THURSDAY, APRIL 8, 1909.

TELEOLOGY.

Design in Nature. By Dr. J. Bell Pettigrew, F.R.S. In three volumes; with nearly 2000 figures and three portraits of the author. Vol. i., pp. xxxi+421; vol. ii., pp. xi+425–1069; vol. iii., pp. ix+1073–1416. (London: Longmans, Green and Co.) Price £3 3*s.* net.

ALTHOUGH the manuscript of these three large volumes was completed by the author, it was not until after his death that the greater portion of the book passed through the press. In these circumstances nothing remained for the editors but faithfully to carry out the work of publishing "Design in Nature" in the form in which it was left, although, as they point out, many improvements would no doubt have suggested themselves to Prof. Pettigrew if he had lived to see the book in type. The aim and object of the work was to demonstrate the existence of a first cause, or Creator, from the study of the phenomena of the organic and inorganic worlds.

In attempting to deal with physics, chemistry, botany, zoology, anatomy, physiology, psychology and palæontology "more or less in detail," the author attempted a task which no one man could be expected adequately to perform. A discussion of such a wide range of subject-matter, to be really conclusive in its arguments, would have to run to the size of an encyclopædia, and, like the latter, be the work of a number of different contributors. As it is, the extent of knowledge covered may be described as being as broad as the ocean, but lacking in depth. Indeed, there is considerable want of uniformity, and many of the arguments are distinctly shallow. A large part of the work deals with anatomical, zoological, and physiological considerations, especially in relation to organs of reproduction, circulation, and locomotion, but other matters, such as the telephone, bones of the hand and foot, spiral formations, and new theories of matter, are dropped down rather at random in the middle of discussions with which they do not appear to have much connection. Moreover, the same subject is sometimes discussed in two widely different places.

It would be impossible to deal at any great length with the theoretical aspect of the book. We can only select one or two illustrations. On p. 767 are given fourteen "proofs that the brain is the organ, apparatus, or laboratory of the mind." Some of these are legitimate deductions from statements for which Prof. Pettigrew's authority affords sufficient guarantee, but the argument is surely weakened by the inclusion of the following:—

"1. The brain rests eight hours or so (period of sleep), and during that time the mind is a blank."

"4. The intellectual faculties are sluggish after a full meal. They are most active between meals. They are also more active during the day than during the night."

"6. When the brain is overworked during the day, sleep at night is difficult or impossible. The brain apparatus is excited, and endless mental pictures, known as dreams, are formed."

"8. Mesmerism is largely a physical condition."

"13. The brain can be trained and developed. It is impossible to train and develop what is immaterial."

"Weight, Momentum, and Power as Factors in Flight" is the heading of § 378, from which we extract the following:—

"The increase of power due to momentum in heavy bodies in motion is well illustrated in the start and progress of steamboats. In these the *slip*, as it is technically called, decreases as the speed of the vessel increases; the strength of two or three men, if applied by a hawser attached to the stern of a moderate-sized vessel, being sufficient to retard, and, in some instances, prevent, the starting. In such a case the power of the engine is almost entirely devoted to 'slip' or in giving motion to the fluid in which the screw or paddle is immersed. It is consequently not the power residing in the paddle or screw which is cumulative, but the momentum inhering in the mass. In the bird the momentum, *alias* weight, is made to act upon the inclined planes formed by the wings, thus adroitly converting it into sustaining and propelling power. It is to this circumstance, more than any other, that the prolonged flight of birds is mainly due, the inertia or dead weight of the trunk aiding and abetting the action of the wings, and so relieving the excess of exertion which would necessarily devolve on the bird." . . . "In the flight of the albatross, on the other hand, the momentum acquired by the moving mass does the principal part of the work, the wings for the most part being simply rotated on and off the wind to supply the kite surfaces and angles necessary for the inertia or mass to operate upon."

From these examples we can only advise the reader to regard "Design in Nature" as a memorial volume of the late Prof. Pettigrew, and not to attach too great scientific value to statements and conclusions which the author might have expunged or modified had he lived to complete his task.

Since the above criticisms were written, a fresh aspect of Prof. Pettigrew's work has suggested itself to the present reviewer. A large portion of the three volumes deals with matters anatomical. Now, anatomy is a subject which, for reasons that the psychologist alone is competent to explain, is not pleasing to the majority of individuals. It is highly desirable that the mind which controls the human mechanism should know as much as possible about the working of that mechanism as well as of those of other members of the animal kingdom; yet the parent's letter to the board school teacher, "Please don't learn my little girl any more about her inside; it does her no good and is rude," represents a widespread sentiment which, whatever its origin, is opposed both to the true scientific spirit and to considerations of expediency. Now Prof. Pettigrew certainly succeeded in associating a great deal of information on this usually unpalatable subject in connection with an appeal to one of man's highest sentiments—his appreciation of beauty and order in the universe, and his reverence for that first cause which must have produced the countless results that cannot

be attributed to mere chance. Any reader, whether scientific or otherwise, who will study the book in this spirit, will, unless he has already specialised in anatomy, derive great benefit from the information which he will acquire on this particular branch of science.

A TREATISE ON THE PROTOZOA.

A Treatise on Zoology. Edited by Sir E. Ray Lankester, K.C.B., F.R.S. Part i., Introduction and Protozoa. First fascicle. Pp. xxii+296. (London: A. and C. Black, 1909.) Price 15*s.* net.

THE publication of the present volume completes the account of the Protozoa, the other sections of which were dealt with in the second fascicle, which appeared in 1903. An introductory chapter from the pen of the editor is followed by a series of separate treatises by various authors. To Prof. Hickson has fallen the task of dealing with a number of organisms, grouped into the class Proteomyxa, many of which have been seen only once and have been so imperfectly investigated that practically nothing is known of their nuclear condition. The author has given a systematic account of the organisms, which he has arranged into five groups. The structure and life-history of a few of the better-known forms, such as *Plasmodiophora brassicae* (the cause of "finger and toes" in turnips), are briefly considered.

The section on Heliozoa has been written conjointly by the late Prof. Weldon and Prof. Hickson. A clear account is given of the structure, fission, and nuclear changes seen in these Protozoa, particular attention being devoted to the observations of Schaudinn and R. Hertwig on the nuclear phenomena presented by Actinosphærium and Acanthocystis. The reproductive processes of the former organism are carefully considered in view of the statement that self-fertilisation appears to be of normal occurrence, but the facts are capable of other interpretation, as is clearly shown in the discussion of the published observations. Mr. J. J. Lister has given an admirable account of the Mycetozoa, organisms which usually receive scant attention in courses of zoology, but which are here brought before the notice of teachers and students in a manner which compels attention to the interesting phenomena they present.

The Lobosa are described by Prof. Hickson in an article which might well have been of greater length in order to permit the more detailed treatment of the life-histories of some of the organisms considered. The author has changed the spelling of the now well-known name Entamœba to Endamœba, but there is surely no warrant for such an alteration, which is to be greatly deprecated.

Dr. Gamble's clear and comprehensive account of the Radiolaria is deserving of high praise, especially for the prominence given to the biology and physiology of these organisms. Thalassicolla is chosen as a type for description, following which the chief modifications in structure of the Radiolaria are considered. An account is given of the recent observations on somatic variation and on somatic and gametic dimorphism, while flotation, the central capsule, nuclear and reproductive phenomena, the skeleton and its biological significance, subjects in regard to which the Radiolaria present special features of interest, are well treated. The author fully discusses the relation of the yellow cells to the organisms. He points out that, though nitrogenous excreta are formed in abundance, there is no accumulation in most Radiolaria of excretory substances, the absence of which, it is suggested, is due to the action of the yellow cells, which, attracted to their host chemotactically, derive their nitrogen from the urea and uric acid which they find therein. Support is afforded to this view by the fact that masses of granules—the phæodellæ—which are regarded as excretory by Borgert, do occur in quantity in the one division of the Radiolaria (the Phæodaria) in which yellow cells are constantly absent. The yellow cells of Spumellaria and Nassellaria are bounded by a cell wall and leave their host on the death of the latter, but those of Acantharia have lost the power of independent existence; they have become assimilating granules and are transmitted from parent to offspring.

Dr. Willey and Prof. Hickson have given a useful account of the Mastigophora. A little more extended reference to the characters and life-history (so far as it is known) of flagellates, such as Lamblia and Trichomonas, which are found in man and other animals, would have been helpful to many readers. *Trichomonas intestinalis* is mentioned as occurring in the intestine of mice; its occurrence in man is not referred to. The authors reject the genus Cercomonas; they should have at least indicated to which genus the well-known species associated with man should be referred. In the description of Euglena we miss reference to Wager's observations on the nature of the base of the flagellum.

Dr. Woodcock's section on the Hæmoflagellata, which is a critical summary of the extensive literature of this subject, will be of great service to students of zoology and of medicine. The author strongly upholds the status of the kinetonucleus as a true nucleus homologous with the trophonucleus, the two being specialised for different functions; the kinetonucleus is not merely an extra-nuclear centrosome as held by Moore and Breinl. The section on the life-history of trypanosomes presents a clear discussion of this difficult subject. The author announces (in a footnote, p. 239) that during the investigation of the hæmatozoa of the chaffinch he obtained unmistakable evidence that the trypanosome and halteridium of the chaffinch are ontogenetically connected, thus supporting the observations of Schaudinn on the corresponding organisms in the little owl. Dr. Woodcock gives a brief account of the "Leishman-Donovan-Wright" bodies, which he regards as intimately related to Piroplasma on account of their nuclear dimorphism and mode of fission. Attention is directed in this connection to the recent accumulation of evidence in favour of the flagellate affinities of Piroplasma. The author's discussion of the nature of spirochætes is too brief to give him the opportunity of dealing in an adequate manner with this vexed question, but he is evidently of the opinion that they are not Protozoa. The article concludes with a useful list of the known natural hosts of trypanosomes and allied forms.

A short appendix is added by Mr. J. J. Lister on Chlamydomyxa and Labyrinthula. He considers that the former is not allied to the Mycetozoa, but rather to the fresh-water forms with filose pseudopodia classed under the order Gromiidea, while Labyrinthula is regarded as a colonial organism the units of which remain in connection by means of their pseudopodia. Both organisms may be regarded as related in one direction to the outlying members of the Gromiidea and in the other to the Heliozoa and Proteomyxa. In a final appendix there is a brief notice of the Xenophyophoridæ, which were formerly regarded as sponges, but which, through the labours of F. E. Schultze, are shown to be more nearly related to the Foraminifera, to which subdivision they are now provisionally referred.

Throughout the volume the systematic characters of each group and of its constituent orders and families are given, and each section concludes with a well-selected bibliography. This volume worthily upholds the high standard attained in its companion fascicle, with which it forms a comprehensive treatise on the Protozoa of outstanding excellence.

THE TEACHING OF OPTICS.

Cours de Physique conforme aux Programmes des Certificats et de l'Agrégation de Physique. By Prof. H. Bouasse. Quatrième Partie: Optique. Étude des Instruments. Pp. 420. (Paris: Ch. Delagrave.) Price 13 francs.

PROF. BOUASSE has pronounced opinions on the subject of the teaching of optics, opinions which he is vigorous in defending—a defence which consists in a spirited attack on those who differ from his views—and in the application of which to the development of his subject he undoubtedly shows originality and independence of thought. Into the merits of his quarrel with the Sorbonne we have no inclination, nor is this the place, to enter; but his views on the presentment of optical theory and on the relative value of the "ray" and "curvature" methods touch on a question which has been discussed a good deal of late in this country, and are in themselves well worthy of attention.

The advocates of the "curvature" method of teaching optics proceed on the assumption that this method is based on a close representation of the actual physical phenomena, and that hence, if it can be applied in a simple manner to the deduction of the ordinary results of geometrical optics, it must necessarily and from the nature of the case have an advantage over any more artificial method. The curvature method undoubtedly has advantages, but they do not rest on the assumption thus made. The ray and curvature methods are alike based on an ideal representation of certain characteristics of the phenomena, and the proposition that the latter mode of representation has a greater physical significance than the former at least admits of argument. But whatever opinion may be held on this point, it will hardly be urged that the ray method, or an equivalent procedure, can be dispensed with in the handling of many not particularly advanced optical problems, and the view that it is desirable to limit the student to the one method of attack seems to be founded on a higher estimate than usual of his average stupidity. We learn through Prof. Bouasse that there exists at the Sorbonne a course of geometrical optics in which "rays of light" are not so much as mentioned. We can but trust that his information is incorrect.

The author himself urges strongly, whether from the physical or the purely ideal aspect, the importance of the ray in optical theory. He points out that the wave surface is defined by Fermat's principle of least distance independently of any theory as to the propagation of light; that the caustic, which is a locus of concentration of energy, has the immense advantage over the wave surface that it is directly determinable by experiment, and that it is this which is first naturally met with; but especially he insists on the convenience and clearness of the ray theory as a first approximation in the representation of the phenomena.

He is at some pains, too, to expose the inherent absurdity of the practice of avoiding, in optical and physical text-books, the use of such elementary mathematics as is really essential to the development of the subject. He points out that, so far as the use of certain mathematical functions is concerned, any person of average ability can readily make himself acquainted with their definitions and elementary properties sufficiently, at the least, to be able to use intelligently tables of their values. As to the general knowledge of mathematics required, he insists—with Prof. Perry—that it is the mathematicians who must mend their teaching, and that it is not the part of the physicist to attempt to make bricks without straw. His final plaint on this subject, "Je perds mon temps; les mathématiciens sont pleins de bonne volonté pour satisfaire nos désirs, mais ils ne les comprennent pas," is not, perhaps, altogether without application in Great Britain.

The views of Prof. Bouasse above referred to are laid out at some length in the preface, and, apart from their intrinsic interest, are pertinent to the present notice as indicating two main features of the book—adherence to the ray theory as the foundation of the earlier chapters on geometrical optics, and the use of rather more mathematics than is perhaps usual, where necessary for concise expression, and in a form which, we think, will appeal to the intelligent student.

The volume is one of a series of advanced physics text-books written to meet the requirements of the French public examinations. It suffers inevitably from many of the disadvantages of the examination text-book; it has, on the other hand, more than an average share of its merits. It is not a study of optical instruments, nor is it a text-book on practical optics; it deals with the theory of geometrical and physical optics so far as this is necessary as an aid to the study of optical instruments. Electro-optics is expressly reserved for another volume. On the other hand, many matters usually treated under the

heading of meteorological optics—halos, the rainbow, coronas, scintillation—are dealt with, although necessarily very incompletely, yet almost too fully in view of the character of the book. Indeed, although for the first principles of the subject one is referred to an elementary treatise (this volume opens with a general exposition of the Gauss theory), its chief fault lies in the extent of the ground covered. On every topic it leaves the reader with a tantalising thirst for more information. It is, perhaps, only on the theory of caustics, here treated with exceptional fulness, that one comes away satisfied.

This is only to repeat that it is a text-book designed for class use. Such a book, which treats the theory from the point of view of a close interest in the practical questions involved, is undoubtedly stimulating and of high value in the hands of a capable teacher.

CHEMICAL CRYSTALLOGRAPHY.

Chemische Krystallographie. By Prof. P. Groth. Vol. ii., Die anorganischen Oxo- und Sulfosalze. Pp. vii+914; with 522 figures. (Leipzig: Wilhelm Engelmann, 1908.) Price 34 marks.

WITH this, the second, volume, Prof. von Groth completes that half of his great work which deals with inorganic salts. The fact that it has appeared within two years of the publication of the first volume is, even when every allowance is made for the assistance which we believe has been placed at his disposal, eloquent testimony to the remarkable industry displayed by the author. To absorb, digest, and arrange in orderly sequence such a mass of data is a gigantic task, and such rapid progress demands unremitting labour and indomitable perseverance. To the great services rendered by Prof. Groth to mineralogy and crystallography, and to those pre-eminent qualifications which mark him out as the obvious man to plan and carry through this important work, Dr. Tutton, in writing of the opening volume (NATURE, 1907, vol. lxxv., p. 529), has referred in graceful and felicitous language. The present writer, who was privileged to serve his novitiate in mineralogical science in Prof. Groth's laboratory at Munich, feels it would be presumption on his part to add anything to those words beyond his cordial agreement with them.

