year of life, and that after the third year the environmental influences even of infancy alone appear to preponderate over any possible selective influence" (p. 78). There is no space even to indicate the wealth of fact that goes to the discussion of the causes of infant mortality. The broad conclusion is that no effort should be spared to reduce the mortality of infants and to remove all removable causes of death. Philanthropic impulse is thus reinforced by scientific analysis of the facts. This report will be followed next year by a similar study of infant mortality in the large towns. Dr. Newsholme is to be congratulated on his admirable combination of scientific analysis with practical administration.

[1] Supplement to the Thirty-ninth Annual Report of the Local Government Board, 1909–10. By Dr. Arthur Newsholme, Medical Officer to the Board. (London: Wyman and Sons, Ltd., 1910.) Price 1*s*. 3*d*.

FIXATION OF ATMOSPHERIC NITROGEN.

SINCE the work of Lord Rayleigh in 1894, when he repeated the experiments of Cavendish with improved apparatus and more modern methods, continual progress has been made in connection with the oxidation of atmospheric nitrogen. Rayleigh's experiments, carried out on a large laboratory scale, showed the feasibility of obtaining nitric acid or nitrates from the atmosphere, and, given cheap power and appropriate appliances, the possibility of it being done on a paying commercial scale.

The pioneering work which followed for a long time spelt—commercially—failure. But as first one idea and then another was shown to be unsatisfactory, and had to be discarded, knowledge increased, as is always the case with research, and in 1903 Birkeland and Eyde designed and erected a plant which, at any rate, in part solved the problem. In a lecture delivered before the German Association of Naturalists and Physicians in September last, Prof. J. Zenneck takes up the subject at that stage, and reviews this process and others which have since been devised (Leipzig: S. Hirzel, 1911). The lecture was evidently delivered to a popular audience, because Prof. Zenneck describes and illustrates the processes in a way which will interest and instruct those who may have very little knowledge of chemistry. For example, by means of a model, he showed how in the Notodden process of Birkeland and Eyde the air is driven by means of a compressor through the furnace containing the disc-shaped arc, then how gases are partially cooled and the heat given up is used for the generation of steam and for evaporating the liquors. We believe, indeed, that coal is not required in the works at all for heating purposes. The Notodden plant, however, is so well known that it will be superfluous to describe it further, except to mention that very good diagrams and pictures of the works are included in the printed lecture.

Prof. Zenneck then describes the Pauling process. It is a well-known fact that vigorous blowing will put out the electric arc, consequently it is not an easy matter to blow air through an arc so that the nitrogen may become oxidised without blowing out the arc. In the process of Pauling, air is blown through an arc. The arc, however, is struck between horn-shaped conductors, such as are used as lightning arrestors. The two horns are closest together near the bottom, and it is here that the arc is struck. Owing to the ascending hot air, the arc rises upwards, and is broken once for each period of the alternating current. A new arc, however, is immediately produced again at the bottom, and this goes on continuously. An air current is also driven at high speed through the electrodes, and this further elongates the flames, so that an arc of very considerable length is produced. This process is now in successful operation in Switzerland and the south of France.

Special attention is given to the interesting process of the Badische Anilin- und Sodafabrik. This particular process was illustrated experimentally at the International Congress of Chemistry held in London in May, 1909. An arc is caused to form throughout a long tube, and the air is blown in tangentially. In practice, arcs of 8 metres long are employed.

Which of these three processes will best stand the test of time remains to be seen. The *sine qua non* in all cases is, however, cheap power. In structional details each plant is being continually improved, and at present each of these processes is being commercially worked. The Paulin process is, we believe, very well adapted for the manufacture of concentrated nitric acid, which is so important in the manufacture of explosives, and if sufficiently cheap may readily be converted into a fertiliser. The other two processes are certainly well adapted for the manufacture of fertilisers, and there is no inherent reason why nitric acid should not also be produced in all cases.

F. M. P.

BIRD NOTES.

IN a lecture on the birds of Victoria delivered to the local Field Naturalists' Club in September, 1910, and published in vol. xxvii., No. 8, of the *Victorian Naturalist*, Mr. J. A. Leach directed attention to the extraordinary, and apparently unique, richness of Australia in birds. Not only, he remarks, has the country its own peculiar types of interesting birds such as emeus, malleebirds, black swan, laughing jackass, cockatoos, many parrots, lyre-birds, bower-birds, &c. (some of these being common to New Guinea), but it likewise contains representatives of every widely spread family of birds with the exception of vultures and woodpeckers.

To vol. vi., No. 2, of the Journal of the South African Ornithologists' Union Messrs. Bucknill and Grönvold contribute a paper on the eggs of certain South African birds, which, for the most part, have not been previously described or figured, the paper being illustrated by an exquisite coloured plate. The largest egg figured is that of the African hawk-eagle (*Eutolmaëtus spilogaster*), one of a pair taken in Matabeleland in 1904, and now in the Transvaal Museum. Perhaps the most interesting of all is the egg of *Poliohierax semitorquatus*, which, in its uniform whiteness, corresponds with those of the nearly related Indo-Malay falconets (Microhierax). In 1902, when the second volume of the "Catalogue of Birds' Eggs" was published, the British Museum possessed one clutch of eggs of Microhierax, but none of the allied African genus.

The third part of vol. x. of the *Emu* (December, 1910) contains a report of the tenth annual session of the Royal Australian Ornithologists' Union, held at Brisbane in October. Special attention was directed to the need for protecting Australian birds, and it was decided to request the Government of Tasmania to take action for protecting the penguins on the Macquarie Islands. Mention was made of the founding of a Gould League for the purpose of encouraging a love of birds among the rising generation. At one of the meetings the State Governor, Sir William Macgregor, expressed himself in favour of bird-protection, but had doubts as to the feasibility of its enforcement. His Excellency stated as an example of this difficulty that when in British New Guinea he passed laws for the protection of birds-of-paradise, and that these were nearly fatal to the red species. For during his absence a visitor asked permission to obtain one or two specimens for scientific purposes, and, having obtained it, straightway proceeded to shoot all that were obtainable, so that when the Governor, on his return, visited Ferguson Island he found not a single full-plumaged bird of this species remaining.

Country Life of January 1 contains two life-size illustrations of the newly named Irish coaltit, placed alongside those of its British representative, with descriptive notes by Mr. W. R. Ogilvie-Grant. The Irish bird is characterised by the light patches on the sides of the head and neck, as well as the occipital spot, being pale mustard-yellow, instead of white; the back olive-grey washed with yellowish cinnamon, in place of olive-grey; the upper tail-coverts cinnamon, in marked contrast with the rest of the upper parts, instead of brownish-fawn, not decidedly different from the back; the breast and belly whitish, washed with mustard-yellow, in place of whitish or greyish-white; and the sides and flanks cinnamon, instead of fawn. In freshly killed examples the mustard-yellow is bright and conspicuous, but fades a few days after death. The British coaltit, which Mr. Grant regards as a subspecies (*Parus ater britannicus*), occurs in County Down, a fact, in his opinion, affording additional evidence in favour of regarding the Irish bird (*P. hibernicus*) as a separate species.

Considerable discussion, reported in various issues of the *Field*, has taken place at the British Ornithologists' Club with regard to white-breasted British cormorants. While some ornithologists regard all such birds as immature, others maintain that certain examples are much older, and consider that one particular skin belonged to a bird of from twelve to fifteen months old. It was also suggested that white-breasted birds appeared sporadically in certain colonies, where they might become the dominating type.

Notes on the peregrine falcon in the Midlands and on the habits of the crested grebe are contributed to the January number of the *Zoologist* by Mr. O. V. Aplin. The former species, it appears, is still a regular visitor to the southern Midland counties, but the birds seen there in autumn are, in most instances at any rate, immature.

Of a very different character from all the foregoing is a paper by Mr. H. C. Tracy, issued in the Zoological Publications of the University of California, on the significance of white markings in passerine birds. The object of the inquiry on this subject undertaken by the author was to endeavour to reconcile the old theory that white markings in birds are recognition-signs, with the newer, and apparently contradictory, hypothesis that they are for protective purposes. The result, in Mr. Tracy's opinion, is that both theories are perfectly true and mutually supplement one another. Markings which are displayed only or chiefly when the birds are in flight, such as the white area at the base of the tail-feathers common to many terrestrial birds—as in our own wheatear—are recognition-marks, and it is noticeable that these are specially developed in gregarious groups. On the other hand, in the case of arboreal species, white markings at the base of the flight feathers, which become specially conspicuous when their owners are in flight, appear to serve for protection and for recognition. The author took, for instance, specimens of the green-backed goldfinch (*Astragalinus psaltria*) and black-headed grosbeak (*Zamelodia melanocephala*), in which these particular markings are well developed, and, after spreading the wings, "photographed them against sunlit foliage and backgrounds of leaves with spaces of sky showing through. The birds were difficult to find in the resulting prints. Undoubtedly the photographs, by their lack of relief, exaggerated the concealing effect; yet that there is such an effect, in general, it is safe to admit." Later on, it is added that when the bird takes wing, a different principle comes into play, and, as there is no broken background, the markings stand out conspicuously. "When we consider," continues the author, "the value to all birds ranging in the open foliage of instant recognition at a distance and sight-clues for the purpose of keep-

ing together, we shall not easily believe that wing and tail white are solely features of concealing coloration. Their revealing function during flight is entirely in harmony with their concealing functions when at rest."