To state that Prof. Groth's "Chemical Crystallography" meets a long-felt want is but a trite and inadequate way of expressing the situation. For years past, students of crystallised substances which are known to occur in nature have, in the well-known and invaluable "System of Mineralogy," which Prof. E. S. Dana prepared as the sixth edition of his father's successive treatises on mineralogy, had before them a coherent arrangement of minerals based upon their chemical and crystallographical properties, and they could readily ascertain what precisely was known with regard to the crystalline characters of any species. Prof. Groth himself has provided an admirable bird's-eye view of the grouping of minerals in his handy "Tabellarische Übersicht der Mineralien," and Prof. C. Hintze is rapidly nearing the final parts of his exhaustive "Handbuch." But the researches of chemists in the laboratory have brought about the formation of a vast number of crystallised substances which have never been found in nature, mostly because of their want of durability for some reason or other, and every year the need for a work that should group together all known crystallised substances, however formed, and give full details of their physical characters, has grown more urgent.

The general arrangement of the substances is exactly the same as that devised by the author in the "Tabellarische Übersicht" mentioned above. The nomenclature is chemical, but the mineral names of the natural species are given in brackets. For each species are given as far as possible the physical characters, viz. the specific gravity; the morphological constants—the axial ratios and the interaxial angles when differing from right angles—the type of crystalline symmetry, the mode of twinning, the directions of cleavage, and the indices of the forms which have been observed; the optical characters, including the principal indices of refraction for light of certain standard wave-lengths, the orientation of the optical indicatrix with regard to the crystal, the angle between the optic axes in the case of biaxial crystals, and occasionally the alteration in these constants caused by a rise of temperature. For artificial salts and mineral species recently discovered the information is somewhat amplified; the calculated and observed values of the principal measured angles are quoted, and illustrations of typical crystals are added, the authority for the determinations and the reference to the original paper being always stated. Dr. Tutton's classical researches upon certain salts of the alkali metals, potassium, rubidium, cæsium, and thallium, and of the ammonium radicle, may be cited as examples of an ideal crystallographical investigation; for the care in assuring purity of material, the high standard of the apparatus used, the pains taken in the observations, and the completeness of the determinations, they stand alone. But although it is rarely possible to obtain crystals large or perfect enough for such accurate work, it is not too much to say that at least the morphological constants of every crystallised substance should be determined, since such a determination, even when the dimensions of the crystals do not exceed half a millimetre, presents no serious difficulty with the instruments now available.

Prof. Groth prefaces each group with an introduction, in which, with his customary clearness of exposition, he discusses the relations subsisting between the component members, and indicates gaps in the data or doubtful points which call for further investigation. These illuminating discussions add greatly to the value and importance of the work, and impart to it an interest and a fascination that would be wanting in a dry compendium of figures and facts.

It would be impossible within the limits at our disposal to attempt any detailed discussion or give more than a broad outline of the contents of the present volume. It is devoted to the oxo- and sulpho-salts, and includes such important groups as cyanates,

nitrites, nitrates, perchlorates, carbonates, silicates, sulphites, sulphates, polythionates, borates, phosphites, and phosphates, and, of course, the groups analogous to each of those mentioned; the sulphates, with their companion compounds, fill more than a third of the volume. A complete index giving the chemical and mineral names is appended. G. F. H. S.

NATURAL HISTORY OF TIERRA DEL FUEGO.

The Birds of Tierra del Fuego. By Richard Crawshay. Pp. xl+158; illustrated. (London: Bernard Quaritch, 1907.) Price 3*l.* 13*s.* 6*d.* net.

IT was by accident and not by design that Mr. Crawshay visited Tierra del Fuego, and, spending six months there, has been able to give us this sumptuous natural history of a little-known land. His book was badly wanted, for the author is probably right when he doubts "if there is another land on earth concerning which more misconception prevails." From the description given it does not seem a very pleasant place to live in.

"It commonly freezes at midsummer. . . . There is the wind from the everlasting snows and glaciers, always blowing with terrific force and with cutting keenness, yet how invigorating and fragrant with forest and peat and seaweed."

Yet the author expresses himself fascinated by the country, and while allowing that it is no place for weaklings and for those who cling to luxury, he claims that, however rigorous the climate is, it is healthy. This seems to have been its character always, for Sir John Narborough is quoted as writing in 1670, "A man hath an excellent stomach here. I can eat foxes and kites as savourily as if it were mutton. Nothing comes amiss to our stomachs." This is saying a good deal.

Although the title of this fine volume would lead one to expect only an account of the birds, we referred to it just now advisedly as a natural history of the country. For the "preface" (which might perhaps have been more properly the "introduction") contains an excellent and most interesting account of the physical conditions of this remote spot, including the geology, botany (the flora is very much more extensive than might be imagined), the mammals (including the native races of man), fishes, insects, crustaceans, molluscs, &c. There appears to be only one reptile—a little green lizard—and no amphibian.

The birds dealt with in this work do not claim to represent every species occurring in Tierra del Fuego; but they are, the author believes, the most comprehensive collection yet made in the island, and include many recorded from there for the first time. Seventy-nine species are enumerated in the classified list or "index." The orders most numerously represented by species are Passeres, Limicolæ and Anseres. Psittaci and Pici are represented only by a single species. The woodpecker—a splendid scarlet-headed bird—does not seem to be common. The existence of a parrot in these high latitudes as reported by the early voyagers was for a long time discredited. It is common in flocks in the more open portions of the forest to the south of Useless Bay, but seems to be local and difficult to find. The majority of the species are, however, only summer visitors, and some of these we remember as winter visitors to Uruguay. Five species of goose visit the country or are resident therein, some of which "could hardly be numbered in figures short of millions." An account is naturally to be found of the race horse, loggerhead, or steamer duck, which has constituted one of the wonders of these waters from the time of the earliest navigators, and has been the subject of much controversy.

So little has been observed of the birds of Tierra del Fuego *in* the country that it was at first surprising to see so large a book on the subject. But the author has quoted very extensively from the writings of Azara, D'Orbigny, Darwin, Gould, and other voyagers and naturalists, although for the most part their accounts of the species treated of relate to other parts of South America and even more distant parts of the world. For instance, although the cosmopolitan barn owl is only doubtfully included, nearly six pages are devoted to it, and the article includes Waterton's well-known account of it in Yorkshire. In this way the author has given his readers a fairly complete and always interesting account of the birds on his list, a fact that will be much appreciated by those interested in birds and living in those remote regions into whose hands the book may by good fortune come.

The volume is well illustrated by twenty-one coloured plates of birds by Mr. Keulemans, and twenty-three plates of scenery and bird haunts, also a map.

OUR BOOK SHELF.

Handbook for Egypt and the Sudan. Edited by H. R. Hall. Eleventh edition, revised, largely re-written and augmented. Pp. xiv+613; with 58 maps and plans. (London: Edward Stanford, 1907.) Price 14*s.*

THE first edition of this work—"Murray's Egypt"—appeared so far back as 1847, and was a reprint of Sir Gardner Wilkinson's earlier book, "Modern Egypt and Thebes," which had been revised by that great pioneer in Egyptian studies so as to meet, so far as possible, the requirements of a guide-book. From time to time since 1847 additions were made to the original edition, and in 1873, and again in 1880, it was thoroughly re-cast by the Rev. Greville Chester, the Rev. W. J. Loftie, Mr. Mitchell, and Mr. Phené Spiers, the latter of whom contributed many new architectural plans. Then followed the editions of 1896 and 1900, edited and revised by Miss Mary Brodrick, with the help of Prof. Sayce and Capt. H. G. Lyons, the director of the Geological and Land Surveys of Egypt. Unfortunately, these last two editions—the ninth and tenth—contained numerous errors and were far from satisfactory, so it is now a pleasure to be able to record the appearance of a new edition, under the editorship of Mr. H. R. Hall, which fully maintains the high standard of Wilkinson's original "Handbook for Travellers in Egypt."

Mr. Hall has thoroughly revised the archæological part of the work. The old division into two parts has been abolished. Many paragraphs have been with advantage deleted and new ones inserted. Several sections have been re-arranged and re-cast, while

some—those on Cairo and Thebes, for instance—have been almost entirely re-written. A new section, necessitated by the opening up to tourists of the Upper Nile, deals with the Anglo-Egyptian Sudan, and thus we have, within the compass of a handy volume of 600 odd pages and a plentiful supply of maps and plans, a guide-book which will carry the traveller from Alexandria or Port Said to the frontier of Abyssinia and to the Uganda Railway and Mombasa. In a pocket of the cover Mr. Hall has added a small booklet of 35 pages of "Notes on the Arabic Language, with a Vocabulary of Words and Phrases," which ought to prove of much use to the amateur traveller.

In reading through the handbook we find that Mr. Hall has done the work on the archæological side most admirably, and there is little that he has added to the book which we should feel inclined to dispute. In his transliteration of the Egyptian hieroglyphs, however, we are sorry to note that he has adopted the unscholarly *tch* or *tj* for the serpent hieroglyph which, by English and German Egyptologists, is always rendered by *z* or *d*. In any future edition of the handbook that may be issued, we hope the publishers will see that the section on geology is brought up to date, for in the edition before us no mention is made of Dr. Andrews' or Dr. Beadnell's recent discoveries in the Fayum, nor can we find any mention of the new Geological Museum, with its fine collection of fossils and minerals, now housed in a building in the garden of the Ministry of Public Works.

Index Kewensis Plantarum Phanerogamarum. Supplementum tertium nomina et synonyma omnium generum et specierum ab initio anni MDCCCCI usque ad finem anni MDCCCCV complectens. Ductu et consilio D. Prain confecerunt herbarii horti regii botanici Kewensis curatores. Pp. iii+193. (Oxford: Clarendon Press, 1908.) Price 28*s.* net.

WORKERS everywhere in systematic botany will welcome the appearance of this, the third, supplement of the Kew Index. We now have a register of the generic and specific names of seed-plants up to and including the year 1905—a boon to workers which only those can adequately appreciate who remember the period when there was no Kew Index. The supplement follows closely the plan of the original work—would that those concerned could be persuaded to make one small but valuable improvement! namely, the inclusion of the date of publication in all the references to the original descriptions, as is now done only in the case of periodicals.

The Index and its previously issued supplements are so well known and so generally used that a notice resolves itself into a few remarks and more or less petty criticisms. Thus we note that a fair number of genera are recognised which in the Index or its earlier supplements were regarded as synonyms; in these cases the genus-name formerly accepted is added in brackets followed by the letters I.K. Similar quotations, followed by the letters D.T. & H., look more mysterious, though, presumably, the valuable reference-list of genera by Dalla Torre and Harms will occur to most on reflection. In the absence of explanatory notes, it is not always easy to understand the reasons adopted for the recognition of some genera and not of others; why, for instance, is Limonium still relegated to synonymy as equivalent to Statice, Linn.? Linnæus included under Statice the sea-lavenders, for which the name has until recent years been generally retained, as well as our sea-pink (Armeria). But Miller in 1759 followed Tournefort in keeping the name Limonium for the sea-lavenders and regarding the sea-pink as a distinct genus, Statice, and it is generally agreed that the two genera are distinct. It is, of course, unfortunate that Statice should have been used so long for Limonium; Messrs. Groves, however, in the recent edition of Babington's manual, have accepted the original position, which is therefore no longer strange to British botanists. Limonium, by the way, is cited as of Tournefort, who established the genus before 1753, which is now taken as the starting point of botanical nomenclature; the genus should be credited to Miller (1759). Again, four species of Crassocephalum, described by S. Moore, are referred to Gynura; this reference may be justifiable, but it would be useful to know what standard has been adopted, especially in cases where there is no recent monograph of the family to which the genus belongs.

The supplement forms an interesting review of progress in systematic botany in the first five years of the present century, and is a tribute to the energy and devotion of botanists engaged in this branch of the science. A. B. R.

Die Metamorphose der Insekten. By Dr. P. Deegener. Pp. 56. (Leipzig and Berlin: B. G. Teubner, 1909.) Price 2 marks.

THIS is an exceedingly elaborate discussion of the nature of the various processes involved in the transformations of insects. We should have preferred to see it in larger book-form, with headings and text-illustrations; but reference to the subjects discussed is facilitated by a table of contents prefixed to the work. The chief problems are, of course, presented by insects with complete metamorphoses, in which most of the larval structures are entirely dissipated during the pupa-state, and new ones formed for the use of the imago, whereas in the case of insects with incomplete metamorphoses the organs of the larva are gradually modified into those of the imago. It may be useful to condense Dr. Deegener's classification of larval organs:—

(1) Primitive organs. Those less complicated in the larva than in the imago; those about equally developed in larva and imago; and those wholly absent in imago.

(2) Organs rudimentary in both larva and imago.

(3) Organs inherited by the imago from the larva.

(4) Organs acquired by the larva independently of the imago, or which occupy a subordinate position in the imago. (Provisional organs of the first class.)

(5) Organs common to the larva and imago, but which follow a different course of development in each stage. (Provisional organs of the second class.)

(6) Primary organs, the development of which is retarded during the larval state.

Dr. Deegener points out that the larva is scarcely destitute of any organ present in the imago, whereas many organs present in the larva are wanting in the imago. Hence he concludes that the larva, as such, presupposes the pre-existence of the imago, and that the imago is phylogenetically older than the larva.

The origin of insects from lower forms is then discussed, and Dr. Deegener suggests that they have originated in a primitive Campodea-form, which has developed in one direction towards the imago and in another towards the larva. Other questions discussed are the various processes of metamorphosis, and the sexual relations of larvæ.

We have rarely seen so small and unpretentious a book which contained so much matter of scientific importance, and it has been impossible for us to do more than direct attention to a few salient points in this brief notice. W. F. K.

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.]*

"Structural Geography."

I MUST thank the reviewer of my "Structural Geography" in NATURE of March 11 for pointing out the accidental omission in printing of the red line that should have occurred over the course of the Apennines (Plate XVI.). If he thinks that Fig. 97 is really likely to hurt the feelings of the Polynesians, I may replace it by one with a more pleasing expression; but the other suggestions for the improvement of any possible second edition, which fill nearly three columns of NATURE, I cannot accept. Thus the use of isobaths instead of actual figures on Figs. 37 and 38 would obscure the lessons those figures were inserted to teach. Where, as on Fig. 41, isobaths seemed more useful, they were used.

The "strange blunder" in the figures on pp. 84 and 85 exists only in my critic's imagination. In both diagrams the wind is correctly shown as blowing at a low level out of the high-pressure area, and not into it. This movement, of course, requires the replacement of the air by a high-level inflow, and that is also indicated on the diagrams. In support of this well-known fact reference may be given to a work on elementary physiography, which should be regarded as of authority by NATURE. It says, p. 326:—"A barometer stands high . . . when in any way an upper current sets in towards a given area. . . ."

The reviewer remarks that it is not clear why certain branches of the subject are omitted or merely mentioned. That course was adopted deliberately. The object of the book was to supplement existing text-books, and, as stated in the preface, I omitted various "questions that are adequately treated in current elementary text-books."

My critic objects to the view that the Cotswold and Chiltern Hills show the geographical grain of England, as he says those hills are sculptural rather than structural; but the sculpturing in both cases has been determined by and displays the structural grain of the country.

The reviewer devotes most attention to Plate XVI., a diagrammatic map of Europe. He complains that the European plain is shown extending to County Clare, disregarding the Welsh and Wicklow Hills; but his statement is not correct. The name European plain is written only across Germany and Russia, and the text states (p. 132) that it is "the eastern extension of the eastern plain of England." The site of the Wicklow Hills is left white, and the boundaries of the English and Irish plains are not marked, for they were not needed for the map and were left unelaborated. No intelligent student is likely to include all the area left white in that map, including the Bay of Biscay, the Atlantic Ocean, &c., as belonging to the European plain.

Objection is also taken to the reference in that map to the Scottish Highlands and Scandinavia as parts of an Archæan plateau; but that they belong to a dissected plateau is explained in reference to Scotland on p. 105, and illustrated by a photograph (Plate XIII.), which, as the credit is due only to the photographer and the publishers, I may say is excellent. Then follows an objection to the Armorican and Variscan Mountains being differently coloured from the Central Plateau of France. That plateau has such a different geographical history that I think it is advisable to indicate its special importance by a different shade. The reviewer quotes the new Geological Survey map of France and some borings to confirm the connection of the Central Plateau and the Armorican Mountains. He might also have quoted the text of the book under review (p. 133):—"The southern border [of the Armorican Mountains] was to the south of Brittany and extended through the Vendée *into* that mass of old rocks known as the Central Plateau of France." The reviewer also attacks the representation of Spain on this map. It shows the essential feature in the Spanish Peninsula, which I still think it was desirable to show, viz. the divergence of strike between the mountains south of the Guadalquivir fault and that of the western Meseta. The Asturian nest and its "confocal parabolic curves" would not have made for clearness. His severest criticism of this map of Europe relates to Asia Minor. He notes one difference between the representation of Asia Minor on the maps of Europe and Asia. He could have noted others, for on the map of Europe no attempt was made to show the structure of Asia Minor, as it was included more suitably in the map of Asia (Plate XIX.), which includes both Naumann's Pontic and Tauric Mountains. (The reviewer refers to Naumann's paper in the *Geographische Zeitschrift*, 1896; anyone interested in the question will find a simpler statement of that author's view, in English, in his paper before the Geographical Congress of 1895, Report, 1896, pp. 662–8.) These features were omitted from Asia Minor on the map of Europe; all that was inserted there was a dotted line to show both the continuation of the Cyprus branch of the Tauric line and its passage into the mountain knot south of the Caucasus. The line would no doubt have been better if, as in the map of Asia, the curve at its eastern end had been somewhat sharper.

In the explanation of Fig. 83 it is pointed out that Japan is exaggerated in width, and a student may be trusted to apply that remark to the sea beside Japan.

My critic apparently doubts the Mongolian affinity of the Eskimo. It is true that some authorities regard the American aborigines as a distinct race-group from the Mongolian, but there is ample authority for the other view. The difference in opinion is indicated by the warning that the American Indians are "generally regarded" as a Mongolian race. No doubt the Eskimo of Greenland differs markedly from the typical Mongolian. Their extreme dolichocephaly is one of the best-known facts in American anthropology; but as this character diminishes to the west, the view that the Eskimo are a modified variety of the American section of Mongolians is at least reasonable. The Caucasian affinity of the Australian aborigines seems to me better established, and the view has been gaining ground since its first authoritative advocacy by Dr. A. Russel Wallace, who justly claims it as one of his chief contributions to science.

The "so-called tetrahedral theory" has been growing steadily into favour since 1899, when I happened to support it in a lecture to the Geographical Society. Although its advance has probably been hampered by my crude explanations, I am quite satisfied with its progress, otherwise I should not have included it in a text-book. It seems to me quite unnecessary to refer to the earlier theories, though perhaps my critic would have been less displeased if I had referred to one later theory.

One great difficulty in writing elementary text-books is the necessity for a shortness that must often seem dogmatic, and for unqualified statements that are therefore liable to the charge of crudeness; but, fortunately, one can usually trust as safely to the common sense of students and teachers as to the fair appreciation by critics of the difficulty of presenting in brief statement and graphic diagrams the complex and confused data that have to be summarised in geographical text-books.

J. W. GREGORY.

4 Park Quadrant, Glasgow, March 16.

I FULLY acknowledge that the diagrams on pp. 84 and 85 are correct if taken by themselves, but in the explanatory letterpress given below Fig. 57 it is stated that the distribution of pressure is "owing *to the condensation of the cooler air over the sea and the expansion of the warmer air over the land.*" The necessary inference is that the area over the land is one of low pressure and that over the sea of high pressure, with the winds blowing into the latter. On examination of the diagram I see that this is opposed to the inference which may be drawn from the course of the "level" of equal pressure, and hence I conclude that the error arises from a misprint, which may be easily set right by transposing the words "sea" and "land" in the statement I have put in italics.

The omission of certain branches of the subject called for comment, because it is precisely these which, as a rule, are not adequately treated in English text-books. The ordinary text-books are out of date, and I cannot but think an excellent opportunity of supplementing their belated information has been missed. It would not prove a very easy task, however.

The map on Plate XVI. was criticised independently of the letterpress, because a map should speak for itself, and in some detail, because it represents that part of the world most familiar to us. I must confess that the more I study this map the less I like it. I do not know why the Guadalquivir fault is more "essential" than many other features of Spain, and the true form of the Meseta, which it helps to define, would have been better shown if the dislocation which forms the eastern boundary of the Meseta had been introduced. The "grain" of the land, shown by heavy blue lines like those used to express the Caledonian trend in Scotland, and not black like the Armorican in Brittany, is not correctly given even by those lines which are cut off by the fault; if they had been more precisely indicated and the Asturian curves added, a definite system, somewhat resembling a nest of parabolas, would have made itself manifest. The fundamental structure of the Meseta would then have been visible at a glance. Had only as much of these lines been introduced as is required to show their relation to the fault, the only objection that could have been raised would have been as to their incompleteness; as it stands, my comment that the map fails to express the true structure of Spain is a mild way of stating the facts. Passing to the Armorican peninsula, which, thanks to the observations of Barrois, is better known, we again find the trend lines out of drawing. It is difficult to know on what principle some have been omitted and others introduced; the omission does not make for clearness, and in this case, as in that of Spain, a truthful rendering would have simplified the facts by making them more intelligible. If the lines of Armorica had been properly generalised, we should have seen one of the most important of them (*axe de Cornouailles*) pointing straight at the Central Plateau, and the introduction of trend lines in the Central Plateau would have made clear the relation on which I insisted when pointing out that the connection of the trend lines of Brittany and the Central Plateau is no hypothesis, but a definitely known fact.

As it stands on the map, I still think the legend "Archæan Plateau of North-Western Europe" written across a tract showing strong Caledonian folding is confusing, and I cannot agree that anything in the subsequent history of this Central Plateau or of Spain calls for its distinction by colour from the rest of the Hercynian system; I am the more disposed to object to this colour scheme, since the same colour is used for Spain, the Central Plateau, and the so-called Archæan Plateau of the north, thus introducing a second source of confusion. It was not complained that the structure of Asia Minor is omitted from the map which bears the title "Europe," but that an important line common to Europe and Asia is wrongly drawn. The Cyprus-Taurus line is one of the most conspicuous on the map, and is rendered all the more so by the omission of other lines in Asia Minor. That part of it (in Transcaucasia) which is most erroneously drawn is not dotted in, but continuous; but even in Europe it does not run true, the relation of the Peloponnesus to Crete being inexactly indicated. In the map of Asia greater care is exercised over this and related lines, but if Oswald's account of Armenia is correct there is still room for improvement. I am unaware of the existence of a mountain "knot" south of the Caucasus.

The objection to the diagram section shown in Fig. 83 is that the vertical scale is somewhere between 50 and 100 times the horizontal. Geologists have long agreed that such exaggerations are to be deprecated.

Assuming that the Eskimo are modified Mongolians, how does the action of the environment, as asserted by the author, account for the chief modification which distinguishes them, that is, the elongation of their heads? and to this I may add now the length of their face and the narrowness of their nose. The question involved is the direct action of the environment, and in my opinion schoolboys should not be indoctrinated with notions of this kind. Again, admitting that the Australian aborigines are related to what the author calls "Caucasians," what reason is there for the assertion that they are "modified Caucasians"? This is to invert the order of facts. Numerous important anatomical characters stamp these people as a primitive race. The most plausible speculation would assign them a position near the root of the "Caucasian" stem, regarding them as an unprogressive survival of an ancestral stock rather than as one of the higher races "modified by adaptation to life in an arid region." But why introduce these jejune speculations at all?

The real gravamen of the criticism to which objection is taken lies in the remark that the author has not been sufficiently careful to distinguish between opinion and fact. The treatment of the whole question of the form of the earth is open to this charge. I do not understand the cryptic remark which the author interjects in his reference to this matter, but I may add that, in the opinion of competent mathematicians, there is no sound physics or dynamics at the back of the "tetrahedral" theory. It has proved wholly unfruitful, and has made no real scientific progress. That it has grown in popular favour is probably true, and its dogmatic presentation in a school text-book is calculated to advance it still further in this kind of progress; I cannot believe that this will be wholly to the satisfaction of the author, since I credit him with a juster appreciation of the responsibility which attaches to the instruction of youth. THE REVIEWER.

The Gases of the Ring Nebula in Lyra.

EVERY friend of astronomical research has learned with great pleasure the news that Prof. Wolf, of Heidelberg, has succeeded in proving by spectrum photography that the well-known ring nebula in Lyra consists of four different gases, which, owing to the rapid rotation of the ring, have been separated and concentrated in four different layers. On using the image of the ring itself instead of the slit of a spectroscope, photographic images of the rings corresponding to the different spectral lines were obtained on the plates, but the dimensions of the rings were found to be different and to correspond to four gases of which the ring nebula is composed. The smallest ring, A, representing the innermost part of the ring, is composed of an unknown gas; the next largest ring, B, is composed of hydrogen; the next largest ring, C, consists of helium; and the largest ring, D, consists of an unknown gas. The question arises, What is the nature of the two unknown gases?

Bredig found in 1895 that if a mixture of two gases is subjected to centrifugal rotation, the relative concentration of the gas of higher molecular weight (*i.e.* higher density) increases with the radius of rotation. We must, therefore, assume that in the series of our four gases A, B, C, and D, the density or molecular weight increases from the smallest value of A to the largest value of D, and this is, indeed, proved by the fact, found by Wolf, that the gas B consists of hydrogen, molecular weight=2·016, and the gas C of helium, molecular weight=3·96. From this it follows that the gas concentrated in the smallest zone of the ring A must have a smaller molecular weight than hydrogen. This gas has not yet been isolated upon our earth, but its existence and atomic weight were predicted by the great Russian chemist and natural philosopher Mendeléeff in a popular article published in Russian in 1902, the essential part of which was translated into English in 1904 under the title "An Attempt towards a Chemical Conception of the Æther."

Mendeléeff shows that if the elements of the rare or inactive gases He, Ne, Ar, Kr, and Xe, discovered by Rayleigh, Ramsay, and Travers, are placed in the well-known nought-group, we must expect the existence of elements of the same group possessing smaller atomic weights than helium and hydrogen. Mendeléeff assumes that in the first horizontal series of the system, on the left side of, or before, hydrogen in the nought-group, where

we find hitherto an empty place, an element stands possessing an atomic and molecular weight of 0·4, and he adds that this element might be identical with Young's "coronium." This part of the periodic arrangement is:—

	Groups	
Series	0	I
1.	? = 0·4	H = 1·008
2.	He = 4·0	Li = 7·00

As there must be a definite ratio between the densities of the four gases A, B, C, and D and their radius of rotation corresponding to their maximal molecular concentration, it is not impossible that from the data obtained by Wolf the density of the lightest gas, *i.e.* its molecular weight, which must be identical with its atomic weight, might be calculated. As regards the heaviest unknown gas, D, if this is not a gas of the helium-argon group we may be allowed to point out that the existence of a gas possessing a larger atomic weight than hydrogen and a smaller atomic, but a larger molecular, weight than helium is not absolutely excluded.

BOHUSLAV BRAUNER.

Bohemian University, Prague, February 27.

On the α Rays from Radium B.

A RECENT number of the *Physikalische Zeitschrift* (x., 46, 1909) contains an article, by Frederic A. Harvey, in which he states that radium B gives out α particles, the ionisation range of which in air lies between 2·6 mm. and 3·0 mm. In investigating these short-range α particles he used a modification of the method employed by Bragg and Kleeman (*Phil. Mag.*, x., 318, 1905), but on account of the limited range of the radiation he did not use a cone of rays.

Some time ago the writer (*Phil. Mag.*, xi., 806, 1906) investigated the same subject by an entirely different method, and reached the conclusion that radium B did not give out α particles with sufficient velocity to ionise the air. I have recently repeated Harvey's experiment, but have been unable to get any indication whatever of the presence of short-range α particles. In addition to this, I have employed a third method, which eliminated most of the difficulties inherent in the previous one.

The principle of the method is very simple, and involves no change in the position of the testing vessel or wire during the experiment; it is based on the fact that the range of the α particles is increased by reducing the pressure of the air. The two plates of my testing vessel were placed 5 mm. apart; the lower one, which was of wire gauze, was 5 mm. above the active wire. Now, if none of the α particles present had a range in air at atmospheric pressure of less than 10 mm., then the ionisation current should vary as the pressure. If, however, radium B gives out α particles having a range of about 2·5 mm., and if they produce about the same number of ions per cm. of path as the α particles from radium C, then, after the pressure is reduced to half an atmosphere, the short-range α particles will begin to enter the testing vessel, and the ionisation will remain constant until the pressure has fallen to a quarter of an atmosphere. At this point the path of these α particles will extend through the entire depth of the testing vessel, and as the pressure is still further decreased the ionisation will again become proportional to the pressure.

The results of this experiment have shown that the ionisation in the testing vessel is approximately proportional to the pressure of the air from 76 cm. to 3 cm. It would, therefore, seem fair to conclude that there was not present on the active wire any substance giving out α particles which had a range in air from 1 mm. to 5 mm.

It should also be pointed out that Harvey's reason for attributing the short-range α particles to radium B is at fault. He assumes that after 140 minutes radium B has practically disappeared, and that only radium C remains. The theory of radio-active transformations, however, requires that, after 140 minutes, the number of atoms of radium B and radium C changing per second shall be very nearly the same.

HOWARD L. BRONSON.

McGill University, Montreal, March 20.

British Association—Winnipeg Meeting.

IT is becoming more and more noticeable at the meetings of the association that communications are read which are of special interest to members of sections other than that to which each of the papers happens to be presented. In fact, there is little doubt that interests are now far too much subdivided at our meetings, and that one of the main purposes of the association is therefore unfulfilled. Many of us have felt the desirability of associating sections for the consideration of topics of common interest—not merely for set debates.

I am glad to say that the arrangement is being made that at Winnipeg Sections A and B shall sit together on the Friday; Sections B, K, and the Subsection of Agriculture on the Monday; Sections B and I on the Tuesday. *Wheat* is to be the main subject of consideration on the Monday, and *food* on the Tuesday. It is hoped that it will be possible to treat these two important topics somewhat fully, so as to present, in abstract form, a clear statement of our present state of knowledge, and thereby guide public opinion as well as influence inquiry.

HENRY E. ARMSTRONG.

Fluorescence of Lignum Nephriticum.

MUSSCHENBROEK, referred to by Mr. Shaxby in NATURE of April 1 (p. 128), is evidently quoting from Boyle's memorable experiment, nearly a hundred years earlier. Mr. Shaxby will find it in the fifth volume of Boyle's works as follows:—

"If you make an infusion of *Lignum Nephriticum* in spring water it will appear of a deep colour like that of oranges when you place the vial between the window and your eye, and of a fine deep blue when you look on it with your eye placed between it and the window" ("Experimenta et Observationes Physicæ").

The history of the discovery is so fully dealt with in Tyndall's well-known lectures on light that it is surprising that anyone should imagine that Sir David Brewster was the first to observe fluorescence.

The *Lignum Nephriticum* is the Indian horse-radish tree, still cultivated for its fruit, which is eaten as a vegetable or pickled. The root has a flavour similar to that of horse-radish, and its title, nephriticum, is derived from the belief of the old pharmacologists that it was useful in cases of disease of the kidneys.

CHARLES E. BENHAM.

Essex County Standard Office, Colchester, April 3.

The Ancestry of the Marsupialia.

IN the notice (NATURE, December 24, 1908) of Prof. A. A. W. Hubrecht's paper on the early ontogeny of the Mammalia, the writer states that the view adopted by Prof. Hubrecht, according to which the Metatheria are the descendants of placental ancestors, is in direct opposition to my own. May I be permitted to correct this statement, and to point out that it is just this view which I have all along advocated, and still hold? As a matter of fact, the idea that the Metatheria and Eutheria may best be regarded as the divergent branches of an ancestral placental stock was first definitely expressed in a joint paper by Prof. J. T. Wilson and myself (Quart. Journ. Micros. Sc., vol. xxxix., p. 579).

JAS. P. HILL.

The Zoological Laboratory, University College, W.C., March 24.

I TAKE Prof. Hubrecht to mean that the Didelphia (Metatheria) are descended from Eutheria, which is what Prof. Hill, in his own letter, refuses to admit.

THE WRITER OF THE NOTE.

ARCHÆOLOGICAL RESEARCHES IN GUATEMALA.[1]

THE Peabody Museum of American Archæology and Ethnology of Harvard has already rendered signal service by publishing the results of Mr. Teobert Maler's journeys and researches among the ruins of ancient Indian towns and cities on the banks of the River Usumatsintla and the adjacent region. We are now favoured with the first instalment of the account of Mr. Maler's last expedition, describing the ruins of Yaxhá, Naranjo, &c. Although the expedition commenced with the explorations of the ruins of Tikál, the records of the second part of this expedition are given first, and the account of the exploration of Tikál is to be published later. However, there is no lack of interest in this first instalment, and Mr. Maler's photographs of the sculptured monuments are as excellent as those he made of Seibal, Piedras Negras, Yaxchilan (Menché), which is saying that they are as good as it is possible to make them.