In conclusion, brief reference may be made to the paper by Mr. E. A. Wilson, field-observer to the Grouse-disease Inquiry Committee, in the Zoological Society's Proceedings for December, 1910, on the changes of the plumage in the grouse, a communication specially noteworthy on account of the excellence and beauty of the numerous coloured plates by which it is illustrated. R. L.

THE AUSTRALASIAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

THIS year's meeting of the Australasian Association for the Advancement of Science was held at the University of Sydney on January 9–14, under the presidency of Prof. Orme Masson, F.R.S., professor of chemistry in the University of Melbourne.

The work of the meeting was divided among eleven main sections, each with its own president, vice-president, and secretary. The following is a list of sections with the name of the presidents and the subjects of their addresses, when these are stated in the official circulars which have been received.

Section A, Astronomy, Mathematics, and Physics: Prof. T. H. Laby, professor of physics in Victoria College, Wellington, N.Z. Section B, Chemistry, Metallurgy, and Mineralogy: Prof. B. D. Steele, professor of chemistry in the University of Queensland, Brisbane, who in his address dealt with inorganic solvents. Section C, Geology: Prof. P. Marshall, professor of geology in the University of Otago, Dunedin, N.Z., whose address was on the western margin of the Pacific basin. Section D, Biology: Mr. F. M. Bailey, Government botanist at Brisbane. Section E, Geography and History: Prof. G. C. Henderson, professor of history in the University of Adelaide, whose address discussed colonial historical research. Section F, Anthroplogy and Philology: Mr. Edward Tregear. Section G, (1) Social and Statistical Science: Mr. E. W. H. Fowles, the subject of whose address was unemployment. Section G, (2) Agriculture: Prof. W. Angus, late director of agriculture in Adelaide. Section H, Engineering and Architecture: Mr. Ellwood Mead, who was unable to attend the meeting, and instead of a presidential address, Prof. W. H. Warren, of the University of Sydney, delivered a lecture on irrigation in India. Section I, Sanitary Science and Hygiene: Dr. W. Perrin Norris, Commonwealth Director of Quarantine, Melbourne, who took for his subject public health ideals. Section J, Mental Science and Education: the Rev. E. H. Sugden, whose address dealt with the place of music in education

During the meeting Prof. P. Marshall delivered a popular lecture in the great hall of the University on glaciers of the southern Alps; Dr. Mawson, of Adelaide, lectured on "Antarctica," with special reference to his forthcoming expedition; and Prof. T. H. Laby exhibited a working model of Brennan's mono-rail. Numerous social functions were arranged, including a garden-party to members of the association, given by Lord Chelmsford.

There are several committees of the association which are to continue to exist during the present year. Among these may be mentioned the Solar Eclipse 1910 Committee, appointed at Brisbane in 1909. In connection with the work of this committee, the local Council of New South Wales passed the following resolution:—"That the committee appointed at the Brisbane meeting in 1909 in connection with the solar eclipse of 1910 be asked to make such arrangements as may be necessary before the meeting of the association in January for the observation of the total solar eclipse of 1911 by Australian and other astronomers, and report to the meeting." It was announced during the meeting that the Federal Government had granted 500*l.* in aid of the solar eclipse expedition of this year. Other existing committees are those on solar research, terrestrial magnetism in Australia, seismology, alkaline rocks of Australia, glacial phenomena, geological and geo-physical phenomena, deep-sea dredging off the east coast of Australia, New Zealand food-fishes, and the biological and hydrographical study of the New Zealand coast.

RECENT ADVANCES AND PROBLEMS IN CHEMISTRY.

THE subjoined lecture was delivered by Prof. Emil Fischer, of the University of Berlin, on the occasion of the inauguration of the Kaiser-Wilhelm-Gesellschaft zur Förderung der Wissenschaften, in the presence of the German Emperor, on January 11, in the Ministry of Education at Berlin.

Prof. Fischer traces the relations between science and scientific industries in Germany, pointing out that by affording facilities for the prosecution of pure scientific research, technical industry can only gain.

If only this fact were practically realised in this country as it is in Germany, we should be spared the humiliation of seeing important technical branches of commerce, such as chemical industry, transferred soon after their initiation from England to the Continent.

Prof. Fischer in his address deals fully with this subject from the German point of view, so that it is unnecessary to refer to it here in detail; the remedy, however, lies entirely with the powers that be.

Your Majesty; Gentlemen,

At the present time, more than at any other period, we are inclined critically to examine the fundamental principles of all branches of knowledge, and, when necessary, to introduce far-reaching alterations in our original conclusions. This state of mind applies also to the natural sciences. During the last decades our actual knowledge has been extended to an extraordinary degree owing to new methods of research, and in view of the more recent observations the older theories have proved in many cases to be far too narrow. Even the fundamental principles of our knowledge appear, to a certain extent, to demand revision.

Thus the progress in physical science forces us to adopt views which are incompatible with the older principles of mechanics, in spite of the fact that these were regarded as unassailable by thinkers such as Hermann von Helmholtz, Heinrich Hertz, and Lord Kelvin.

We stand in the same position with respect to the elements in chemistry. Owing to the discovery of radium and similar bodies, we have been forced to the conclusion that chemical elements are not unalterable, and hence that their atoms are not indivisible.

The same state of affairs obtains to even a greater degree in the biological sciences. In comparative anatomy, animal and vegetable physiology, theory of evolution, microbiology, and almost all branches of medical science, the rapid advance of experimental knowledge is accompanied by an equally rapid change in established theories. Even the semi-historical sciences, such as geology, palæontology, anthropology, and the venerable science of astronomy, are taking active part in the general progress.

Thus in these times of general scientific activity is founded the Kaiser-Wilhelm-Gesellschaft zur Förderung der Wissenschaften, the primary object of which is the erection and maintenance of institutions of research.

It need scarcely be said that we scientific investigators welcome this new and highly specialised creation with intense satisfaction, and I regard it as a particular honour to be permitted to be the first to give expression of our profound gratitude.

No one will be able to assert that experimental research in Germany has been neglected; exactly the opposite conclusions must be drawn on contemplating the history of science during the nineteenth century. This displays a long series of brilliant scientific discoveries made in this country. The industries closely connected with science, such as the chemical and electrotechnical industries, fine mechanical engineering, production of metals, industries connected with fermentation, and last, but not least, agriculture, have also undergone in our hands a development envied on almost all sides by other nations.

Should a criterion of the results of experimental research be desired, this may perhaps be found in the distribution of the Nobel prizes, which are awarded by absolutely independent corporations in Sweden.

Only a month ago the Nobel prize for chemistry came

for the sixth time to Germany; this constitutes 60 per cent. of all the Nobel prizes hitherto awarded for chemistry. During the same period of time two and a half prizes were awarded to Germans for physics and three and a half for medicine. Dr. Alfred Nobel, unfortunately, did not provide for the remaining natural sciences.

The majority of the investigations distinguished by the award of these prizes, however, belong to the nineteenth century. Since that time matters are to some extent altered. It is well known that the greater number of German scientific investigators are teachers at universities or polytechnics. During the last ten years a scheme of practical education of the masses has developed, which affords to all students the possibility of acquiring a thorough training in experimental science, and which provides our industries with an army of scientifically educated workers. But this very education of the masses tends mentally to exhaust the teacher to a great extent, certainly to a higher degree than is desirable, or indeed compatible, with the creative power of the investigator.

There prevails in modern educational laboratories a condition of overstrained activity comparable with that existing in all but the smallest factories and commercial offices, and in the harassing cares of the day the teacher loses far too readily that peace of mind and broad view of scientific matters necessary for tackling the larger problems of research. This danger has been most keenly appreciated by teachers of chemistry, to which body I myself belong. It is therefore no mere accident that in our circles of recent years the cry for new laboratories should be at its loudest; an appeal for laboratories which should permit of research in absolute tranquillity, unencumbered by the duties of teaching.

But all our efforts were fruitless, in spite of the active support of an industry ready to make any sacrifice, and we were about to abandon, with reluctance and with sadness, our cherished plan, when the action of your Majesty in directing the attention of all munificent ladies and gentlemen in Germany to the need of supporting scientific research came to us like a heaven-sent aid.

In place of the one State-supported chemical institute which we had planned, chemists may now anticipate the immediate possession of two such institutes in which gifted men may conduct their original researches with ample means in freedom from any other duties. It is anticipated that the younger generation of chemists will thereby derive special benefit. By the younger generation I mean in particular those men who are at present acting as assistants or lecturers in university laboratories, and who can carry on research in addition to the servile labour of teaching only by possession of an extraordinary capacity for work.