Before passing on to the account of his discoveries, we must congratulate Mr. Maler (who commenced his connection with tropical America as an officer in the service of the Emperor Maximilian) on his pluck and endurance in undertaking and carrying to a successful issue such an arduous enterprise in the years 1904–5. He is, indeed, the well-tried veteran of Central American archæological exploration. Mr. Maler passes lightly over his hardships and discomforts, yet it needs but little personal experience to appreciate how great the discomfort can be in travelling through the low-lying and frequently flooded forests of northern Guatemala; but Mr. Maler's enthusiasm for his work and knowledge of the natives would carry him over obstacles which would daunt and discourage many a younger man. Food in that country is always scarce, and workmen to accompany the traveller are most difficult to obtain.

After completing his investigations at Tikál in November, 1904, Mr. Maler returned to the east end of Lake Petén and struck through the forest to the east for a distance of about fourteen leagues, following, when possible, the paths of the "chicle" gatherers, until he reached the shores of the Lake of Yaxha. Chicle is the gum which exudes when an incision is made in bark of the Chico Sapote tree, and is used as the basis of American chewing-gum. It is curious to note the complete demoralisation that chicle-hunting has entailed on the very scanty population of Petén. "No one will plant a milpa (a maize field), and even the poorest ragamuffin proudly refuses to do any work, saying 'I am a Chiclero and have no need to work for anyone.' The result is that a general famine occurs nearly every year in Petén, which would otherwise yield an over-lavish abundance. Hence all the Chicleros are poverty-stricken, and, being heavily in debt, from which they never free themselves, they no longer have huts or milpas and no regular wife or children; for this unsettled life in the forests, interrupted occasionally by debauches in this or that village, puts even the most unpretentious form of family life out of the question."

On an island named Topoxté, in the lake of Yaxhá, Mr. Maler discovered the remains of one temple of considerable size and several other buildings, and secured photographs of the fragments of some sculptured stelæ. Then directing his attention to the north shore of the lake, he explored a long line of ruined temples and other buildings extending for a distance of more than three kilometres, and found the broken remains of ten sculptured stelæ.

Mr. Maler makes a note of the fact that the waters of Lake Yaxhá have risen at least one metre during the last twenty-five years, and that the level of the water in the lake of Petén Itzá also shows a considerable rise during that period.

In January, 1905, Mr. Maler left Yaxhá for Benque Viejo, within the boundary of British Honduras, and in February returned through the forest to the ruin known as Naranjo, previously unexplored. This was indeed a considerable discovery, as the ruins are very extensive, and Mr. Maler was fortunate in discovering forty-three stelæ, many of them in good preservation and adorned with sculptured figures and hieroglyphic inscriptions. Unfortunately, the buildings are far advanced in ruin, and none of the rooms could be made available for habitation, and so Mr. Maler had to seek shelter during the three months of this stay in a small cave, and here, during the night time, he developed the splendid series of photographs which accompany his report.

FIG. 1.—Naranjo: Stela 21, South Side.

Two of these photographs are here reproduced, one to show the excellence of the sculpture (Fig. 1), and the other (Fig. 2) to show the importance of the inscriptions and to emphasise the disappointment which must always be attached to the examination of carved inscriptions when photography alone is relied on for recording them. The inscription is weather-worn, but it is sure to be as perfect a photograph as could be obtained in the surrounding conditions, yet it would not be possible to analyse the inscription from this record alone. Paper moulds or squeezes are so perfectly suitable for recording sculpture of this character, and the Peabody Museum has already secured such a fine collection of casts of inscriptions by this method, that it is to be hoped they will do justice to Mr. Maler's discoveries by sending an expedition to make paper moulds of all the sculptures and inscriptions for careful study by the well-qualified staff of the museum.

In digging round the fallen stelæ, several of the curiously shaped flint objects were unearthed like

[1] Memoirs of the Peabody Museum of American Archæology and Ethnology, Harvard University. Vol. iv., No. 2. Explorations in the Department of Petén, Guatemala and Adjacent Region. By T. Maler. Pp. 55–127+(14–44) plates. (Cambridge, Mass.: Published by the Museum, 1908.)

those discovered by Dr. Gann in a similar position in the ruin near Benque Viejo (Proc. of the Society of Antiquaries, May, 1895), and this fully establishes the connection of these curious objects with the builders of these now ruined cities.

On returning to British Honduras, at the frontier village of El Cayo Mr. Maler met Mr. Blancanaux, a well-known collector of natural-history specimens, who told him that in the year 1882 he had included among specimens forwarded from the Island of Cozumel to the British Museum, two ancient maps of Yucatan, drawn on bark or agave paper. Careful inquiries have been made at the British Museum, both at Bloomsbury and South Kensington, but no

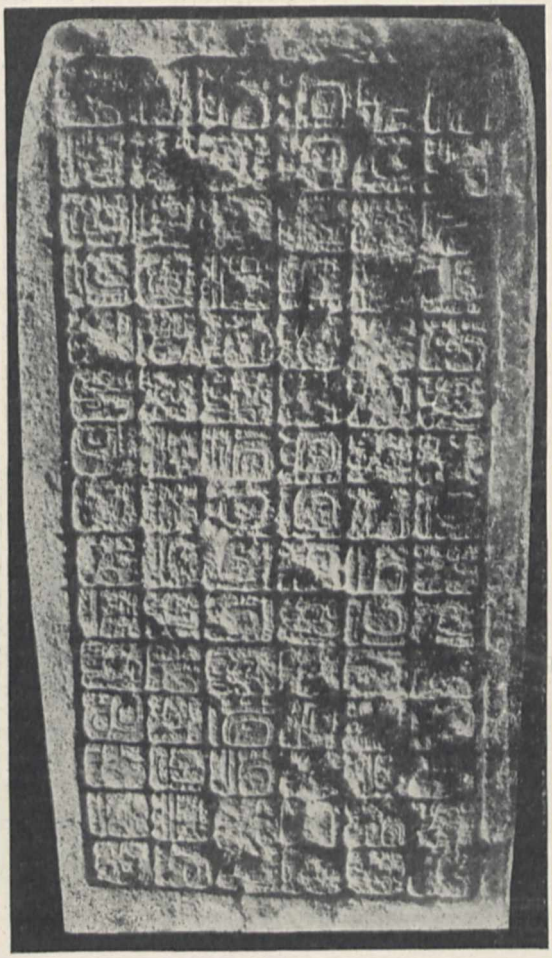


FIG. 2.—Naranjo: Stela 30, East Side.

trace of their arrival can be found. There is very little probability of their having been overlooked, as is suggested, because they were packed among natural-history specimens, for ethnological and other objects are frequently sent with such specimens, and when unpacked are at once handed over to the department concerned with them, and that such a valuable prize as two manuscript maps on some form of native paper could be overlooked is hardly possible. However, Mr. Blancaneaux is being communicated with, and every effort will be made to clear the matter up.

The next instalment of Mr. Maler's work describing his explorations of Tikál, one of the most interesting ruins in Central America, will be looked for with the greatest interest.

ZOOLOGY OF THE ANTARCTIC.[1]

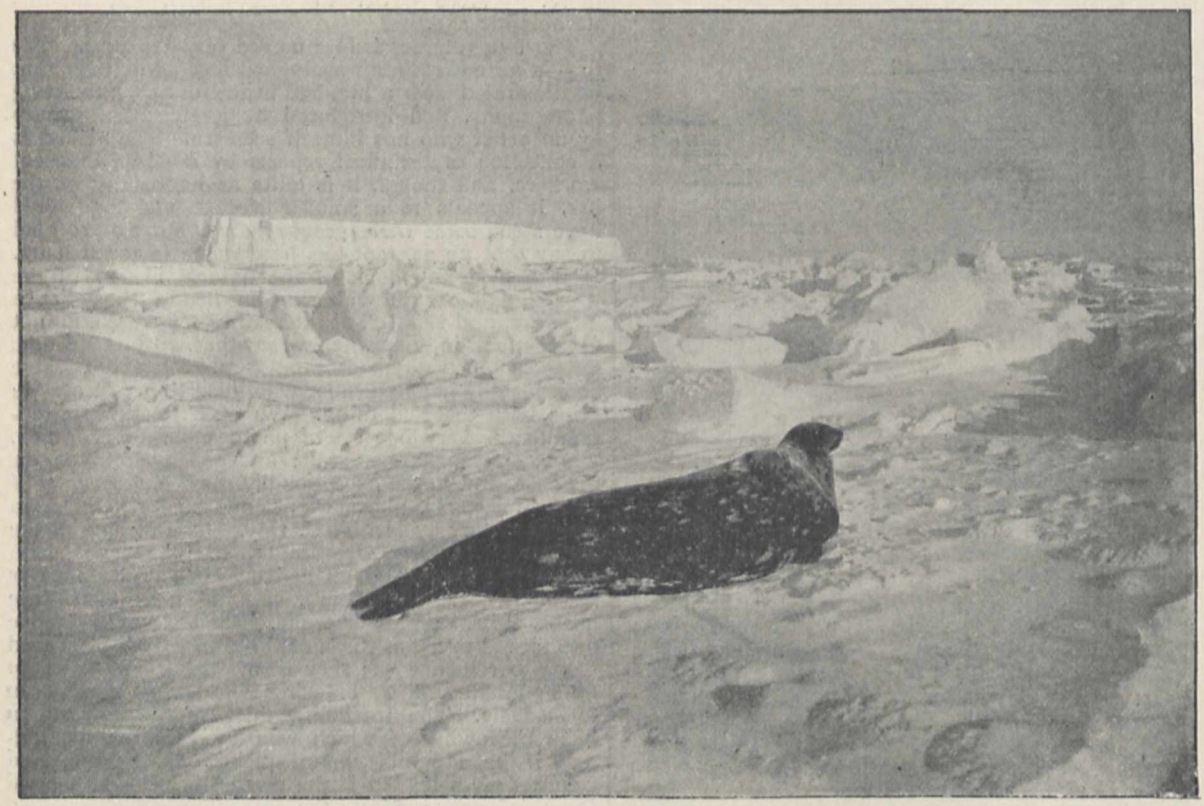
FROM first to last there was high courage in the *Scotia* voyage. Dr. Bruce organised it single-handed, backed, of course, by generous pecuniary help from Mr. Coats and others, and he brought it to a successful finish with a minimum of loss or wastage. We do not forget the wise and wary captain and his loyal crew, or the fearless company of scientific assistants, or those who have helped to work up the results; but as volume follows volume from the unpretentious, hard-working laboratory at Surgeons' Hall in Edinburgh, we cannot withhold our admiration for what has been accomplished *essentially* by Dr. Bruce's pluck and determination. Both these qualities will be needed, we fear, before the tale of the *Scotia* voyage is fully told, for working up and editing scientific results is an arduous and unremunerative business, requiring all the encouragement it can get and a great deal more. "More power to your elbow, sir, in this unromantic age."

The two volumes before us are very different. The first is an entertaining zoological log, as logs go, that is, illustrated with a hundred beautiful and interesting photographs, and introduced by a charming picture by an artist who has himself seen ice. The second is a collection of technical reports by a dozen different workers, and though it is quite as interesting as the log, it appeals to a smaller circle. The log would have stood some more proof-reading, but we are glad to say that no attempt has been made to touch it up. It is a field note-book of the natural history of the voyage and of the wintering in Scotia Bay, South Orkneys, and it is full of interesting facts. We do not depreciate its interest when we say that with its splendid series of illustrations it would make an admirable book for any boy-naturalist who likes to get into close grips with the real thing. We wish to direct attention to the very fine set of photographs of penguins, shags, skuas, petrels, seals, and sea-lions, taken on the spot, and to the exceptionally good photographs of starfish, isopods, alcyonarians, and so forth taken in the laboratory by Mr. T. C. Dey. As a sample of the log we quote from October 11, 1903:—"The adelia penguins were nearly all actively collecting stones or resting from their labours, sleeping near their little heaps, either upright or prone. Some were very active and moved over ten yards at times in search of a good stone to return with; they throw the stones down in no apparent order. Thieving was being carried on extensively. The intending thief moved towards a heap the owner of which was away or not looking, and if he saw his chance picked up a stone and returned with it; but if the owner turned and spotted the thief approaching, the intending culprit walked innocently by as if nothing was further from his intentions than stealing a stone. If a thief was caught, the owner bit at him viciously and thus warned him off for the occasion, but as soon as an opportunity again presented itself he returned once more on thieving bent. I noticed several adelias eating snow in large quantities."

The various reports in the more technical volume have been mostly passed through the Transactions of the Royal Society of Edinburgh, which has thus aided in the publication. They are interesting in many different ways. Sometimes it is an isolated fact of

[1] Report on the Scientific Results of the Voyage of S.Y. *Scotia* during the Years 1902, 1903, and 1904, under the Leadership of Dr. William S. Bruce. Vol. iv., Zoology. Part i., Zoological Log, by David W. Wilton, Dr. J. H. Harvie Pirie, and R. N. Rudmose Brown. Thirty-three plates and 2 maps, including 100 photographs by the Editor and the Authors; coloured frontispiece by William Smith. Pp. xiv+104. (Edinburgh: The Scottish Oceanographical Laboratory; Edinburgh: Thin; Glasgow: Maclehose, 1908.) Price 13*s.* net, cloth, or 10*s.* 6*d.* paper. Vol. v., Zoology. Parts i.–xiii., Invertebrates. Pp. xi+313; 36 plates. Price 23*s.* 6*d.* cloth, 21*s.* paper.

distribution that arrests one, as when Messrs. Thomson and Ritchie report the occurrence of the very beautiful *Umbellula durissima*, Kölliker, from 48° 0′·6 S., 10° 5′ W.—a far cry from the south of Yeddo, where the *Challenger* found it. In other cases we get a useful general impression. Thus we find abundant evidence of the distinctiveness of many of the elements in the marine fauna of the Antarctic and sub-Antarctic regions, for instance, in the Tardigrada, which Mr. Murray disentombed out of a little moss from the South Orkneys; or in Dr. von Linstow's new Ascarido from the Weddell seal; or in the new turbellarians reported by Drs. Gemmill and Leiper, the first adequately described members of this class from the far south; or in Mr. E. T. Browne's new medusa, *Botrynema brucei*, from 64° 48′ S., 44° 26′ W. Most striking, however, is Prof. Koehler's fine memoir on the asteroids, ophiuroids, and echinoids, is a specimen of the hitherto unique abyssal gastropod *Guivillea alabastrina*, dredged from near the original *Challenger* locality at a depth of 1775 fathoms. Messrs. Melvill and Standen, who deal with the molluscs, direct special attention to some other benthal species from unusual depths, such as *Columbarium benthocallis*, n.sp., a "beauty of the deep," from 1775 fathoms, with a shell of papyraceous texture, as in many other abyssal forms. The bibliographical *résumé* given at the end of this report is to be commended. Among the remarkable types we must also rank the forgotten *Decolopoda australis*, a ten-legged Pycnogonid described by Dr. Eights some seventy years ago, and beside this there is now *Pentanymphon antarcticum*, which Mr. Hodgson found on the *Discovery* expedition. It is also represented in the large *Scotia* collection of Pycnogonids which Mr. Hodgson describes. He points out that the *Scotia* collection of



Weddell Seal (*Leptonychotes weddelli*), male, off Coats Land, Antarctica. From vol. iv. of the Report on the Scientific Results of the Voyage of S.Y. *Scotia*.

which deals with more than forty new species. The author indicates firmly that the Arctic and Antarctic echinoderms are completely different—that question is settled. The Antarctic echinoderm fauna is much richer than the Arctic, and more diverse. Dr. Koehler speaks enthusiastically of Dr. Bruce's "Collection d'Echinodermes antarctiques la plus importante qui ait été recuiellie jusqu'à ce jour," and both in the text and in his beautiful plates he does justice to it.

In other cases we have to welcome a new type, like Sir Charles Eliot's Notæolidia, a genus of large nudibranchs linking the Æolididæ to such forms as Dendronotus and Lomanotus. The largest specimen of *N. gigas*, it may be noted, is no less than 122·5 mm. long. Interesting also is Mr. Ritchie's new hydroid Brucella, with two nematophores to each hydrotheca, and a beautiful, highly specialised coppinia or bunch of clustered gonangia. Not new, but very welcome, Pycnogonids is "totally different from that made by the *Discovery* in the same region, but on the opposite side of the world."

A collection of the minute wingless insects known as springtails does not seem to the outsider of much geographical interest, yet if those who come to scoff at this sort of small game will read Prof. Carpenter's report on the Collembola of the South Orkneys, they will probably remain to pray—for more springtails. "For the wingless—primitively wingless, as we believe—condition of these insects, their frail integument, and their concealed mode of life make it highly unlikely that they can cross broad tracts of sea; therefore the presence of identical or closely allied species on widely separated islands or continents may safely be regarded as sure evidence of the antiquity of the insects, and of the former existence of land-connections to explain their present discontinuous

range." There seems good reason to suppose that the Antarctic Continent, to which the South Orkneys once belonged, was formerly connected with the northern continents, probably by way of America.

Among the curiosities we may notice *Echinorhynchus antarcticus*, n.sp., from the stomach of the Weddell Seal, well described by Dr. Rennie, who compares it to a pipe with a short stem and a fantastic lid, and notes that the males are larger than the females.

We have not thought it necessary to do more than illustrate the varied interest of the reports which make up this volume, but we hope we have said enough to show that the *Scotia* has made contributions to zoology not less important than those of a meteorological kind already published. If we are to know our earth we must know the Antarctic, if we are to know the Antarctic we must know it all round, with its spring-tails as well as its magnetic mysteries, and we earnestly hope that Dr. Bruce, who is one of the most intrepid and disinterested of living geographers (in the wide and only true sense), will be encouraged by the reception given to his reports and will not be straitened in the publication of more.

INDIAN MINERAL RESOURCES.[1]

IN a recent article in an American journal, the editor remarked that "geology in Britain scorns the study of ore deposits, and it is deemed gentlemanly to investigate molluscs rather than ores, scenery rather than outcrops." Such a reproach would never have been just, though naturally certain branches of economic geology cannot be studied in this country through lack of necessary material, and Sir T. H. Holland's instructive "Sketch of the Mineral Resources of India" shows the increasing recognition by British geologists of the interesting problems of economic geology. This report is a concise summary of the mineral resources of India, and the use now made of them.

The most important Indian metalliferous minerals are now gold and manganese. The metallurgical industries for which India was once famous have been practically killed by the competition of European imports. The brass used is now all imported, and none of the old copper mines are worked, though efforts are being made to revive them. Lead ores are widely distributed, but none of them is mined. Sir Thomas Holland is careful to explain that the ruin of the local industries has been due less to the cheapness of the imported metals and chemical products than to their greater trustworthiness and uniformity.

The total value of the minerals for which returns are available amounted in 1906 to only 6,312,818*l.*, of which gold yielded 2,230,284*l.* and coal 1,912,042*l.* The other important minerals are petroleum, manganese, salt, saltpetre, and mica; they range in value of output from petroleum, with a yield of 574,238*l.*, down to mica, worth 259,544*l.* The mineral output compared with the size and population of India is, therefore, small, but Sir Thomas Holland points to a marked increase in value during the past five years, and is hopeful for its future.

The memoir opens with a short statement of the geology of India in relation to the distribution of its minerals. The author explains that, owing to the exceptional geological stability of the Indian peninsula, its rocks have been comparatively little mineralised; it is only in the very oldest that metallic ores occur in valuable quantities, and their discovery is often difficult, as they are buried under prolonged accumulations of weathered material. In the later rocks the only minerals of economic value are those found in beds, such as coal, rock-salt, clay, and laterite. Coal mining is unusually easy and safe, owing to the slight geological disturbance of the country. Coal is sold at the pit's mouth for 3*s.* 11*d.* a ton, the low cost being due to the shallowness of the mines, the deepest shaft being only 800 feet, the firmness of the roofs of the seams, and the freedom from explosive gases; underground fires due to spontaneous combustion are, however, troublesome.

The geological foundation of India is a series of Archæan schists and gneisses with infolded areas of schists that belong to the Dahwar group. Upon this foundation rest the rocks of the Purana group, which are perhaps all pre-Cambrian. The Lower Purana beds are sedimentary rocks and limestones, and they are known as the Cuddapah series in southern, and as the Bijawar series in northern, India. The upper Purana beds are the horizontal sandstones, shales, and limestones of the Vindhyans. Then, after a long break, follow the Gondwana beds, which range in age from the Upper Carboniferous to the Upper Jurassic; they contain the chief Indian coal-fields, and probably many that are still unknown, as they are buried under the Upper Cretaceous lavas of the Deccan traps.

The only important Indian gold-field is that of Kolar, in Mysore, where mining was begun in prehistoric times, and some of the ancient workings reached the depth of 500 feet. The present mines are 3000 feet deep, and it is interesting to hear, on Sir Thomas Holland's authority, that the lodes at that depth show "little diminution in value or width of the auriferous gold quartz" (p. 30).

The Indian iron ores are now comparatively little used. They are very widely distributed, and the chief ore is a quartz schist with layers of iron oxides, like the banded ironstones of Rhodesia. In most cases the ore is siliceous and of low grade. The author gives further information about the oft-reported vast block of almost solid iron (pp. 32–3) of Mayurbhanj; he tells us that one bore there gave a core of 120 feet of solid ore containing 68 per cent. of iron.

There is comparatively little information in his report on the manganese mines, the rapid development of which in recent years has been the most remarkable feature in Indian mining; but a monograph on these ores by Mr. Fermor, of the Indian Geological Survey, is announced as in the press.

Among the earthy minerals the most characteristic is mica, of which India produces half the world's supply; but Sir Thomas Holland predicts that unless better methods are adopted for its mining, the output must be greatly reduced. He deplores the practical absence of phosphates from a country where the agricultural industry is of primary importance. There is a short note on each of the gems, for which India was once famous; some diamonds are still obtained, but they are all alluvial.

The carbonaceous minerals include coal, amber, and oil. The coal is of fair quality, and now supplies practically all the fuel required on the Indian railways. Amber of the species free from succinic acid, and known as "burmite," is found in north-eastern Burmah, but the quantity is small, and most of the amber worked in India is succinite imported from Prussia. The author gives an interesting summary of the present development of the Burmese oil industry. The industry was begun by the natives, and wells are still dug by hand to the depth of 400 feet, the men wearing a diving dress for protection against the gases that collect in the shaft. The fields now yield 138 million gallons of crude oil a year,

[1] "Sketch of the Mineral Resources of India." By Sir T. H. Holland. Pp. xi+86; 3 maps. (London and Calcutta, 1908.)

the refined product of which is sold in China and India. The oil was until recently carried down the Irawadi in barges to the refineries at Rangoon; but a steel pipe ten inches in diameter and 297 miles long has been recently laid.

An oil-field occurs in Beluchistan and Persia in rocks of the same age as those of Burmah, but the geological conditions are unfavourable to the collection of the oil in natural underground reservoirs, and thus the western field has remained unimportant.

This valuable guide to the mineral fields of India closes with a summary of the mining laws, a bibliography, a full index, and three sketch-maps that show the distribution of oil in Burmah and of the metallic and earthy minerals throughout the Indian Empire.

J. W. G.

COTTON GROWING IN THE WEST INDIES.[1]

THE history of the modern cotton industry of the West Indies forms one of the most interesting chapters in the history of agriculture. When cotton was re-introduced some six years ago it was practically a new crop to all concerned. Managers of estates had to learn the methods of cultivation and management, and labourers had to be trained. The manurial requirements of the crop required to be studied, and insect and fungoid pests had to be dealt with as they arose, to prevent them killing off the new crop. Thanks largely to the staff of the West Indian Agricultural Department, to the enterprise of the planters, and to the assistance of the British Cotton-growing Association, the crop has now become a very important one, and has been the means of improving considerably the financial position of many of these colonies.

The bulletin before us contains several important papers discussing the various phases of cotton production. Perhaps the most striking feature is the rapidity with which the industry has spread.

Cotton was first planted on a commercial scale in 1902, when about 400 acres were put into cultivation. In 1903 this area was extended to 4000 acres, in 1904 to 7000 acres, in 1905 to 9500, in 1906 to 14,500, and for the season 1907–8 20,000 acres are under culture in this crop. In addition there has been a general improvement in the quality of the lint produced since the plants have become acclimatised, and the planters have gained experience in the methods of cultivation and preparing the products. Mr. Thornton, in his general review of the progress of the industry, adduces evidence to show that further progress is possible; numerous points remain to be settled, and still greater improvements can be anticipated.

Mr. Sands's paper on the cultivation of Sea Island cotton at St. Vincent forms very pleasant reading. St. Vincent had been reduced to very bad straits. There had been a severe hurricane in 1893, and the terrible eruptions of the Soufrière in 1902–3. The unremunerative prices for arrowroot and sugar, the staple products of the island, made it impossible for the planters to retrieve their disasters. In 1903, however, the cultivation of Sea Island cotton was introduced by the Imperial Department of Agriculture, and has proved to be the means of restoring prosperity to the island; the revenue is now exceeding the expenditure, exports and imports are rising rapidly, estates are in full cultivation, and there is full employment for the peasant and labouring classes. The value of cotton exported for the year 1905–6 was 6059*l*., for 1906–7 was 16,922*l*. The total value of the 1907–8 crop, including exports, value of seed, &c., is estimated at 45,000*l*.

In St. Kitts cotton is grown almost entirely as an intermediate crop with sugar-cane. Up to the present no injurious effect on the sugar-cane has been noticed, and with careful manuring there seems little risk in continuing this system of planting. An agricultural inspector has been appointed to instruct the smaller growers in the best methods of working, and the prospects are considered highly satisfactory. In others of the Leeward Islands Dr. Watts has an equally satisfactory report to make; the exports from this group rose from 383,477lb. of lint in 1904–5 to 526,382lb. in 1905–6, and 702,910lb. in 1906–7, while a further increase is anticipated during the current season.

The Imperial Department is studying the question of seed selection, which promises to lead to still further improvement. The manurial requirements of the crop are being investigated, and schemes devised for dealing with the pests. Mr. Ballon gives a summary of his experiments on the cotton-worm, the boll-worm, cut-worms, the stainers and other pests; constant vigilance will obviously be necessary, but with a strong Department of Agriculture there is no reason to fear that the pests cannot be coped with. The progress of the industry reflects the greatest credit alike on the Department and on the planters, and augurs well for the future prosperity of the West Indies.

E. J. R.

[1] "West Indian Bulletin. The Journal of the Imperial Agricultural Department for the West Indies," vol. ix., No. 3, 1908.

NOTES.

SIR RICHARD D. POWELL has been re-elected president of the Royal College of Physicians of London.

MR. T. EDISON has been awarded the gold medal of the Royal Academy of Sciences of Sweden for his inventions in connection with the phonograph.

PRINCE ALBERT OF MONACO, distinguished for his researches in oceanography, has been elected a foreign member of the Paris Academy of Sciences in succession to the late Lord Kelvin.

THE summer meeting of the Institution of Mechanical Engineers will be held this year in Liverpool, and will begin on Monday, July 26.

THE Royal Physical Society of Edinburgh—one of the oldest scientific societies in the kingdom—has now opened its doors to women members. At the March meeting of the society, Mrs. Elizabeth Gray, Edinburgh, Miss Marion I. Newbigin, D.Sc., Edinburgh, Mrs. Ogilvie Gordon, D.Sc., Ph.D., Aberdeen, and Miss Muriel Robertson, London, were elected ordinary fellows.

REUTER'S correspondent at Sydney reports that during a violent storm in the New Hebrides on March 29, Teouma was swept by a huge wave, which caused great destruction. The Government buildings at Vila were destroyed, and many vessels were stranded.

THE New York correspondent of the *Times* announces that Dr. W. H. Edwards died at Coalburo, West Virginia, on April 4, at the age of eighty-eight years. Dr. Edwards was the author of "The Butterflies of North America," a standard work on the subject, and contributed many papers on entomology to various scientific periodicals.

FROM Honolulu is reported the death, in his seventy-third year, of the Rev. Dr. Sereno E. Bishop, who had spent fifty-six years as an American missionary in the Hawaiian Islands. He was a frequent contributor to

scientific journals on subjects relating to volcanic action, and in 1883 he discovered the corona caused by the Krakatau eruption, since known in Europe as "Bishop's Ring."

A GENERAL meeting of the American Philosophical Society will be held in Philadelphia on April 22–24 inclusive. The preliminary programme includes particulars of forty-three papers, on a great variety of subjects, by distinguished American men of science. On the evening of April 23 a commemoration of the centenary of Charles Darwin's birth and the fiftieth anniversary of the "Origin of Species" will be held. Dr. James Bryce, British Ambassador at Washington, will speak on personal reminiscences of Darwin and the reception of the "Origin of Species." Prof. G. L. Goodale will give an address on the influence of Darwin on the physical sciences, and Prof. J. M. Baldwin will speak on Darwin's influence on the mental and moral sciences.

THE council of the Royal Geographical Society has resolved to award Lieut. Shackleton a special gold medal for his Antarctic work, and silver replicas to his fourteen companions who were with him throughout his expedition. With the approval of the King, the two Royal medals have been awarded to Dr. M. A. Stein, for his extensive archæological and geographical explorations in Central Asia, and Colonel M. G. Talbot, for his extensive surveys on the North-West Frontier of India and in the Anglo-Egyptian Sudan. The Victoria research medal has been awarded to Prof. Alexander Agassiz. Other awards are:—the Murchison bequest, to Captain C. G. Rawling; the Gill memorial, to Commander B. Whitehouse; the Cuthbert Peek fund, to Captain R. Ommanney, R.E.; and the Back bequest to Rai Sahib Lal Singh.

REUTER'S Agency is informed that Dr. W. Bruce, of the Scottish Oceanographical Laboratory, has made more detailed plans of another Antarctic expedition to leave this country in 1911, the cost of which is estimated at 50,000*l*. It is proposed to carry on extensive oceanographical work in the South Atlantic Ocean between and south of Buenos Ayres and Cape Town, as well as in the Weddell and Biscoe Seas; to map the coast-line of Antarctica to the east and west of Coats Land, and to investigate the interior of Antarctica in that longitude. Part of the project includes a journey across the Antarctic continent, starting at some suitable base in the vicinity of Coats Land and emerging at McMurdo Bay, Victoria Land, or King Edward Land. The programme includes a circumpolar bathymetrical survey, especially in relation to the study of former Continental connections. Reuter's correspondent at Berlin announces that Mr. C. E. Borchgrevink will conduct a new expedition to South Polar regions some time during the summer. The expedition, the financial and other details of which have already been settled, has been arranged under the auspices of the International Polar Exploration Commission at Brussels.

CONTINUOUS efforts have been made by the Hampstead Scientific Society during the past year to find a suitable site for the establishment of a small astronomical observatory and meteorological station near the summit of Hampstead Heath. It is now proposed to rent, at a nominal charge, a portion of the top of the reservoir near the Whitestone Pond, to build there an observatory house, and to erect the 8-inch reflecting equatorial telescope presented to the society by Dr. F. Womack; also to establish on the same area a meteorological station. A sum of about 250*l*. will be required for the purpose of preparing the site, building the observatory house, and procuring the meteorological instruments. An appeal has been made for donations to the fund being raised for this purpose. The report of the society for 1908, which has just been issued, shows that the society is doing good work to promote interest in science by means of lectures, classes, and field meetings. One of the honorary secretaries of the society is Mr. C. O. Bartrum, 12 Heath Mansions, Hampstead, N.W.

THE Lord Mayor presided at a large meeting held on Monday at the Mansion House in support of the objects of the Aërial League of the British Empire, "a non-political organisation to secure and maintain for the Empire the same supremacy in the air as it now enjoys on the sea." In a letter read to the meeting Lord Curzon said:—"While other countries have been perfecting their scientific and mechanical inventions we have accomplished little, and the popular inclination has been to regard the navigation of the air as a harmless but unpractical whim. This can no longer be said to be the case. Aviation has taken its place among the sciences, and whether it be regarded as a means of communication or as an instrument of warfare, it will undoubtedly admit of development in which nations as well as individuals will compete, and in which the superiority will rest with those who possess the greatest enterprise, resting upon a foundation of technical proficiency and scientific research." The speakers included Lord Montagu of Beaulieu, Dr. Hele-Shaw, Major B. F. S. Baden-Powell, and Sir Hiram Maxim, and the following resolution was carried unanimously:—"That this meeting of the citizens of London, held at the Mansion House, regards with considerable anxiety the rapid development of the science and practice of aërial navigation by other nations, and deplores the backwardness and apathy shown by this country regarding this new means of communication, which is of vital importance from a commercial as well as from a national defence point of view, and pledges itself hereby heartily to support the objects of the Aërial League of the British Empire."