That which applies to chemistry may, *mutatis mutandis*, be applied to the other sciences, and is especially applicable to new branches of knowledge, for the prosecution of which the laborious organisation of educational laboratories leaves no possibility.

The handicap under which we work, in comparison with other nations, in particular the United States of America, in which similar institutes have recently been founded, can thus be removed. If the hopes which we all place in the new institutes are fulfilled, Germany will in the future not lack recipients of Nobel prizes, and we may then hope to maintain the honourable position which we hitherto have held in the domain of science.

That this is, however, not only a matter of sentiment and honour, but a palpable advantage in material respects, is at once evident from the close relation between modern scientific progress and national well-being. I am not here to demonstrate this relation by means of statistics or political economical considerations. On the contrary, I would invite your attention to a cursory review of my own science. I shall thus, in considering the most recent achievements in this field, be able to point out to you the diversity of the problems and their fertility with regard to the most varying branches of technical industry.

As I have already remarked, our conception of the nature of chemical elements has to some extent altered owing to the discovery of radium, the first element to be discovered by a woman. We are now acquainted with more than twenty-four such substances—the so-called radio-active elements—and we recognise that they disintegrate spontaneously, and that elementary transmutations are hence possible.

Germany took at the outset only a small part in the notable researches connected with the discovery of these elements, although the first stimulus leading to the discovery of radio-activity was given by the Röntgen rays. The reason for this is that Germany possesses none of the raw materials necessary for the production of radium, and that the majority of German investigators have not the means for the purchase of this costly element. This lack of means was especially keenly felt when radium first found profitable application in the fields of medicine.

We are therefore all the more delighted to record such an event as the recent discovery due to Prof. Otto Hahn of the chemical laboratory of the University of Berlin.[1] He has for several years been investigating the disintegration products of thorium, which is employed in large quantities in the manufacture of incandescent mantles, and has in the course of his work discovered several radio-active elements, the most important of which he has designated mesothorium. He has, moreover, succeeded in devising a process for the isolation of this substance from the valueless waste products occurring in the manufacture of thorium. I am therefore able to show to you a specimen of Hahn's preparation. This is the bromide of mesothorium, a white salt, which evolves the same highly penetrating rays as the corresponding salt of radium. In radio-active power this preparation is equivalent to 100 milligrams of pure radium bromide, but costs only one-third as much. Nevertheless, it is not cheap, since for this small quantity of material 550*l.* was paid. Thanks to an endowment from Dr. von Böttinger, of Elberfeld, the Akademie der Wissenschaften in this city will in a few months be in possession of 250 milligrams of this substance, and lend it out to German investigators. It would be possible yearly to produce in Germany a quantity of this preparation of Dr. Hahn's equivalent to more than 10 grams of pure radium bromide from the valueless residues after the extraction of the thorium. This is approximately equivalent to the world's stock of radium. By this discovery, the radium famine hitherto prevalent in Germany may be said to be relieved.

The field of chemical experimentation has in the last decade been widened to an extraordinary degree by the ease with which it is possible to obtain very high and very low temperatures. High temperatures can now be obtained by means of electric furnaces with which temperatures up to 3000° are easily produced. Low temperatures may be obtained by means of liquid air. This commodity can now be purchased in Berlin at the price of a wine of medium quality, that is to say, at 1*s.* 9*d.* per litre. For this we are indebted to your Majesty, who invited Prof. von Linde, of Munich, to erect here one of his large machines for the liquefaction of air.[2] You will understand how indispensable this liquid has become when I tell you that in the laboratories of the University of Berlin several litres are daily consumed for scientific purposes.

Far more effective is liquid hydrogen, which affords a temperature lying 60° below that of liquid air. The boiling point is so low as −252·6°, only 20·4° above the absolute zero. It cannot, however, yet be purchased in Berlin; in fact, it cannot be obtained here at all. I am nevertheless able to show it to you. This preparation comes from the physical laboratory of the University of Leipzig, where it was prepared this morning and transported here with some care. I will now transfer a small quantity from the oddly shaped container into a transparent glass vessel, and demonstrate the lowness of its temperature by immersing in it a glass tube sealed at the bottom. On removing the tube it is seen to be filled with a white solid resembling snow; this is solid air; you will see that, when once removed from the cooling liquid, this solid melts after a few moments.

The remainder of the liquid hydrogen in the containing vessel is to serve to-day for scientific purposes. At the end of my lecture it will find its way to the physical

[1] Dr. Hahn made the discovery of mesothorium in the laboratory of University College, London, while investigating some thorianite residues given to him by Sir William Ramsay.—Tr.

[2] A similar apparatus was independently devised and simultaneously patented by Dr. William Hampson in London.—Tr.

chemical laboratory of the University, there to be employed this evening and during the night by Prof. Nernst for his important researches on the specific heat of the elements at temperatures in the vicinity of the absolute zero.

When the Kaiser-Wilhelm Institutes for Chemistry are once in full swing, we shall, I hope, no longer be obliged to travel to Leipzig every time we want some liquid hydrogen.

Liquid hydrogen was prepared for the first time about twelve years ago by Prof. Dewar in the famous laboratory at the Royal Institution in London. But the costly experiments necessary for its production were rendered possible only by the liberal means which Dr. Ludwig Mond, the great benefactor of chemistry, placed at his disposal. Dr. Mond, moreover, has not forgotten his German Fatherland and German science. He bequeathed to the University of Heidelberg, where he had studied, the sum of 50,000*l.* for chemical and physical research, and several years ago he endowed the State-supported chemical institute which we had planned with the sum of 10,000*l.*

Inorganic chemistry, in which, thirty years ago, advance was scarcely considered possible, has, owing to the new aids to research—as, for example, high temperatures and powerful electric currents, &c.—undergone absolutely unexpected developments. I will merely give you some idea of this development by indicating a few processes of technical importance, beginning with the attempts to prepare valuable nitrogenous compounds from the nitrogen of the atmosphere.

The direct production of nitric acid from air [1] by means of a powerful electric discharge has reached the stage of large-scale manufacture. In Norway at the present moment a gigantic works, by the side of a mighty waterfall, is in course of erection by German factories in conjunction with Norwegian engineers, and supported by German and French capital.

Synthetical saltpetre is already on the market, and German dye factories derive a considerable portion of the nitrites necessary for their work from the same source.

The strikingly original process devised by Prof. A. Frank and Dr. N. Caro in Charlottenburg for the preparation of calcium cyanamide from calcium carbide and atmospheric nitrogen, came somewhat earlier into practice.

And now a third process, based upon the direct combination of atmospheric nitrogen with hydrogen to form ammonia, has been announced. Prof. Haber, of Karlsruhe, by means of an ingenious application of the laws of physical chemistry, has succeeded in obviating the difficulties which hitherto have rendered this synthesis impracticable. The well-known Badische Anilin- und Sodafabrik at Ludwigshafen-am-Rhein has taken over his patents and technically perfected the process to such a degree that synthetical ammonia will in all probability shortly be placed on the market.

The greater the number of such processes and the keener the competition which they excite, the greater is the benefit to the consumer. In the case I have just mentioned, this has an especial significance, as the bulk of technical nitrogenous substances are employed in agriculture for artificial manures.

In the opinion of high authorities, German agriculture could easily consume twice, nay thrice, the amount of nitrogenous material at present employed for this purpose, were only the price to fall to a corresponding degree. In such a case it is possible that the crops would increase to such an extent that Germany could be independent of foreign countries with respect to agricultural produce. A task of great national importance has thus been set to chemical industry.

This last process, the synthesis of ammonia, possesses the advantage that no electricity, merely heat, is involved. In other words, all that is necessary is fuel, a commodity of which Germany has ample store. Furthermore, it is to be noted that the cost of production depends only on the price of hydrogen, which, together with the inexpensive atmospheric nitrogen, serves as raw material. The problem of producing hydrogen at a moderate cost has already been solved by chemical industry, owing to the great interest recently taken in airships. In this way, the truth of the old saying is established—that all industries affect one another, and that improvements in one field may occasion fertile results in totally remote spheres of activity.

Such a relation of mutual stimulus obtains also between theoretical chemistry and the production of metals. The production of gold, silver, and copper has gained in simplicity to an extraordinary degree by the introduction of electrochemical methods. The study, moreover, of alloys, and the perfecting of inexpensive methods of preparing metals hitherto obtainable only with difficulty, such as chromium, tungsten, manganese, vanadium, and tantalum, has been of immense benefit to the steel and electrotechnical industries.

Not to omit the latest productions of these industries, I here show you a new sort of iron, the so-called "electrolytic iron." This is prepared by the Langbein-Pfannhauser factory in Leipzig by a process devised by Prof. Franz Fischer in the laboratories of the University of Berlin, in which process the iron is deposited from a solution of an iron salt by an electric current. You see it before you in the form of extremely tough plates, reaching a thickness of 5 mm., which may readily be rolled or drawn into wire. The bright surface is not due to any polishing, the metal being detached in this state from the electrode. Here you see a seamless iron tube coiled in serpentine fashion, which was deposited in the same way upon a leaden core.

This iron is distinguished from all other commercial varieties of iron by its extraordinary purity, in consequence of which it possesses distinctive physical properties. In particular, it is much more readily magnetised, and loses its magnetism far more rapidly than other kinds of iron, this property rendering it especially suitable for electromagnets. This electromotor before you, of ordinary design, formerly developed 0·5 horse-power, but on replacing the original electromagnets by those constructed of electrolytic iron, the efficiency has risen to 1·25 horse-power. This new iron should therefore be of the greatest importance in the construction of electromotors.

Our present-day material civilisation is to a great extent founded on the rapid utilisation of the fossilised combustibles anthracite and brown coal. But posterity will not fail to reproach us with having grievously squandered this valuable material, for in the conversion of the heat of combustion of coal into energy in the ordinary way by means of steam engines, more than 85 per cent. of the work potentially contained in the coal is lost. This loss, however, may be appreciably lessened by suitable chemical treatment of the coal. If the coal be first converted into combustible gas—so-called power gas—and this then consumed in a gas engine, the output of useful power is treble that developed in a steam engine. Valuable bye-products—ammonia and tar—can, moreover, be recovered, and, indeed, the methods hitherto employed for the production of power gas are in many respects capable of improvement. I therefore deem it possible that at some time special institutes will be founded in the centres of the coal districts—perhaps under the auspices of the Kaiser-Wilhelm-Gesellschaft—where these important problems can be investigated with the aid of all the methods known to science.

Fossilised combustibles, which owe their origin to the vegetable kingdom, form a connecting link between mineral and organic substances. Organic chemistry surpasses inorganic chemistry in variety of methods and products to the highest degree. Small wonder, for it embraces all those complicated chemical bodies which occur in animal and vegetable life. The number of organic substances accurately investigated may to-day be estimated at the huge figure of 150,000, and every year eight or nine thousand more are added to the list. We may therefore reckon that at the close of this century organic chemistry will comprise the entire gamut of substances found in the animal and vegetable kingdoms.

This rapid increase is wholly due to organic synthesis. From the few elements occurring in organic chemistry, of which carbon predominates, all these compounds are built up, much as an architect produces the most diverse edifices from the same form of brick.

Synthesis in organic chemistry is an offspring of Berlin. It was born eighty-two years ago in the Niederwallstrasse by the synthetical production of urea by Friedrich Wöhler. It has, moreover, found its greatest field of

[1] First carried out on a moderately large scale by Lord Rayleigh (Trans. Chem. Soc., 1897, lxxi., 181).—Tr.

activity in Germany. It stands no longer in fear and trembling of the complicated constituents of the living organism. I shall demonstrate this fact by discussing the three classes of substance predominating in organic life: the fats, the carbohydrates, and the proteins. The synthesis of fats was effected so far back as two generations ago by M. Berthelot in Paris. The first synthetical carbohydrates—grape sugar, fruit sugar, &c.—saw the light twenty years ago in Würzburg; and the methods for the synthetical building up of albuminous substances have been worked out during the last ten years in the laboratory of the University of this city. I am therefore able to show you one of these products. It is the most complicated substance ever evolved by synthesis, and has so long a name that I do not venture to pronounce it here. The amount is certainly small, and, as you will perceive later, the beakers and flasks of the scientific investigator are minute when compared with the vats employed by the chemical manufacturer. This relative difference in size is also borne out by the comparative wealth of these two classes of men. This synthetical protein, like the preparation of Dr. Hahn, is anything but cheap. The starting materials for its synthesis cost about 50*l*., and the labour involved in its preparation must be estimated at even a higher figure. It has therefore not as yet made its appearance on the dining-table. It is, in fact, nothing but a chemical curiosity. But you must bear in mind that what is to-day a curiosity may to-morrow be of the greatest value. Chemistry affords numberless illustrations of this statement.

Through such things as these proteins, carbohydrates, and fats, organic chemistry is brought into close touch with the biological sciences; for the entire metabolism in the living organism is merely a sequence of chemical transformations which these substances undergo. Chemistry is thus called upon to partake in the solution of the great riddles of life: nourishment, growth, reproduction, heredity, age, and the manifold pathological disturbances of the normal state. It is not surprising that the keenest activity exists in these interesting fields of work, and we may safely hope that provision will be made for biological research in the new Kaiser-Wilhelm institutes.

The example given by the magnificent institute here in Berlin for the study of the problems of the industries connected with fermentation, in which the results of scientific research meet the practical requirements of brewers and distillers, serves to show how fruitful can be the collaboration of biologists and chemists. This institute has contributed its share to the small exhibition here this evening by a series of beautiful mould cultures and yeast preparations.

Moreover, chemical and many other industries have derived great benefit from organic chemistry. A few examples from recent times will illustrate this fact.

The most widely distributed of all the carbohydrates is cellulose, of which cotton and linen are entirely composed, and which is the chief constituent of wood and plant fibres. And what a variety of articles is nowadays manufactured from cellulose! Paper, collodion, celluloid, photographic films, smokeless powder, artificial silk, artificial hair, artificial leather.

Paper, in this era of paper, is not a substance which justifies its exhibition here; the same may be said of celluloid and collodion. I have not brought here samples of smokeless powder and the other high explosives derived from cellulose, as the Ministry of Education seems a place far too peaceful for their exhibition. But you see before you artificial silk and horse-hair and films in diverse and magnificent array. These come from the works of Fürst Guido von Donnersmarck; and not to omit mention of his competitors, I here show you some photographic films, manufactured by the Berlin Anilinfabrik, which, unlike the ordinary variety, burn only with the greatest difficulty. All these products have been prepared by ingenious combinations of chemical and mechanical processes. To dispel any false impression, I must tell you that artificial silk and hair, in spite of their striking similarity, are of totally different composition from the natural products, which are not derived from cellulose, but belong to the class of proteins.

The magnificent colours[1] with which these artificial textures are so beautifully dyed are, of course, the work of organic chemistry. These belong to the family of synthetical coal-tar dyes. This subject is to-day so large that complete half-yearly courses of lectures are delivered upon it at the universities. Hundreds of such dyes are on the market, and the value of the dyestuffs produced in Germany, the majority of which are exported, approximates to fifteen millions of pounds sterling.

Of all these dyes I shall only mention synthetical indigo, because this substance was the most difficult of all to synthesise, and on the other hand was a great commercial success. This beautiful crystalline preparation, purified by sublimation, hails from the Badische Anilin- und Sodafabrik. It is also manufactured by the dye factory at Höchst-am-Main.

This synthetical product is not only much purer in composition and colour than the natural dyestuff, but also considerably less expensive. On this account, the cultivation of the indigo plant in India has diminished to one-sixth of the original extent, and will, to all appearances, soon disappear altogether.[1] Woollen and cotton goods are now dyed with German indigo even in Asia, to which continent a quantity of indigo worth no less than 1,900,000*l*. was exported in the year 1909.

While on this subject, I may refer to the two most important colouring matters of animal and vegetable life, chlorophyll and hæmoglobin. The former plays an important part in the chemical process upon which all life depends—I refer to the conversion of the atmospheric carbon dioxide into sugar, which takes place in green leaves under the influence of sunlight. The red pigment in the blood fulfils in our own bodies the important function of transporting the oxygen from our lungs to the tissues, thus rendering possible that process of combustion which forms the basis of our bodily and mental strength.

I here show to you two specimens of pure chlorophyll, one of which is crystalline. I owe these rare preparations to Prof. R. Willstätter, of Zürich, who of recent years has been studying this colouring matter with remarkably successful results. Hæmoglobin has also lately been thoroughly investigated in Stuttgart and in Munich, and the remarkable conclusion has been drawn from these investigations that chlorophyll and hæmoglobin are closely related. This fact thus denotes a species of consanguinity between the animal and vegetable kingdoms. This must, however, be of great antiquity—that is to say, to date from remote times, when the animal and vegetable kingdoms were as yet not distinct.

Of greater commercial importance than the coal-tar dyes is indiarubber. Its consumption is continually increasing, and is estimated at some 70,000 tons yearly, an amount corresponding in price to about thirty-five millions of pounds. You can therefore readily understand that this subject has attracted the attention of synthetic chemists, and for the last nine months one has heard, even in public, of attempts to prepare synthetical indiarubber. In fact, in August, 1909, Dr. F. Hofmann and Dr. C. Coutelle, chemists to the Elberfelder Farbenfabrik, succeeded in devising a practical process for its synthesis. The starting material is a volatile, mobile, and colourless liquid termed isoprene,[2] which in turn can be readily synthesised from even simpler substances.

This liquid is converted into indiarubber merely on heating in closed vessels. Here you see a sealed glass tube which was originally filled with this mobile liquid isoprene, but now, after heating, contains a jelly-like mass of synthetical indiarubber. When thus prepared on a large scale, it is somewhat denser and of a light yellow colour, as you see from this preparation. That this product is really indiarubber has been definitely established by the scientific investigations of Prof. Harries in Kiel, a high authority on this subject, who has since independently devised another process for the same purpose.