ON April 1 Count Zeppelin's airship, carrying the Count, eight other passengers, and a crew from the Army Balloon Corps, accomplished a voyage of about 100 miles, from Friedrichshafen to Munich. According to the *Times* correspondent, the airship travelled along a considerable curve, and completed the voyage in five hours. As the airship approached Munich, a strong south-west wind prevented a landing upon the Oberwiesenfeld, as had been arranged. The airship failed to make headway against the wind, and drifted with the wind to a place near Dingolfing, about forty miles from Munich, where a landing was effected. On April 2 Count Zeppelin sailed from Dingolfing about 11.30 a.m., and arrived at Munich shortly before 2 p.m., where a successful landing was effected. At 9 a.m. on April 5 the airship started upon another voyage; it returned to the balloon shed at Friedrichshafen at 7.30 p.m., after about 10½ hours' sailing, coming gently down in front of the shelter with perfect precision. From the Berlin correspondent of the *Westminster Gazette* we learn that, while Count Zeppelin has been practising with his reconstructed old airship, his newest, *Zeppelin II.*, has been nearly finished. Only some of the rudders and stability planes are lacking. The new ship is 136 metres long, 13 metres in diameter, and holds 15,000 cubic metres of gas. The aluminium frame is divided into cells, holding altogether seventeen separate balloonets, all except one being of rubbered cotton. The exception is made of English gold-beater's skin,

which is an experiment. There are two gondolas, each fitted with rubber buffers, to take up the shock when descending on dry land. The Daimler motors are those used in the former *Zeppelin II.*, destroyed last August, developing 110 horse-power. The gondolas are connected by a gangway, but there is no covered cabin, as in the former ship. The newest feature of *Zeppelin II.* is a vertical shaft going through the hull, equipped with a ladder, so that it is possible to reach easily the top of the hull and there to make observations of position.

THE relative size of the frontal lobe of the brain in the two sexes, in men of genius, and in the lower races has attracted the attention of many anatomists. The smaller frontal lobe in women and in negroes, and the larger in men of genius, would prove, it is believed, that this portion of the brain is the chief seat of a good mind. In the February number of the *American Journal of Anatomy* Prof. Franklin P. Mall, of Johns Hopkins University, brings forward evidence to show that no such unequal distribution of brain substance exists. The brain of woman, it is often stated, is of a simpler type than that of man; but if weight is not considered, it is questionable, says Prof. Mall, whether a collection of brains could be assorted according to sex with any degree of certainty. It is generally believed, also, that the brains of men of genius are of complex configuration, and those of lowly races of a simple type; but facts do not bear this out, and such statements are only misleading. Prof. Mall concludes that "arguments for difference due to race, sex, and genius will henceforth need to be based upon new data, really scientifically treated, and not on the older statements."

IN its report for 1908 the Rugby School Natural History Society announces a change in the presidency, and likewise the appointment, for the first time, of vice-presidents. A gratifying increase in the number of associates is recorded, the names on the list now for the first time exceeding four hundred.

COCCIDIANS inhabiting the intestine of a nemertine worm of the genus Cerebratulus form the subject of a paper, by Mr. S. Awerinzew, in vol. xxxix., part i., of the *Comptes rendus* of the St. Petersburg Academy. They are stated to present certain interesting features in their development.

THE birds and mammals collected during the Alexander Expedition to south-eastern Alaska in 1907 form the subject of a paper by Dr. J. Grinnell and others, issued as vol. v., No. 2, of the University of California Zoological Publications. The expedition was financed and headed by Miss A. M. Alexander, to whom the University is indebted for the gift of the large series of specimens collected. Several species and subspecies of mammals and birds are described as new, and notes on the habits of several species, especially beavers, are given.

TO the first part of vol. xxxix. of Gegenbaur's *Morphologisches Jahrbuch* Mr. Carl Dilg, of Cologne, contributes an important paper on the post-embryonal development of the Amazonian manati (*Manatus inunguis*), together with notes, accompanied by maps, on the distribution of this species and *M. latirostris*, and of the Sirenia generally. The author's observations on the skull-structure apply in the main to the genus, and not specially to the Amazonian species. In the young the brain-chamber and the enclosing portion of the skull are elongated, and it is not until mature life that they attain the characteristic elongation. The foramen magnum is always oval, and not, as has been stated, round in *M. inunguis*. It does not seem possible to distinguish the sexes (*Geschlecht*) by the dentition. The tympanic and petrosal do not fuse to form a petro-tympanic. The molars of Manatus resemble the milk-molars of Lydekker's *Prorasthomus veronense* of the European Oligocene. The dentition of the manatis is of a secondary type, so far as the exceptional number of cheek-teeth is concerned, while the extension of the skull in the line of the body-axis, the marked forward inclination of the orbital region, and the small orbits are all features indicative of adaptation to an aquatic life; the comparative lateness of this adaptation being indicated by the preservation of the original condition in the structure of the internal ear. The author agrees with Messrs. Thomas and Lydekker in regarding Prorasthomus as the ancestor of Manatus. As regards distribution, *M. inunguis* is now mainly confined to the Amazon basin, although it still survives in the Rio San Francisko; it was formerly met with for a considerable distance along the Brazilian coast. *M. latirostris*, on the other hand, is chiefly a Central American species, ranging but little south of the main stream of the Orinoco. For an undescribed Cretaceous sirenian from Parà the author proposes the name Trachypleurotherium.

AN account by Mr. C. K. Subba Rao of the cultivation in the Madras Presidency of the leguminous plant *Crotalaria juncea* is published as vol. iii., Bulletin No. 59, by the Department of Agriculture, Madras. The plant is grown either for the sake of the fibre known as sunnhemp or as a fodder crop. The fibre is chiefly used for weaving locally, but a certain amount is exported to the United Kingdom and Italy.

THE outstanding feature of the report for 1907–8 on the experiment station at Tortola, in the Virgin Islands, is the large increase in the cotton crop of the islands, shown by a rise in the export from fifty-one bales in 1907 to 162 bales in 1908. Good results have been obtained at the station with Liberian coffee, onions, cassava, and seedling sugar-canes; the report from London on a small quantity of cacao grown and cured locally indicates that there is an opening for an industry in this product.

THE annual report for 1908 of the Rothamsted Experimental Station contains a brief summary of salient features in the series of manurial experiments and of the papers published by members of the staff during the year. It is noted that the grass plot, which receives a large dressing of nitrate of soda, and has become strongly alkaline, is being overrun by *Lathyrus palustris*. A new line of research regarding the existence and nature of land "sickness" was started, and in connection therewith an examination was begun of the changes taking place in soil when heated to the temperature of boiling water or partially sterilised by treatment with volatile antiseptics. The improvement is apparently due to a re-distribution of the bacterial flora, and partially to chemical change.

AN article is contributed by Dr. H. Marzell to *Naturwissenschaftliche Wochenschrift* (March 14) on the subject of plants which have been popularly endowed with magic qualities. The chief of these is undoubtedly the mandrake, *Mandragora officinalis*, the cultivation of which dates back to very ancient times, and spread from the East to various European countries, so that in the fourteenth century the sale of the roots was interdicted in Paris. Another plant, known as "moly" (μωλυ), frequently mentioned in the classics, because it was given to Ulysses to protect him from the wiles of Circe, is generally regarded as a species of Allium. Reference is also made to an old English cantation, "The Song of the Nine Herbs," and to the

superstition connected with "fern seeds," *i.e.* fern spores, which are supposed to render the bearer invisible.

A PRELIMINARY note by Mr. B. W. Bežénov, communicated to the *Bulletin de l'Académie impériale des Sciences de St. Pétersbourg* (series vi., No. 1), furnishes a calendar of algal growth in the bay of Sebastopol. *Ceramium rubrum*, *Cladostephus verticillatus*, species of Callithamnion and Porphyra persist through the year, but start fresh growth in February. The hot-weather algæ, *e.g. Chondria tenuissima*, *Padina pavonia*, *Dictyota Fasciola*, and *Arthrocladia villosa* appear in April or May, and persist until August or November. *Porphyra leucosticta*, *Scytosiphon lomentarius*, and *Ulothrix implexa* show an active period of growth from November to February, and die down in April. Contrasting these periods with the periods for the same algæ in the Mediterranean, it is found that the seasonal growth generally begins later and sometimes persists longer in the North Sea.

THE prickly pear—a general name for the flat-jointed members of the genus Opuntia—is used as cattle food to an increasing extent in certain of the United States, and investigations into its composition have been made at the New Mexico College of Agriculture. Recently (Bulletin No. 69) the digestibility by steers was determined, and was found to be not unlike that of ordinary green fodders. The results were :—

	Water	Ether extract	Protein	Nitrogen free extract	Fibre	Ash	Total dry matter
Composition	83·41	0·31	0·75	9·41	2·64	3·48	16·59
Per cent. digestible	—	67·90	58·25	82·59	41·32	34·68	65·86

It is stated, however, that the digestibility is increased when prickly pear is fed with other foods.

THE Linnean Society has published a very interesting memento of the Darwin-Wallace celebration held on July 1 of last year. It will be remembered that an account of the proceedings on that occasion appeared in NATURE for July 9, 1908. The present volume contains a complete record of the meeting held in the theatre of the Institution of Civil Engineers under the presidency of Dr. D. H. Scott, with full reports of all the speeches then delivered; a list of those present at the dinner given to the medallists and foreign guests; the programme of the reception held at the rooms of the Linnean Society, with an account of the exhibits and lantern demonstrations then shown; the minutes of the meeting held on July 1, 1858, and a reprint of the papers by Darwin and Wallace that were read on that famous occasion, together with the joint letter from Lyell and Hooker by which the communications were introduced. Dr. Wallace himself has contributed to the volume an interesting note, embodying passages from Malthus's "Principles of Population," which illustrate the influence of that work in suggesting the idea of natural selection. Excellent portraits are given of Charles Darwin and of the recipients of the Darwin-Wallace medal, and good reproductions are included of the medal itself and of the beautifully illuminated address presented by the Royal Academy of Science, Stockholm. The whole forms a complete and valuable record of a momentous occasion.

THE *National Geographic Magazine* for February is largely devoted to papers on western Asia, of which the most important is that by Mr. E. Huntingdon on the mountaineers of the Euphrates. The original population of this region consisted of Kurds, who were conquered by Armenians, and these in their turn by the Turks. The Turks, as a rule, now confine themselves to the richest plains and the cities; but the areas occupied by the three races are not clearly defined, and when they settle in the same village their quarters are separate. The permanent hostility of these peoples is the cause of the present dangerous political situation. The Kurd hates the Turk because he has been often defeated and is rigorously taxed; he despises the Armenian because he is a Christian, and can be ill-treated with impunity whenever the Turk gives permission. The Armenian hates and fears both Kurd and Turk. The Kurd, in fact, is a pagan, with an outward veneer of Islam. The Kuzzilbash, or "red-head" Kurds, of the Dersim district between the two main branches of the Euphrates, are neither good Mohammedans, good Christians, nor good pagans, and another cause of religious animosity is that, being by name of the Shiah sect, they are detested by the Sunni Turks. The illustrations to this paper admirably depict the modes of transit on the Euphrates by means of rafts made of inflated sheepskins. The numerous Hittite inscriptions in this region would attract archæologists if only the new Turkish administration could enforce a semblance of order in this interesting and little-known country.

THE title of a memoir by Mr. Gilbert Walker, F.R.S., on "Correlation in Seasonal Variation of Climate," in vol. xx. of the Memoirs of the Indian Meteorological Department, is somewhat misleading, as the present part is of an introductory character only, and is confined to a deduction of the correlation coefficient, the regression equations for two or more variables, and the remaining formulæ of greatest importance in the theory of correlation, on lines that are for the most part simple. The author proceeds by assuming that the departures of one variable, x, are made up of a portion governed by, and a portion independent of, the second variable, y, and that the portion determined by y may be taken as ky if y be small; in order to determine a good value of k, it will be as well to weight each observation equation by the value of its y, as the equations dependent on small values of y are untrustworthy. It will be seen that this amounts to a way of suggesting the formation of the normal equations of the method of least squares.

THE thirty-first annual report of the Deutsche Seewarte, for 1908, like those of all establishments dealing with meteorology, shows increased pressure in various directions. In the department of maritime meteorology the chief events have been the publication of monthly pilot charts of the Indian Ocean (see NATURE, February 11, p. 443), and the preparation of an atlas of the currents of Indian, eastern Asiatic, and Australian waters. The number of observers in the mercantile marine cooperating with the Seewarte at the end of the year was about 1000; these receive publications in exchange, and a few medals are awarded annually. In the department of weather telegraphy and storm warnings several improvements have been introduced; the change of hour from 8h. a.m. to 7h. a.m. at British stations has been of great advantage to the German service. Some 6000 storm-warning telegrams were issued during the year, but the percentage of success is not stated. Experiments in the use of wireless telegraphy for weather forecasts have been arranged, with the cooperation of the London Meteorological Office. About 200 kite ascents were made during the year, eighty-six of which exceeded an altitude of 2000 metres; observations with registering balloons have also been regularly made at the times arranged for international ascents. The

discussion of observations at over-sea stations forms an important part of the useful work of the Seewarte; returns from twenty-one places were received, irrespective of the stations in German East Africa, the results for which are being prepared for publication, as in previous years. The departments dealing with the supply and verification of instruments and the preparation of handbooks for seamen also show great activity.

A SIMPLE method of illuminating opaque objects is described by Mr. J. E. Stead, F.R.S., in the Journal of the Royal Microscopical Society (February). With low-power objectives a cover-glass is placed at an angle of 45° in front of the objective, and reflects light on to the object from an electric lamp. For higher powers the reflector is always placed in a slit in the objective above the lens.

DR. EMILIO ODDONE, applying the methods of Kövesligethy and Rudsky to the recent Sicilian earthquake, computes the depth of the epicentre at about 9 kilometres. The corresponding result for the Calabrian earthquake of 1905 was 7 km., and the author refers to Mallet's result of 10 km. for the Neapolitan earthquake of 1857, pointing out, however, that other methods lead to much higher values. Dr. Oddone's note is published in the *Atti dei Lincei*, xviii., 4.

IN a communication to the *Atti dei Lincei*, xvii. (2), 12, Prof. Augusto Righi integrates, for a particular case, the equations of motion of an electron describing an orbit about an ion in a magnetic field. The case considered is that in which the mass of the ion is so large in comparison with that of the electron that its velocity is practically uniform, and the plane of the orbit is perpendicular to the lines of magnetic force. The problem reduces to a simple one in particle dynamics, and gives for the relative orbit a conic described about the focus. The author discusses the conclusions to be derived regarding the effects of the field in assisting or impeding the separation of the electron from the ion in the case of collisions.

No. 5, vol. xxviii., of the *Astrophysical Journal* contains a paper, by Messrs. G. Duffield and R. Rossi, on the emission spectrum of silver heated in a carbon-tube furnace in air. Previous work by Mr. Duffield having led to the conclusion that a more complete knowledge of the band-spectrum of silver was desirable, the authors employed a similar furnace to that used by Dr. King in his investigations of various spectra at the Pasadena Observatory. The large number of lines observed suggested that the spectrum was not due to silver alone, but comparative experiments with tin and other metals brought out none of the lines. One or two of the flutings observed, in the region λ 5370 to λ 5750, are of doubtful origin, but no opportunity of obtaining definite results presented itself. None of the lines, however, occurs in the arc or in the spark spectrum of silver, although Hartley detected three faint lines in that region of the flame spectrum. The general conclusion is that the oven spectrum of silver differs markedly from the spectra of silver produced by other methods. The experiments were carried out in the physical laboratory of the Manchester University.

Ion for February devotes a dozen pages to a report, by Prof. R. Gans, of the University of Tübingen, on recent advances in ferromagnetism. The subject-matter is arranged under the following heads:—methods of measurement, permeability and hysteresis, influence of frequency, alloys, crystals, influence of temperature, strain and magnetisation, molecular theories of magnetisation. References to more than 100 papers published during the years 1907–8 are given, and a glance through the list shows that the great bulk of them deal with questions which have arisen in practice, and that very little has been done towards a scientific explanation of magnetic processes. This undue devotion to practical problems the author regrets, and he expresses the view that it is to the interest of all that the purely scientific side of the subject should not be neglected in the quest for material with low hysteresis losses.