When synthetic chemistry has once taken possession of such a field, it is not confined to the particular product

[1] The first, "mauvine," was prepared by the late Sir William Perkin in the year 1856 and manufactured at Greenford.—Tr.

[1] The recent work of Bloxam and his collaborators has demonstrated the possibility of recovering from the leaf a yield of indigo increased to such a degree that the cost of production is certainly no more than that of the synthetical product. Furthermore, the natural indigo is stated by some authorities to possess certain benign impurities which render it more suitable for dyeing purposes.—Tr.

[2] First shown to yield indiarubber in 1892 by Sir William Tilden (*Chem. News*, lxv., 265).—Tr.

occurring in nature, but can bring forth a whole series of similar substances. You will therefore not be surprised when I show you other rubber-like substances which have been prepared, not from isoprene, but from similar liquids, such as dimethylbutadiene. Such products are termed homologues. They possess properties closely resembling those of indiarubber, but differ slightly in chemical constitution. It is, as yet, not decided which of these synthetical substances forms the most suitable substitute for indiarubber. The same applies to the far more important question of cost of production. But when one considers the fate of natural indigo, of madder, and of other natural products, one may hope to see synthetical indiarubber gradually enter into successful competition with the naturally occurring commodity.

Camphor, which may be placed in the same chemical category as indiarubber, is also prepared artificially on a large scale. The first firm to manufacture synthetical camphor was the Chemische Fabrik auf Aktien (formerly Schering), of Berlin, but other firms are now following suit. By this, the camphor monopoly, which the Japanese Government was able to establish after the annexation of Formosa, was broken down.

Here you see an artificial resin which closely resembles amber in its external characteristics, and which, as these necklaces, combs, cigar-holders, &c., show, can be employed as a substitute therefor. These articles have been placed at my disposal by the Bakelite Company of this city, Bakelite being the trade name of this substance. It is prepared from constituents of coal-tar by a process which, although long known, has been technically worked out by the American chemist Baekeland.[1]

Synthetic chemistry, in close association with medicine, is actively engaged in pursuit of the discovery of new medicaments. The great amplitude of this subject again compels me to mention only a few instances.

In this bottle you see a white powder—veronal—which is a hypnotic largely employed at the present day. It is in no way connected with the older vegetable narcotics—opium, &c.—but is entirely a synthetical product. One-tenth of this quantity would suffice to send this entire gathering into a peaceful slumber. But should the mere demonstration of this soporific—coupled with this lecture of mine—take effect on any susceptible persons present, there is no better remedy than the cup of tea which we are to enjoy later, for tea contains a chemical substance which stimulates the heart and nervous system. This is also present in coffee, in which it was discovered ninety years ago by Runge in this country. The humorously inclined discoverer gave to it the name of "Kaffeebase," which, however, was afterwards changed to the more aristocratic "caffein." It is an odd coincidence that caffein was first synthesised in the laboratory of the University of Berlin exactly fifteen years ago. This synthesis has led to its manufacture on a large scale. In this bottle you see a specimen of synthetical caffein, manufactured by the firm of Messrs. C. F. Böhringer and Sons, in Mannheim. It is prepared in large quantity from uric acid, a constituent of guano, but has undergone such a complete chemical transformation and purification that it no longer possesses the unpleasant characteristics of the raw material from which it is manufactured. The chemist may therefore apply to such substances the remark made by the Emperor Vespasian concerning the tax-money which came to him from an unclean source: *non olet* (it does not smell).

Pure caffein is at present employed only as a medicament, though, indeed, in considerable quantity. But it finds, of course, a far greater application in the form of the active principle in tea, coffee, kola, and Paraguay tea (maté), so that after alcohol it is certainly the most widely employed stimulant. So soon as organic chemistry succeeds in the entirely possible task of synthetically reproducing the aroma of tea and coffee, there will be nothing to hinder the artificial preparation of these beverages; and when the Minister of Education invites to tea a gathering to celebrate the fiftieth anniversary of the Kaiser-Wilhelm-Gesellschaft, the repast, I hope, will consist of synthetical tea.

Organic synthesis is not limited to vegetable products only, but embraces equally fearlessly substances of animal origin. An instructive example of this may be found in a remarkable compound (adrenalin) which is formed in our own bodies in the suprarenal glands, and which plays an important part in the regulation of the blood pressure. Shortly after its isolation in a pure condition from these glands, Dr. F. Stolz, chemist to the dye factory at Höchst, was able to synthesise it from constituents of coal-tar. This synthetical product has now been placed on the market by the Höchst firm under the name of "Suprarenin." A very dilute solution of this substance causes a powerful contraction of the blood vessels, and consequent dispersal of blood from the tissues. A skin surface well charged with blood—as, for instance, a red nose—is instantly rendered quite pale on painting it with such a solution. Unfortunately, the colour is not evenly discharged, owing to the varying permeability of the epidermis, and as the action of the drug soon ceases, with return of the original redness, adrenalin is not suitable as a cosmetic. On the other hand, it finds most useful application in surgery, as by its means certain incisions can be made without loss of blood; this is found particularly convenient for operations on the eye, mouth, and nose.

The factory in Höchst, which has placed at my disposa this preparation in the numerous forms which you see before you, has also contributed several samples of the new arsenical remedy originally known as "Ehrlich-Hata," but now as "Salvarsan." If you are desirous of knowing more about it, I must refer you to the more authoritative knowledge of the discoverer, Prof. Ehrlich, who is at present in our midst.

Flora's fairest children, the sweet-scented flowers, must also submit to competition with synthetic chemistry. The scent industry has received a powerful impetus from synthesis, and yearly turns out in Germany alone goods of the value of more than two million pounds. I shall here show you only a few of the numerous products. This bottle contains ionone, an artificial violet-scent discovered in the laboratory of this University by the late Prof. F. Tiemann, and manufactured by Messrs. Haarmann and Reimer in Holzminden. The contents of this bottle would be sufficient to envelop, not only the Ministry of Education, but the entire avenue "Unter den Linden" in an atmosphere of violet perfume, for the osmophoric value of these substances is extraordinarily high.

In contradistinction to the simple ionone, the majority of the natural odours of flowers are due to complex mixtures of different scents. These, nevertheless, have been successfully reproduced. Among the scents here displayed are lily-of-the-valley, mock-orange, lilac, tuberose, and, finally, the greatest achievement, synthetical attar of roses. Although the natural oil from roses contains about twenty different odorous substances, the chemists of the scent factories at Leipzig (Heine and Co., Schimmel and Co.) have succeeded after laborious research in isolating all the components, synthesising these, or preparing them from less costly oils, and then reuniting them in the proper proportions. It now requires a most sensitive nose indeed to distinguish the synthetical attar of roses from the natural product.

I only hope that the noble patroness of roses, her Majesty the Empress, will not take amiss this intrusion of chemical synthesis upon the monopoly hitherto held by her favourite flowers. Perhaps she will regard it more favourably if your Majesty will be so kind as to present this synthetical product to her Majesty as a humble offering from chemical industry.

These examples show the success which has followed the encroachment of synthetic organic chemistry in nature's domain. What I have already said is sufficient to prove that chemistry, as well as all natural sciences, is the true field of unlimited possibility. The Kaiser-Wilhelm institutes are henceforth to take part in the expansion of this field and the appropriation of the treasures hidden therein.

It is, of course, not to be expected that they will entirely supplant all the older scientific institutions. We of the older institutions do not feel by any means so weak as willingly to allow such an event to occur. On the contrary, we shall exert our best energies to maintain a keen competition with the younger institutes. This will serve to keep both sides fresh and active.

[1] A similar process for the manufacture of this substance was independently developed and patented in England by Story (Brit. Pat., 1905, 8875).—Tr.

But there can be no doubt that these godchildren of the German Emperor will in the healthy air of the Grunewald soon develop great strength from the liberal nutrition supplied by their patrons, and grow up into renowned centres of research.

We may therefore confidently hope that in later years the foundation to-day of the Kaiser-Wilhelm-Gesellschaft will be regarded as an unmixed blessing to scientific research in Germany.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—It is proposed to alter the regulations for the diploma of agriculture so as to ensure that agricultural physiology shall be one of the compulsory subjects for part ii. of the diploma examination. It is also proposed to abandon the present method of grouping the subjects, and that in part i. of the diploma examination a candidate who has obtained honours in the natural sciences tripos shall be excused chemistry if he has passed chemistry in the tripos, botany if he has passed botany in the tripos, and zoology if he has passed either zoology or physiology.

MR. H. MAXWELL-LEFROY, Imperial entomologist for India, will give the inaugural lecture of his course on entomology at the Imperial College of Science and Technology on Thursday, March 2, at 5 p.m.

PROF. V. H. BLACKMAN, who since 1907 has occupied the chair of botany in the University of Leeds, has been appointed to the professorship of plant physiology and pathology at the Imperial College of Science and Technology at South Kensington. He will take up his new duties at the beginning of July.

ON several occasions we have directed attention to the useful work done by Prof. Perry, F.R.S., through his system of bursaries, which he established at the Royal College of Science in 1902 with a contribution of 100*l.* from the Drapers' Company. The bursary fund was established particularly for the benefit of national scholars, but the scholarships held by these students have now been increased in value sufficiently to render Prof. Perry's bursary fund unnecessary. A final balance-sheet dealing with the period between July 17, 1908, and January 24 of the present year, has been published in the current issue of *The Phoenix*, the magazine of the Royal College of Science and Royal School of Mines. During the years since Prof. Perry inaugurated the scheme, the sum of more than 1600*l.* has been disbursed to students needing judicious assistance in a tactful way. We have reason to know that it is seldom that such a sum of money is spent with so great an advantage to the beneficiaries.

THE successful students of the City and Guilds of London Institute received their prizes from the Lady Mayoress at the Mansion House on February 17. On this occasion the honorary secretary of the college, Sir John Watney, announced that the name of the City and Guilds Central Technical College will be changed to the City and Guilds Engineering College, and as such will constitute the engineering department of the Imperial College. It will be managed by a delegation representing the City and Guilds Institute, the Imperial College, and the Goldsmiths' Company. After the distribution of prizes, Dr. R. T. Glazebrook, F.R.S., director of the National Physical Laboratory, delivered an address on the interdependence of science and industry. He said the agencies at work in London applying science to the wants of industry included the university colleges, the polytechnics, and the technical schools. He asked, Is it not possible to conceive some scheme by which the labours of such agencies can be coordinated and linked up with the Imperial College as a centre where the staff and students will be free to conduct original investigations, and, through these, to learn new truths? Under such a scheme the Imperial College would become, first, the Central Technological University for London, and then for the Empire. A body like its governing body, modified so as to include representatives of the other institutions, forming with it the technological side of the University in London, would become the council of the faculty. He put forward the following propositions:—(1) that a combination of the technological departments of existing institutions and schools into an independent technological faculty is necessary; (2) that in such a faculty a definite value should be given to technical education in each London school; and (3) that the technological faculty should confer degrees under conditions to be laid down by the faculty.

IN the French Chamber of Deputies on February 16, M. Maurice Faure, Minister of Public Instruction, summed up the discussion on the estimates for his department. From the report by the Paris correspondent of *The Times*, we learn that, with reference to higher education, M. Maurice Faure said that the French universities, which are autonomous, thanks to the legislation of 1896, and have been endowed by the State with foundations amounting to more than 1,000,000*l.*, are keeping pace with modern requirements, and are extending their influence abroad as well as at home. New laboratories are being erected by the Sorbonne in the Rue Saint Jacques, the University of Nancy has opened an electrotechnical institute, at Grenoble there is now a new paper-making school, at Lyons a new chemistry school, at Lille various new mining courses, at Dijon an agricultural and œnological institute, and fresh technical subjects have been introduced into the curriculum at Toulouse, Caen, Rennes, and elsewhere. Foreign students are being attracted in increasing numbers, and abroad there have been established French institutes at Florence and at Madrid, which are respectively affiliated to the University of Grenoble and to those of Bordeaux, Toulouse, and Montpellier. The foundation of similar institutes is contemplated at St. Petersburg under the auspices of the Sorbonne, and at Constantinople under the auspices of the University and City of Lyons. The creation of a chair of colonial history in Paris has been proposed by the Budget committee, and the faculty of medicine is to be asked to consider a proposal in favour of the foundation of a chair of climatology and mineral hydrology, the cost of which the various French spas and watering-places have offered to defray. In the secondary schools, the paramount claims of purely scientific studies has been recognised in accordance with modern requirements.

THE third annual meeting of the Old Students Association of the Royal College of Science, London, was held at the college last Saturday, the president, Sir Thomas H. Holland, F.R.S., presiding. Sir Alexander Pedler, F.R.S., was elected president for 1911, and Mr. T. Ll. Humberstone and Mr. A. T. Simmons were re-elected secretary and treasurer respectively. A draft report, prepared by a special committee, for the Royal Commission on University Education in London, was considered and adopted. In the evening, the third dinner of old students was held at the Criterion Restaurant, about ninety being present. Prof. Edgeworth David, F.R.S., an old student of the college, in proposing the toast of the Royal College of Science, referred to the request of the association for the representation of old students on the governing body of the college. It was, he said, the academic thing to do, for no one could better appreciate the needs of a college than the men and women who had graduated there. The principle was recognised throughout the universities of the world, and had been adopted with marked success in his own University of Sydney. Mr. William Burton, in replying to the toast, expressed the hope that better provision would in the future be made for the financial and social needs of the scholars attending the college. The chairman, Sir Thomas Holland, in responding to the toast of the Old Students Association, proposed by Mr. G. T. Holloway, referred to the adoption of an academic costume for associates, which, he said, secured the definite recognition of the college. But, in maintaining the rights of the college and the interests of the association, he urged old students not to forget that they belonged to a larger college in which other interests were represented. The association were indebted to their governors for the sympathetic way in which they had met the demands of members. Sir Alexander Pedler, F.R.S., the new president of the association, proposed the toast of the Guests, for whom Dr. A. D. Waller, F.R.S., replied.

IN reply to a question in the House of Commons last week, the Home Secretary stated that the Pharmaceutical

Society is considering certain questions connected with the educational curriculum of pharmaceutical chemists and of chemists and druggists with the view of framing bye-laws in pursuance of the powers vested in them by the Poisons and Pharmacy Act, 1908. At the present time, candidates for the qualifying examination in pharmacy are not required to undergo a systematic course of instruction, and it is no part of the duty of the society to inquire how or where they were educated. In the absence of a compulsory curriculum, "cramming" is very prevalent in connection with this examination, the result being a high percentage of failures. Thus last year, out of 1027 candidates who entered for the examination, 620 were unsuccessful. Before actually proceeding to frame bye-laws, the council of the society has drafted a scheme, which has been submitted to pharmaceutical associations in all parts of the country and to the principals of schools of pharmacy, with the object of eliciting expressions of opinion on the matter. The draft scheme suggests that the examination be divided into two parts, and that a candidate desiring to enter for the intermediate examination shall produce evidence that, subsequent to passing the preliminary examination and being registered as a student, he has attended, in a teaching institution approved by the council, not fewer than 50 lectures in botany, 100 lectures in chemistry, and 25 lectures in physics, and has done 25 hours' work in practical botany and 300 hours' work in practical chemistry. As to the final examination, it is proposed to require candidates—who must have been engaged for three years in the ordinary work of pharmacy under the supervision of a pharmacist—to produce evidence of having attended at a recognised institution 60 lectures and demonstrations in materia medica, 30 lectures in pharmacy, and 20 lectures in dispensing and prescription Latin, and of having done 200 hours' work in practical pharmacy and 100 hours' work in practical dispensing. The proposals have already been discussed by a number of pharmacists' associations, and divergent opinions have been expressed. While some are in favour of adopting the scheme, others are pressing more especially for a modification of that part of the proposed curriculum which precedes the intermediate examination, and the council is being urged to consider the advisability of accepting the certificates of other examining bodies in lieu of the intermediate examination.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, February 16.—Sir Archibald Geikie, K.C.B., president, in the chair.—W. **Rosenhain** and S. L. **Archbutt**: The constitution of the alloys of aluminium and zinc. In connection with researches on light alloys, carried out on behalf of the Alloys Research Committee of the Institution of Mechanical Engineers, the authors have studied the constitution of the Al-Zn alloys by pyrometric and microscopic methods, including the study of specimens after prolonged annealing at definite temperatures and after quenching. The results are represented in an equilibrium diagram differing materially from those previously put forward. The principal points of difference are:—(1) The liquidus curve shows a small break at a concentration of 85 per cent. of zinc, this break being connected with the formation of a definite compound of probable formula Al_2Zn_3. (2) In alloys under conditions of complete equilibrium the occurrence of eutectic ceases at a concentration of about 78 per cent. of zinc, although in ordinary slowly cooled alloys the eutectic can be traced down to the vicinity of 50 per cent. zinc. (3) At a concentration of about 78 per cent. of zinc, the solidus curve of the alloys rises abruptly from the eutectic line (380° C.) to a horizontal line of arrest points at 443° C. This line commences at the break in the liquidus curve already mentioned, and extends to about 37 per cent. of zinc; between 78 and 40 per cent. this line represents the solidus, but near 40 per cent. the solidus bends upwards towards the melting point of pure aluminium. The reaction indicated by this line of arrest points is the formation of a compound (Al_2Zn_3) by the reaction of crystals of a solid solution of zinc in aluminium with the residual liquid. (4) A second horizontal line of arrest points of considerable intensity has been found at 256° C. in alloys containing 99 to 35 per cent. of zinc. These heat evolutions are due to decomposition of the compound (Al_2Zn_3) into two phases, one of which is the saturated solid solution of Zn in Al, while the other is practically pure Zn. (5) The existence of a definite compound is indicated, stable only between 443° C. and 256° C., and having a zinc content of about 78 per cent., most nearly represented by Al_2Zn_3. Evidence for its existence is derived from the termination of the eutectic line and the position of maximum intensity of the line of heat evolutions just mentioned; this is strikingly confirmed by the micro-structures, which show the compound in the form of characteristic hexagonal dendrites. When decomposed (at or below 256° C.), it exhibits a duplex laminated "pearlitic" structure strikingly resembling the pearlite of carbon steel.—R. **Whiddington**: The production and properties of soft Röntgen radiation. Röntgen rays from ordinary bulbs are usually produced at generating potentials of between 10,000 and 100,000 volts. It is possible by using a special tube with a very thin aluminium window to experiment with rays generated at only a few hundred volts. The rays dealt with in this paper were generated at 1000 to 3600 volts. It has been found that such soft Röntgen rays have much the same properties as the harder rays usually experimented with. They produce ionisation in air, affect photographic plates, and can excite secondary radiations when incident on solid bodies. Their range in air, however, is not many centimetres. For many purposes a Röntgen radiation is sufficiently defined by a knowledge of (1) the total energy; (2) the penetrating powers in absorbing screens. These two properties have therefore been investigated in some detail, with reference particularly to the influence exerted by (1) the material of the antikathode; (2) the potential at which the rays are generated. The antikathodes used fall naturally into two groupings:—Group A.—Al, Pt. Group B.—Ag, Cd, Cu, Fe, Ni, Pb, Sb, Sn, Zn. The antikathodes of Group A emit secondary radiations, those of Group B do not. Experiment indicates that Al emits a soft characteristic radiation of λ/ρ 580 (in Al). In order to arrive at a common explanation of a number of experimental results, it is suggested that this Al radiation disobeys the law of "Röntgen ray fluorescence" recently advanced by Barkla.—Prof. J. **Eustice**: Experiments on stream-line motion in curved pipes. In a paper on the flow of water in curved pipes, the author has shown that during the flow of water through a pipe, if a change is made from a straight to a very slightly curved form, there is an increased resistance to flow, which is very marked at velocities below the critical velocity. In order to find the cause of the increase in resistance, an apparatus was designed which provides for the distribution of six variously coloured filaments of dyed water into a glass pipe through which water is flowing. The positions of the filaments can be so arranged that in the passage of water from a straight to a curved pipe the directions of the stream-lines in any part of the tube can be investigated. The experiments show that the curvature of a filament is less than the curvature of that part of the pipe in which the filament is flowing, and if the velocity of flow increases the curvature of the filament increases. The filaments impinge on the outer wall of the pipe, and, flattening into bands, follow the surface of the pipe and cross over to the inner wall, where the filaments start again in their path along the main stream, until (if the pipe is sufficiently long) the filaments again meet the outer wall, when the return flow along the surface is repeated. A filament flowing in the central plane of the pipe, when reaching the outer wall, divides into two parts, which come together on the inner wall of the pipe; the other filaments flow through the loop which is thus formed. A filament not in the central plane remains on that side of the plane in which it enters the curved pipe. The experiments were extended to angle pipes, and the velocities were increased until turbulent motion was obtained. After flowing through a curved pipe or angle, vortices are generated which persist in a contiguous straight pipe.