No. 43 of the occasional publications of the Conseil international pour l'Exploration de la Mer contains an account of the measurements of the compressibilities of pure water and of sea-water undertaken by Dr. V. W. Ekman, of the central laboratory at Christiania, at the request of the council. The method depends on the measurement of the quantity of mercury forced by pressure into a glass vessel containing the water, through a narrow tube connecting the vessel with another containing mercury and open to the pressure. In the deep-sea instrument the mercury forced in is tilted into a pocket by inclining the vessel. In the laboratory instrument a weighed amount of mercury is placed in the outer vessel, and makes an electric circuit until it is forced past a platinum contact in the narrow tube connecting the two vessels. The compressibility of the glass of the vessels was known, and that of the mercury was found by a separate experiment. The results are given in the form of an expression for the compressibility in terms of temperature and concentration which is valid between 0° C. and 20° C., and up to pressures of 600 atmospheres.

THE new calcium-carbide factory at Odda, on the Sondrefjord, Norway, forms the subject of an interesting article in *Engineering* for March 26. This factory is the property of the Alby United Carbide Factories, Ltd., and has been organised by a British company with British capital in order to ensure a regular supply of calcium carbide, the absence of which was interfering with their business as manufacturers of a special acetylene plant. The potentialities of Norway for industries requiring much power are very great, many waterfalls being splendidly placed for the production of hydraulic power by means of turbo-generators. In the present case, a hydro-electric power installation has been already constructed giving 23,000 E.H.P., and 75,000 to 80,000 horse-power are available in the water supply. The total producing capacity of the new factory is 32,000 tons of calcium carbide and 12,500 tons of nitrolim (for use as a fertiliser) per annum. Care has been taken not to interfere with the amenities of the district, which is a tourist resort. The water-collecting area is 380 square kilometres, from which hundreds of small streams discharge into the Ringedalsvand. As there is only a distance of 3·5 kilometres between this lake and the fjord where the power-station is situated, it will be seen that the conditions are very favourable for the construction of a pipe-line to the power-station.

THE current number of the *Zeitschrift für physikalische Chemie* contains a paper, by J. G. L. Stern, on the application of the platinum resistance thermometer to the determination of molecular weights in fused potassium nitrate as a solvent. The modified form of thermometer used was capable of estimating temperature differences of 0°·04 at a temperature of 335° C. The sulphates, chlorides, and nitrates of the alkalies and alkaline earths were used as solutes. The values obtained for potassium nitrite

appeared to show the existence of double molecules; potassium chloride was normal, and sodium, silver, barium, and strontium nitrates were nearly normal, showing a slight dissociation. Sodium chloride behaved as though dissociated into two, barium and strontium chlorides into three parts, whilst the figures for potassium and sodium sulphates were quite abnormal, being split up into more than three parts.

IN response to a widely expressed request, Dr. H. O. Forbes, director of museums and reader in ethnography in the University of Liverpool, has agreed to publish, in book form, the course of lectures recently delivered by him in the Museums Theatre, on "The Reindeer Hunters: the Golden Age of the Cave-dwellers." The volume will be issued in the autumn.

WE have received a copy of the list of publications already issued by the Carnegie Institution of Washington. The list includes particulars of 118 monographs and other works, many of which have been reviewed in NATURE from time to time, and it provides further evidence of the excellent work which the institution is accomplishing in disseminating a knowledge of recent progress in science. The editions of each book are restricted, and as soon as a volume is issued copies of it are sent gratuitously to a limited number of the greater libraries of the world, while the remainder of the edition is placed on sale at a price sufficient only to cover the cost of publication and of carriage to purchasers.

A NEW and revised edition of Prof. W. Bölsche's book, "Haeckel: his Life and Work," has been published by Messrs. Watts and Co. for the Rationalist Press Association, Ltd. The book is published at the price of 6*d*., and is provided with an introduction and supplementary chapter by the translator, Mr. Joseph McCabe.

MESSRS. CASSELL AND CO., LTD., have commenced the issue, in fortnightly parts, of Prof. Percy Groom's beautifully illustrated "Trees and their Life-histories." The price of each part is 1*s*. net, and there will be thirteen of them to complete the work. The same firm is issuing Prof. F. E. Hulme's "Familiar Wild Flowers" in fortnightly parts at 6*d*. net each, and there will be forty-five parts.

A FOURTEENTH edition of Mr. W. T. Lynn's "Remarkable Comets" has been published by Messrs. Samuel Bagster and Sons, Ltd. In this issue, particularly, the author has endeavoured to bring the information carefully up to date. The price of the little book is 6*d*. net.

OUR ASTRONOMICAL COLUMN.

POSITIONS OF DANIEL'S (1907*d*) AND MOREHOUSE'S (1908*c*) COMETS.—Comet 1907*d* having been observed during the opposition of 1908, Herr H. H. Kritzinger has calculated an ephemeris for the coming opposition, and publishes it in No. 4317 of the *Astronomische Nachrichten*. The ephemeris position for April 16 is 15h. 20·2m., −7° 50′, and the estimated magnitude is 14·3, but the comet may be as much as 3·8 magnitudes fainter than this. There is just a possibility, however, that it may be re-observed by long-exposure photographs.

An ephemeris for comet 1908*c*, prepared by Dr. Ebell, appears in No. 4309 of the *Astronomische Nachrichten*, and gives the positions and estimated magnitudes of the comet up to the end of June. From this we see that the comet will not rise in these latitudes until about the end of May, and will then be only about one-third as bright as it was when discovered.

SUN-SPOTS AND SOLAR TEMPERATURE.—In the March number of the *Observatory* Mr. Evershed continues the discussion as to the interpretation of the phenomena of the sun-spot spectrum with regard to temperature. In a previous letter Prof. Whittaker suggested that the tube-furnace phenomena observed by Dr. King might be produced by the direct action of the radiation absorbed from the heated walls of the solid tube rather than in consequence of the collisions between the molecules of the gases themselves. This suggestion Mr. Evershed believes to be unnecessary for the explanation of the radiations observed, and he adduces evidence showing that the molecules of the gases, when excited thermally, are capable, by their mutual collisions at high velocities, of producing the radiations.

In regard to Prof. Whittaker's second suggestion, that the increased intensity of spot lines may be due to enormous pressures obtaining in the lower parts of the chromosphere, Mr. Evershed quotes experimental results showing that such pressures are unnecessary for the production of the intensifications, and then shows that the evidence for the existence of the pressure-differences required by this hypothesis is insufficient. He mentions, parenthetically, that he has observed what appears to be a minute pressure effect on certain lines measured at the sun's limb, and suggests that further observations of this phenomenon may lead to conclusions regarding the various levels at which absorption takes place.

THE APPARENT DISPERSION OF LIGHT IN SPACE.—In an article appearing in the March number of the *Astrophysical Journal* (vol. xxix., No. 2, p. 101) Prof. Lebedew criticises the conclusions arrived at by Belopolsky, Nordmann, and Tikhoff concerning the dispersion of light in interstellar space.

In the first place, he shows that if the delay found by Tikhoff and Nordmann were due to ponderable matter, the absorption produced by such matter would be so great as to render the sun and stars invisible to us. There remains the possibility that the æther itself disperses, without absorbing, light, but this entails an attack on the electromagnetic theories of light, which Prof. Lebedew believes to have been too firmly established, by theory and experiment, to allow of any attack being made simply to explain a series of astronomical observations.

Prof. Lebedew then shows that Tikhoff's assumptions are unsafe, and that his results do not agree sufficiently closely with those of Nordmann to produce conviction, and, finally, he shows that in the case of such systems as those of β Aurigæ and R.T. Persei physical processes sufficient to produce the phenomena observed may be readily conceived.

COLOURED STARS IN THE GLOBULAR CLUSTER M 13.—In the October number of the *Astrophysical Journal* for 1900 Prof. Barnard directed attention to some "abnormal" stars observed by him in the globular cluster M 13 Herculis, such stars being relatively much fainter visually than photographically.

Since the publication of this result he has found other stars of this class in the same cluster, and also in M 5 Libræ. On comparing a photograph of the cluster taken with the Potsdam refractor with one taken with the Yerkes 40-inch refractor fitted with a yellow screen, he was surprised to find that there were many more of these "blue" stars than he had hitherto found; further, a large number of the stars of this cluster must be yellow, for they are relatively much brighter on the Yerkes than on the Potsdam photograph.

Thus, while it is impossible visually to observe any difference in the colours of the stars of M 13, the above comparison shows that great differences of colour, and hence of spectral type, do exist, and Prof. Barnard now gives tables showing which are the blue and which are the yellow stars; he also mentions one or two striking examples of colour-difference, and briefly discusses the variable stars hitherto discovered in this cluster (*Astrophysical Journal*, vol. xxix., No. 1, p. 72).

THE UNITED STATES NAVAL OBSERVATORY.—The report of the U.S.A. Naval Observatory, Washington, for the fiscal year ending June 30, 1908, contains several important announcements, and gives the record of the work done during the year.

Rear-Admiral Walker having retired from the superintendentship on November 13, 1907, Captain W. J. Barnette was appointed to the position, and submits this report.

Having asked a board of astronomers to report on the state of the observatory and the most proper work for it to perform, he received a report in which it was laid down that astronomy of position, rather than astrophysics, should be the principal work of the observatory. In order to secure the continuity and coordination of the work, an astronomical council, consisting of the officers of the observatory, was appointed, and will in future act as an advisory council in connection with all the work, astronomical and administrative, of the observatory.

The climatic and terrestrial conditions at Tutuila, Samoa, having been found too unfavourable, the branch observatory established there in 1904 has been discontinued.

SCIENTIFIC AGRICULTURE.[1]

THE bulk of this work is taken up by the reports on economic zoology and mycology; the remainder comprises reports from the veterinary, chemical, and botanical departments, and the farm report.

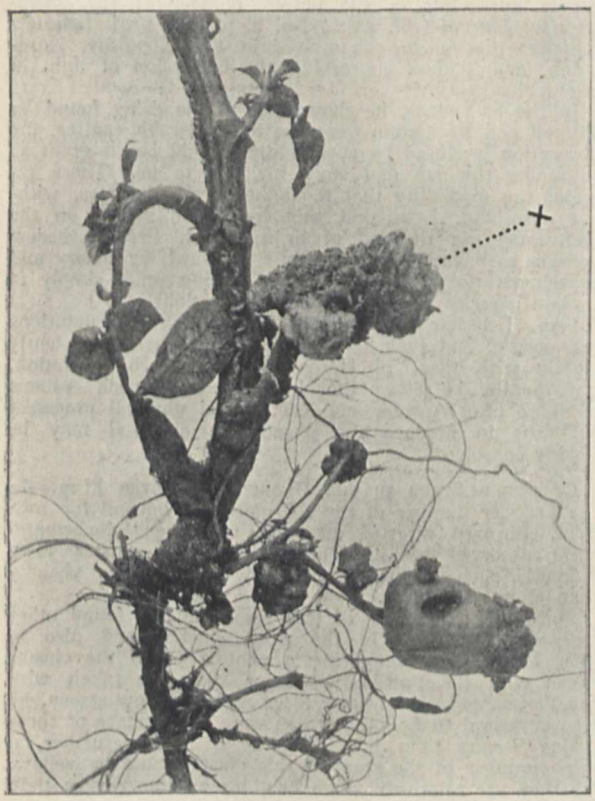


FIG. 1.—Photograph of a growing potato plant attacked by the "Black Scab." At × is a diseased shoot above ground; several young diseased potatoes can be seen below.

The determination of the digestibility of feeding stuffs, giving, as it does, an insight into Continental methods, is of exceeding interest to all scientific agriculturists. Prof. F. V. Theobald's work is well known, and in his contribution to the journal the notes on the damage to hops by *Entomobrya nivalis*, Linn., and on the occurrence of *Rhagoletis cerasi* in imported cherries, are worthy of special mention. Most of the illustrations in this section are excellent.

FIG. 2.—A branch of seedless Golding Hops.

The report on economic mycology contains articles on American gooseberry mildew and on black scab, among others, illustrated by a series of twenty-six splendid plates, one of which is reproduced here. This shows very plainly the peculiar warty outgrowths to be found, not only on the tubers, but on the shoots and leaves of potatoes attacked by *Chrysophlyctis endobiotica*. Hops, as is fitting in a hop-growing district, receive attention, and the article on the value of the male hop, illustrated by most lucid plates, is by no means the least important item in the journal. The plates illustrating "seeded" and "seedless" Golding hops, taken from the same bine, show one of the effects of fertilisation, viz. that "growing out" takes place along with seed production; in fact, the investigations carried out at Wye prove beyond question that only "seeded" hops will grow out properly. The "growing out" takes place immediately after fertilisation, thus obviating a long "burr" period, a period in which there is the greatest danger of attack by "mould."

The amount of resins, too, is increased by more than one-half as a result of fertilisation; in fact, the quantity and quality of hops is improved by the presence of the male hop. This was shown in a practical manner by the fact that samples of "seeded" and "seedless" hops, grown in the college hop-garden, were submitted to the hop-factors for valuation, and it was found that the "male plant had increased the value of the crop (at the price of hops then current) by the sum of 24*l.* 10*s.* per acre." Such investigations are not only of absorbing interest, but of the greatest possible utility.

One always looks for good work in the veterinary department, and the present report is no exception, but mention can only be made of the discovery of *Strongylus*

[1] The Journal of the South-Eastern Agricultural College, Wye, Kent. No. 17. Pp. 478. (London and Ashford: Headley Bros., 1908.) Price 6*s.*; Residents in Kent and Surrey, 3*s.*

ostertagi, new to this country, and large numbers of the rare *Sclerostoma hypostomum*.

Exigencies of space forbid the mention of other contributions.

FIG. 3.—A branch of seeded hops produced on the same bine and under identical conditions as those shown in Fig. 2, except that pollen was supplied to the "burr."

The letterpress and plates are alike excellent, and, as a year's record of all that is best in scientific agriculture, the Journal of the South-Eastern Agricultural College should find a place on many bookshelves.

C. A. E.

THE ROYAL PRUSSIAN AËRONAUTICAL OBSERVATORY'S AËROLOGICAL EXPEDITION TO TROPICAL EAST AFRICA.

THE Royal Prussian Aëronautical Observatory, Lindenberg, supported by the active interest of some "friends of science," sent out in June, 1908, an aërological expedition to tropical East Africa under the direction of Prof. Berson, first observer at Lindenberg, accompanied by Dr. Elias, formerly assistant, and Mr. Mund, balloon superintendent of the observatory. At the end of December last they returned safely, and in possession of a good amount of interesting data.

In consideration of the proximity of the region explored to British possessions in East Africa, and also in recognition of the help and protection given to our work by the English authorities, I asked Prof. Berson to write a special report for NATURE, believing that there are British readers who take interest in our work.

I am therefore glad to offer the following account of the work by Prof. Berson.

R. ASSMANN.
Director of the Royal Prussian Aëronautical Observatory, Lindenberg.

Much good work has been done lately in the exploration of the upper atmosphere in the region of the trade winds, more particularly the Atlantic trades, where men of science of Germany, the United States, and France have been making investigations, trying above all to elucidate the very important question of the anti-trade. But in the Indian Ocean and the adjacent regions, the realm of the most powerful and persistent monsoonic system of the globe, with the exception of a few ascents from the German ship *Planet*, carried out in the southern and eastern portions of the ocean, only the Indian meteorologists, Mr. Walker and Mr. Field, had applied the new aërological methods for the study of the monsoon phenomena, the work in the south-west monsoon proving especially difficult on account of the stormy and rainy character of the weather prevailing during its sway.

Very naturally the idea occurred to try similar explorations on the east African coast and the waters washing it, the region lying at the starting point or (in the case of the Indian "winter monsoon") at the extreme limit of these peculiar wind-systems. It might be expected that there would be less difficulty to be encountered here than in India proper, especially if the work were carried out on the water, where self-registering balloons might be found easier, by means of a small steamer chartered for the purpose, and the wind, if too weak or too strong for kite ascents, increased or lessened by the motion of the vessel.