Challenger Society, January 25.—Dr. G. H. Fowler in the chair.—Commander Campbell **Hepworth**: Remarkable displays of phosphorescence in the sea. These displays took the form of rapidly moving curved bands of lumin-

escence, separated by dark or non-luminous bands: they appeared to radiate from a centre on the horizon, round which they seemed to rotate with increasing brilliancy and velocity. In one case they overtook the ship. The writer attributed them to the stimulation of phosphorescent organisms by tide-ripplings.—G. P. **Farran**: The breeding seasons of *Calanus finmarchius*. Though found over much of the North Atlantic, the species is only abundant shoreward of the isohaline of 35·25 per mille. In the end of the year a small stock, consisting of the penultimate stage V is found. In early March maturity has been attained and rapid reproduction sets in. By May immense shoals are formed, consisting mostly of the youngest stages, but with some adults. Reproduction slackens gradually, and by November has ceased.

Royal Meteorological Society, February 15.—Dr. H. N. Dickson, president, in the chair.—R. **Cooke** and S. C. **Russell**: Variation of the depth of water in a well at Detling, near Maidstone, compared with the rainfall 1885–1909. This well is on the chalk formation at the foot of the range of the North Downs, 358 feet above sea-level; its present depth is 118 feet. Weekly plumbings of the water in the well have been taken without interruption since 1885, and the authors have compared these plumbings with the rainfall of the previous week. The extreme variation of the water-level during the whole period was 30 feet 3 inches. Successive weeks of steady rainfall exercise a far greater effect upon raising the water-level than weeks of heavy but intermittent rainfall. As a rule, the effect of the autumn rains is not felt on the well until the month of December, but the winter rainfall penetrates most readily. Following a series of wet years, a high limit of saturation is attained; and once this condition is thoroughly established, the water remains at an almost constant level throughout the seasons, excess or deficiency of rain causing very little effect.—A. W. **Clayden**: The actinograph—a new instrument for observing and recording changes in radiation.—K. M. **Clark**: New set of cloudiness charts for the United States.

EDINBURGH.

Royal Society, January 23.—Prof. J. C. Ewart, F.R.S., vice-president, in the chair.—James **Ritchie**: An entoproctan polyzoon (*Barentsia benedeni*) new to the British fauna, with remarks on related species. An account was given of the minute structure of individuals attributed to this species, colonies of which, obtained at Hull, were kept alive under observation for some time. The later development and the various forms of this and related species were described, and the conclusion was arrived at that a redundancy of species and of genera had been established among the entoproctan polyzoa. Some of these the author proposed to suppress.—The following three papers were from the Physiological Department of Glasgow University:—(1) Adam **Black**: A study of artificial pyrexia produced by tetrahydro-β-naphthylamine hydrochloride. Experiments on rabbits were given to show that the fall of temperature produced by ether anæsthesia was largely due to increased loss of heat, and that it was prevented if the loss of heat were checked. It was then shown that the ether prevented the development of pyrexia under the drug, the conclusion being that the drug acted largely by causing contraction of cutaneous vessels, and thus decreasing heat loss. The changes in the protein metabolism under the drug were studied in the dog, and it was found that the disturbance was small in comparison with the disturbance produced by fever-producing toxins. (2) Dr. Janie Hamilton **M'Ilroy**: The independence of the peripheral neurons of the retina. The nature of the neurons having been considered, the results of a series of experiments upon section of the optic nerve upon these neurons were described, and it was shown that the peripheral neurons having their cells in the inner and outer nuclear layers preserve their integrity for at least nine months after section of the nerve. On the other hand, another series of experiments showed that in aseptic autolysis these peripheral neurons disintegrated rapidly and at an earlier date than the neurons of the ganglionic layer.—(3) Dr. Williamina **Abel**: A description of the cerebral cortex of the guinea-pig. The histological examination of the cerebral cortex showed the presence of five types of cerebral lamination. The area, in which the lamination indicated a motor type of cortex, lay in the posterior half of the cerebrum, and was surrounded by sensory zones. Electrical stimulation supported the conclusion come to through histological investigation as to the position of this motor area. Consideration was given as to the significance of this special type of cerebral topography.

PARIS.

Academy of Sciences, February 15.—M. Armand Gautier in the chair.—C. **Guichard**: The deformation of quadrics.—M. **Gouy**: The periodic structure of the magneto-kathode rays. A further investigation of the fringes described in an earlier paper. A reproduction of a photograph of a set of fringes is given. According to the electron hypothesis of these phenomena, the figures described would be the caustics of the trajectories of the electrons, and the experimental results are not inconsistent with this view.—Lecoq **de Boisbaudran**: The dehydration of salts. It has been stated that there are no examples of salts, containing more than one molecule of water of crystallisation, losing a single molecule of water to form a lower hydrate. Examples are given from the sulphates of copper, iron, cobalt, magnesium, zinc, and nickel disproving this statement.—Paul **Sabatier** and A. **Mailhe**: Direct esterification by catalysis. The preparation of benzoic esters. If a solution of benzoic acid in an alcohol is vapourised, and the vapours passed over a column of oxide of thorium heated to 350° C., a nearly quantitative yield of the corresponding benzoic ester is obtained. The benzoates of ethyl, propyl, isobutyl, isoamyl, and allyl have been prepared in this manner.—C. E. Guillaume was elected a correspondant for the section of physics in the place of M. Van der Waals, elected foreign associate.—Paul **Dienes**: Series of polynomials and the singularities of analytical functions.—N. **Saltykow**: The theory of characteristics and its applications.—Pierre **Weiss**: The magnitude of magneton deduced from the coefficients of magnetisation of solutions of iron salts. The mean figure, 1122·1, is practically identical with the 1123·5 deduced from experiments made at Leyden on the metals themselves in liquid hydrogen.—A. **Hanriot**: Adhesivity. When two strips of brown gold are heated within the limits of temperature of their transformation into ordinary gold, and the strips are allowed to come in contact, they become soldered to each other. The conditions under which this phenomena takes place have been experimentally studied, and the results are given in detail.—A. **Guntz** and J. **Minguin**: Contribution to the study of the ultra-violet radiations. An account of the mechanical, physical, and chemical effects of ultra-violet light on some organic substances.—J. **Boselli**: The velocities of reactions in gaseous-liquid systems.—Daniel **Berthelot** and Henry **Gaudechon**: The comparative action of the ultra-violet rays on organic compounds possessing linear and cyclic structure. The study of mineral salts in aqueous solutions. It has been shown in earlier papers that fatty compounds are decomposed with evolution of gas under the action of the ultra-violet rays. The treatment in a similar manner of a series of aromatic derivatives has given throughout negative results; no change is effected.—R. L. **Espil**: Some new anhydrous selenites.—A. **Verneuil**: The preparation of the black enamel of the Italo-Greek potteries. The secret of the preparation of this fine enamel has been lost, and numerous attempts to reproduce it in current times have been unsuccessful. The author finds that the use of finely divided metallic iron in the coating gives a black resembling that of the ancient pottery.—Marcel **Oswald**: The action of heat upon silver nitrite.—J. B. **Senderens**: Ketones derived from phenylpropionic acid. Mixtures of phenylpropionic acid and a fatty acid, passed over a column of thoria at about 460° C., give three ketones, the two symmetrical ketones derived from the phenylpropionic and fatty acids singly, and the mixed ketone. A description is given of several new ketones prepared by this method.—Charles **Moureu** and Amand **Valeur**: The preparation of isosparteine. The action of methyl iodide on this base.—M. **Grignard**: Two new methods for the synthesis of nitriles. Chloride of cyanogen or cyanogen itself reacts with organo-magnesium compounds, giving nitriles, the necessary condition being that the magnesium compound should be added drop by

drop, and never be in excess.—Marcel **Dubard**: Remarks on the classification of the genus Sideroxylon.—J. **Granier** and L. **Boule**: The phenomena of the conjugation of the chromosomes at the prophase of the first reducing kinesis.—Raoul **Bayeux**: Experiments made at Mt. Blanc in 1910 on gastric secretion at very high altitude. The experiments were made on a dog, and showed that the quantity of gastric juice secreted in a given time, the feeding being maintained constant, diminishes in a marked manner during a stay at a high altitude. The total acidity is only slightly diminished under the same conditions. The general activity of the gastric juice is also slowed down. The bearing of these results upon mountain sickness is discussed.—H. **Agulhon**: The action of the ultra-violet rays upon diastases. Eight diastases were studied, and all of them were more or less rapidly attenuated by the radiations passing through quartz and arrested by glass.—Samuel **Lifchitz**: The sonorous reproduction of a periodic curve.—A. **Conte** and C. **Vaney**: The experimental reproduction of acephalous Lepidoptera.—E. **Roubaud**: Biological studies on the Glossina of central Dahomey.—H. **Coutière**: The ellobiopsis of bathypelagic crayfish.—Fernand **Guéguen**: Cladosporian mycosis in man. Details are given of a diseased condition in man caused by a fungus of the genus Cladosporium, the first example of a pathogenic action of a member of this genus.—R. **Robinson**: The heterotopic theory in pathology.—Louis **Gentil**: The formation of the south Riffian isthmus.—Ph. **Négris**: The existence of the Trias and Cretaceous on Mount Voïdias in the north of the Peloponesus.

DIARY OF SOCIETIES.

THURSDAY, FEBRUARY 23.

ROYAL SOCIETY, at 4.30.—Transmission of Flagellates living in the Blood of certain Freshwater Fishes: Miss M. Robertson.—Report on the Separation of Ionium and Actinium from certain Residues, and on the Production of Helium by Ionium: Dr. B. B. Boltwood.—The Secondary γ-Rays produced by β-Rays: J. A. Gray.—The Specific Heat of Water and the Mechanical Equivalent of the Calorie at Temperatures from 0° to 80° C. With Additional Note on the Thermoid Effect: W. R. Bousfield and W. E. Bousfield.—On the Measurement of Specific Inductive Capacity: Prof. C. Niven, F.R.S.

ROYAL INSTITUTION, at 3.—Problems of Animals in Captivity: P. Chalmers Mitchell, F.R.S.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—Long Distance Transmission of Electrical Energy: W. T. Taylor.—Extra High Pressure Transmission Lines: R. B. Matthews and C. T. Wilkinson.

FRIDAY, FEBRUARY 24.

ROYAL INSTITUTION, at 9.—Mouvement Brownien et Réalité Moléculaire: Prof. Jean Perrin.

PHYSICAL SOCIETY, at 5.—Flames of Low Temperature supported by Ozone: Hon. R. J. Strutt, F.R.S.—The Movement of a Coloured Index along a Capillary Tube, and its Application to the Measurement of the Circulation of Water in a Closed Circuit: Dr. Albert Griffiths.—An Optical Lever of High Power suitable for the Determination of Small Thicknesses and Displacements: E. H. Rayner.

INSTITUTION OF CIVIL ENGINEERS, at 8.—The Design and Construction of Works for the Bacterial Purification of Sewage: R. J. Samuel.

MONDAY, FEBRUARY 27.

ROYAL GEOGRAPHICAL SOCIETY, at 8.30.—Labrador: Dr. Wilfred T. Grenfell, C.M.G.

ROYAL SOCIETY OF ARTS, at 8.—Brewing and Modern Science: Prof. Adrian J. Brown.

INSTITUTE OF ACTUARIES, at 5.—The Assurance Companies Act, 1909, some Explanatory Notes on such Portions of the Act as relate to the Business of Life Assurance: A. R. Barrand.

TUESDAY, FEBRUARY 28.

ROYAL INSTITUTION, at 3.—Crystalline Structure: Mineral, Chemical, and Liquid: Dr. A. E. H. Tutton, F.R.S.

ROYAL SOCIETY OF ARTS, at 4.30.—The Resources and Problems of the Union of South Africa: The Hon. Sir Richard Solomon, K.C.B.

INSTITUTION OF CIVIL ENGINEERS, at 8.—Modern Railway-signalling: some Developments upon the Great Western Railway: A. T. Blackall.

WEDNESDAY, MARCH 1.

ENTOMOLOGICAL SOCIETY, at 8.—Persistence of Bacilli in the Gut of an Insect during Metamorphosis: A. Bacot.

SOCIETY OF PUBLIC ANALYSTS, at 8.—Examination of the Process of Shrewsbury and Knapp for the Estimation of Cocoanut Oil: R. Ross, J. Race, and F. Maudsley.—The Estimation of Iron by Permanganate in the Presence of Hydrochloric Acid: A. C. Cumming and A. Gemmell.—The Analysis of Sweetened Condensed Milk: A. Backe.—Note on Henry C. Frey's Method of Estimating Petroleum in Turpentine: H. S. Shrewsbury.—Note on the Formation of Hypoiodites and their Action on Sodium Thiosulphate—a source of error in certain Iodine Titrations: J. P. Batey.—New Form of Specific Gravity Apparatus: C. Butler Savory.

ROYAL SOCIETY OF ARTS, at 8.—Caisson Sickness and Compressed Air: Dr. Leonard Hill, F.R.S.

THURSDAY, MARCH 2.

ROYAL SOCIETY, at 4.30.—*Probable Papers*: Reversal of the Reflex Effect of an Afferent Nerve by altering the Character of the Electrical Stimulus applied: Prof. C. S. Sherrington, F.R.S., and Miss S. C. Sowton.—Carbon Dioxide output during Decerebrate Rigidity (preliminary communication): Dr. H. E. Roaf.—The Alcoholic Ferment of Yeast Juice. Part VI. The Influence of Arsenates and Arsenites on the Fermentation of the Sugars by Yeast Juice: Dr. A. Harden, F.R.S., and W. J. Young.—Experiments to ascertain if certain Tabanidæ act as the Carriers of *Trypanosoma pecorum*: Col. Sir D. Bruce, F.R.S., and others.

LINNEAN SOCIETY, at 8.—Dermaptera (Earwigs) preserved in Amber, from Prussia: Dr. Malcolm Burr.—Report on the Marine Polyzoa of the Collection made by Mr. J. Stanley Gardiner in the Indian Ocean in H.M.S. *Sealark*: Miss Laura Roscoe Thornely.—On the Mysidacea and Euphausiacea collected in the Indian Ocean during 1905: W. M. Tattersall.

RÖNTGEN SOCIETY, at 8.15.—Some Experiments with a 10,000 volt. Storage Battery: A. A. Campbell Swinton.

FRIDAY, MARCH 3.

ROYAL INSTITUTION, at 9.—Scents of Butterflies: Dr. F. A. Dixey, F.R.S.

INSTITUTION OF CIVIL ENGINEERS, at 8.—Lagos Harbour Survey, 1909–1910: H. Ellis Hill.

SATURDAY, MARCH 4.

ROYAL INSTITUTION, at 3.—Radiant Energy and Matter: Sir J. J. Thomson, F.R.S.

MONDAY, MARCH 6.

SOCIETY OF ENGINEERS, at 7.30.—Petrol Air-gas: E. Scott-Snell.

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