This plan once conceived, it occurred to us that some 600 miles further inland there was situated a vast sheet of water—the Victoria Nyanza—on the surface of which all the above-named advantages might be met for balloon as well as for kite work, thus affording the possibility of efficient and fruitful aërological research *in the heart of a tropical continent*, even in the middle of the equatorial belt, a unique spot of similar convenience to be found on the surface of the globe.

The Royal Prussian Aëronautical Observatory, the well-known creation of Prof. Assmann, took the matter in hand, and after having overcome a rather lengthy series of difficulties—above all, naturally enough, of a financial character—chiefly by the persistence of Prof. Assmann and the generosity of a few wealthy friends of scientific work we succeeded in carrying out our plan, at least in the leading features. This had in itself a double bearing. The first item consisted in an investigation of the monsoons, more particularly of the conditions of their change in the north-hemispheric autumn, and the intervening land and sea breezes, on the coast of British and German East Africa, as well as on the neighbouring sea (as a matter of fact, the work was carried far beyond the limits of the monsoons, down to the tropic of Capricorn). The other point was the "study of the *tropical*, or, more exactly speaking, the *equatorial continent*"—in contrast to the ocean of the same latitudes—from the aërological point of view, over the Lake Victoria, implying the research of the vertical distribution of temperature, the question of the "upper inversion," the study of the winds prevailing in the different strata, and, in addition, a comparative investigation of the land and sea breezes of the lake in analogy to those on the coast of the ocean.

For scientific and practical reasons, though, the experiments had to be executed in the inverse order; we began by the ascents on the large "inland sea of Central Africa," and wound up by research on the ocean.

The writer, as leader of the expedition, accompanied by Dr. Elias, and a technical assistant, left Europe in the middle of June, and managed, after some little delay at Mombasa and Nakuru, to arrive, *viâ* Uganda Railway and the lake, with all our cargo of windlasses, kites, balloons, chemicals, instruments, and personal equipment, on July 24 at Shirati, in German East Africa, situated on the east coast of the Nyanza, in 1° 7′ S. lat.

That all the difficulties which, of course, did not fail to arise could be overcome with so little loss of time is to a large extent due to the extreme courtesy, or in many cases even most helpful assistance, with which the expedition met everywhere in British East Africa. For this the observatory is largely indebted to Dr. Shaw, the director of the Meteorological Office, to the Colonial Office, and to all the authorities, Imperial as well as local, in British East Africa and Uganda. We beg to express our feelings of sincere gratitude to all of them, most particularly to Dr. Shaw and to the officials of the Uganda Railway, the custom and port officers in all those places, and the officers of the steamers plying on Lake Victoria.

Owing to this loyal help we succeeded in securing

small craft, the 45-ton steamer *Husseni*—owner, Mr. Allidina Vishran, of Entebbe, Uganda—for two months, in lieu of the intended *Heinrich Otto*, of Muanza, which, though otherwise likely to answer our purposes, unfortunately had broken down just when on the way to meet us. This delay, of some four days, was the reason that, contrary to our decided intentions, we only were capable of a very insufficient collaboration during the international series of ascents of July 27 to August 1.

After having got through the starting difficulties usual with African work we managed to execute in the time from the end of July until the middle of September twenty-three ascents of self-registering balloons, of which fifteen were retrieved with their apparatus, and registered curves of pressure, temperature, &c., whereas eight instruments were lost; but even the lost balloons furnished highly valuable data for the direction and velocity of wind in the alternate vertical strata, since nearly all the balloon flights were studied by means of theodolites from a fixed point on the shore.

A large number of smaller or larger pilot balloons carrying no apparatus, and some of them ascending to enormous heights, were inserted between the ascents of the self-registering tandem systems to complete the exploration of the wind, so important in these latitudes. A dozen or more kite ascents served the purpose of furnishing details about the lower parts of the atmosphere, particularly during the sea breeze, not exceeding in elevation 3000 feet to 4000 feet above the level of the lake, where the breeze disappeared altogether, thus rendering higher kite ascents impossible.

There can be no question as yet, having only just returned home from Africa, of giving a summary of the meteorological results; this must be reserved for some months later. We can only mention here crudely a few of the most striking points.

The highest self-registering balloon recovered rose to an elevation of 65,000 feet (19,800 metres), where a temperature of $-84°$ C., $=-119°$ F., was encountered, a lower temperature than ever registered at equal or even greater heights over Europe! Two other ascents reached 55,000 feet to 56,000 feet, with variable, although also comparatively low temperatures.

These very low temperatures confirmed the similar results obtained by MM. Teisserenc de Bort and Rotch on the *Otaria* in the equatorial regions of the Atlantic; but over continental East Africa we found also, occasionally, the "upper inversion of temperature" not encountered in the high strata of the atmosphere above the corresponding latitudes of the ocean west of this continent—certainly a feature of great importance.

While omitting the enumeration of many other interesting results, we at present only desire to point out the surprising fact that several times there was found an uppermost current of air blowing nearly from due west, and flowing above the regular easterly current of the equatorial region. The lower strata, underlying the regular east trade, were dominated by diurnal (at the very bottom) and seasonal winds.

After the middle of September we made a cruise on the lake, crossing it for the first time from east to west (from Shirati to Bukoba). The interior of the lake proved to be devoid of islands and uniformly deep.

The end of September and beginning of October were devoted to simultaneous ascents on the coast—at Mombasa—where experiments with kites and pilot balloons were carried out, and on the borders of the Nyanza, where Dr. Elias remained for a couple of weeks and made a series of pilot-balloon ascents, no kite work being possible there, since the little steamer had to be given up.

From October 9 until December 5, when the expedition definitely started on its homeward voyage, Dr. Elias preceding the other members by three weeks, the headquarters of our work was transferred to Daressalam. In this whole space of time there was hardly a day without a kite ascent, and besides these quite a series of pilot-balloon experiments was carried out. Part of the kite work was executed on the ocean south of Zanzibar from the little Government steamer *Rovuma*, in order to reach greater elevations; several of those higher ascents—a few exceeding 10,000 feet—were made at the end of October in the time between the two monsoons, the others in the first days of December, the north-east monsoon blowing then steadily.

We had at first the intention of making in the month of November simultaneous researches on the coast of the continent and on the Seychelles Islands, situated in mid-ocean, some 1000 miles to the eastward. This plan had to be given up for meteorological and practical reasons; we succeeded, though, in replacing it, at least to a certain extent, by two of us going on board the small German cruiser *Bussard* to the south as far as Delagoa Bay, and making a couple of *ballons-sondes* and several kite ascents from this ship, on the ocean as well as in the bay of Inhambane, 24° S. lat. Dr. Elias, who had remained at Daressalam, made in the meantime simultaneous kite and pilot-balloon ascents there and on the sea.

In this whole series of experiments on or near the ocean, forming the second part of our work, the kite and "pilot" experiments prevailed, whereas ascents of self-registering balloons, forming the chief feature of the investigations on Lake Victoria, could only be carried out in two cases in the months of October and November. The higher reached 13,300 metres, =nearly 44,000 feet, the kite ascents, as mentioned, reaching some 10,000 feet, =3200 metres; but the highest pilot balloon soared up to an elevation of about 21,000 metres, =nearly 70,000 feet, before it burst, yielding most interesting data about the superposition of the wind systems and the westerly air-drift in the highest strata of the atmosphere in those regions.

A. BERSON.

THE INSTITUTION OF NAVAL ARCHITECTS.

THE annual meetings of the Institution of Naval Architects opened on Wednesday, March 31, and were continued on Thursday and Friday, the rooms of the Royal Society of Arts being used, as on previous occasions. Owing to a family bereavement, Lord Cawdor, the president, was unable to be present, and the chair was taken by Sir Wm. White, K.C.B. The institution, having been founded in 1860, will complete its fiftieth year in 1910, when it proposes to commemorate the occasion by an international congress to be held in London.

The programme comprised eighteen papers, together with an additional paper by Sir Philip Watts on trials of torpedo-boat destroyers in waters of various depths. Limitations of space will permit of only a few of these to be noticed here.

Lord Brassey contributed the opening paper, on types of warships omitted in recent programmes of naval construction. Every maritime Power is now building Dreadnoughts; the needs of different countries may differ, but almost identical types are being produced, unanimity having been attained by imitation of British design. Types other than the Dreadnought, however, are of great value for the line of battle. Armoured cruisers have disappeared from the latest programmes, being too vulnerable to be reckoned as fighting ships. It is a waste of public money to keep such ships as the *Powerful* and the *Terrible* in commission. The naval experience and professional skill which we have available should now be directed to the creation of a type specially designed for the inshore squadron. The Dreadnoughts are essentially ships for the open sea, beyond the range of torpedoes and free from the danger of floating mines.

In closing the discussion on this paper, Sir Wm. White pointed out that the responsible naval architect had to produce designs to fulfil conditions laid down by the Admiralty. The *Powerful* and the *Terrible* had been designed to deal with some large Russian cruisers which had been built for the purpose of harrying our commerce, and would certainly have done so satisfactorily had occasion arisen. Although ships should be put out of service when twenty years old, it did not follow that such ships then disappeared for all practical purposes. In 1884 the speaker had designed two cruisers for the Japanese, and these ships destroyed Russian cruisers in 1905, when, of course, they ought to have been non-existent. Two matters had to be specially considered in modern policy—power of concentration and power of distribution.

An interesting paper was contributed by Prof. J. B. Henderson on the elasticity of ships as deduced from experiments on the vibration of dynamical models. A dynamical model of the ship is constructed out of a bar of steel of uniform thickness and varying breadth, and is loaded with lead weights soldered on. The conditions are that the model must have a load curve similar to the load curve of the ship, and also a curve of moments of inertia of cross-sections about the neutral axis similar to the corresponding curves for the ship. The scale for the load curve need not be the same as that for the moment-of-inertia curve. The model has its frequency measured stroboscopically when supported at two nodes, the vibrations being maintained electromagnetically. Experiments have been made at the Royal Naval College, Greenwich, on models representing H.M.S. *Pathfinder* and the *Lusitania*, giving results for Young's modulus of 21,000,000 lb. and 23,000,000 lb. per square inch respectively for these ships. The method seems likely to be useful in dealing with other forms of riveted structures, such as bridges. Prof. Henderson also showed in his paper how the causes of vibration in a ship may be located from an analysis of the pallograph record, and applied the method to the records of the *Lusitania* and *Mauritania*. It must, of course, be understood that no criticism is being directed at special vibration in either of the last-mentioned vessels.

Some useful information on the applications of the internal-combustion engine to marine propulsion was given in two papers, one by Mr. H. C. Anstey and the other by Mr. F. R. S. Bircham, the latter having special reference to submarines. Mr. Anstey deals with questions of economy of fuel, weight, and space, and, using certain data, estimates that with powers of, say, 500 horse-power on one shaft, it seems reasonable to expect 12 horse-power to 15 horse-power per ton of machinery weight for a complete installation of oil engines without auxiliaries. The weights would be greater with gas engines on account of the necessity for installing gas producers. The author also deals with a method of splitting the power into a number of convenient units, and transmitting the energy to the propeller electrically. This method has not commercial advantages sufficient to warrant its use for mercantile work, and for naval work could not compete with existing machinery in the considerations of weight and space. Mr. Anstey considers that the installing of internal-combustion engines would, in general, save space, but no great saving in weight would result. The difficulties of producing very large gas engines of a type trustworthy enough for marine purposes were pointed out by Prof. B. Hopkinson, who referred especially to the difficulty of efficiently keeping large cylinders cool. The Marquis of Graham gave an interesting illustration of a vessel in which he had the reciprocating engines taken out and gas engines and producers substituted. He was satisfied with the trustworthiness of the new plant, and found that the radius of action of the vessel was doubled, on account of the lower fuel consumption per horse-power. The total horse-power in this instance was about 500. Sir Wm. White thought that progress in this matter must be gradual, and deprecated the popular exaggeration of the size of engine which could be installed.

Mr. Bircham discussed the advantages and disadvantages of the system of propulsion for submarines in which internal-combustion engines are used when on the surface and electric power when submerged. In Del Proposto's alternative method, one cylinder of a four-cycle four-cylinder Diesel engine is used as an air compressor when running on the surface in order to charge storage bottles to a high pressure, the remaining cylinders propelling the boat and driving the compressor. When submerged, this cylinder is used as an air engine, exhausting into the boat and keeping the air therein fresh. In Mr. Bircham's modification of this plan the internal-combustion engine is coupled to a multi-stage compressor, which is run as an air engine of the multi-expansion type when the boat is submerged; the exhaust is used by the internal-combustion engine, a part being turned into the boat to renew the air therein when required. Efficient cooling of every part of the internal-combustion engine is necessary, the cylinders being entirely jacketed and the exhaust pipes water-cooled to the boat's skin. This paper is illustrated with several working sections of engines suitable for submarine propulsion.

Lieut.-Colonel G. Rota, R.I.N., described some trials which he has made on a steamer in the Royal Dockyard at Castellammare di Stabia, first with a single screw and afterwards with two contrary turning screws of different diameters on a common axis and having a constant pitch, and also with another pair having increasing pitch in accordance with Prof. Greenhill's rules given in 1888. One of the propeller shafts was tubular, the other rotating inside the first, both driven in opposite directions from an ordinary reciprocating engine. The author of the paper found that a reduction of power required to maintain the same speed was obtained of from 30·5 per cent. to 26·8 per cent. for speeds of from 5 to 7 knots respectively, the comparison being between double propellers of constant pitch and a single-screw propeller. The gain with double propellers of increasing pitch at the same speeds amounted to 23·8 per cent. and 17·3 per cent. as compared with that required with a single propeller in use. The experimental vessel had a length of 46 feet, a breadth of 11 feet 9 inches, and a displacement of 25 tons. The gain is evidently due to the better guiding of the stream of water reaching the propellers, which are of smaller diameter when double than that required for a single propeller; the gain in wake is considerable. In this respect the effect of the fore propeller, acting as a guide to the water on its way to the after propeller, may be compared with that of the fixed guide-blades of a steam or hydraulic turbine. The author also points out the adaptability of turbines for driving the shafts, and thus dispensing with gearing; a special turbine for reversing would also not be required.

A note on a mechanical method for determining the thrust of propellers was contributed by Mr. J. H. Heck. In this method one of the tunnel shafts is utilised to form the ram of a hydraulic press, and a slight separation is allowed between two of the tunnel-shaft flanges, these being enclosed within a hollow cylindrical casing in which the shafting can revolve. The casing is fixed in the tunnel, and is made water-tight by means of stuffing-boxes. Water is supplied to the casing by means of a small force pump, and its pressure is indicated by a pressure gauge or recorder. On pressure being applied by means of the pump, the propeller shaft will be slightly forced out of the casing, and, on releasing the pressure, the thrust of the propeller will push it in again. The mean of the gauge readings during both movements of the shaft is taken in order to eliminate frictional effects. This mean pressure, when multiplied by the cross-sectional area of the shaft at the place where it is revolving in the stuffing-box, will give the total thrust of the propeller. The author describes some experiments made with this apparatus.

The offer made by Mr. A. F. Yarrow a year ago to defray the cost, up to 20,000*l*., of establishing an experimental tank at the National Physical Laboratory will be remembered, and the report of the experimental tank committee is of interest. A building subcommittee has been at work, the members being Sir Wm. White, Mr. R. E. Froude, Dr. Glazebrook, and Mr. W. J. Luke. At present 1240*l*. out of the guarantee fund of 2000*l*. per annum required for maintenance under the terms of Mr. Yarrow's offer has been secured, and it is hoped that the total amount will be shortly made up. Meanwhile, in order to avoid delay, the executive committee of the National Physical Laboratory has guaranteed 800*l*. per annum, and has entrusted Messrs. Mott and Hay with the preparation of plans. The committee has considered the question of the management of the tank, and proposes an advisory committee, appointed by the governing body of the National Physical Laboratory, consisting mainly of representatives of the Institution of Naval Architects. Steps will be taken to preserve the confidential character of all work done at the tank for private firms, as well as the arrangements for problems of general interest to be taken up, and the publication of the results of these. Dr. Glazebrook has visited the most recent establishments of the kind in this country, and also in France and Germany, and the results of his visits of inspection are included in the report. The suggested dimensions of the

Bushy tank are:—effective length, 500 feet; depth of water, 12·5 feet; breadth of water, 30 feet; area of cross-section, 40 square yards; breadth of building, 42 feet; breadth of carriage, 31 feet; weight of carriage, 10 tons; velocity of carriage, 25 feet per second; horse-power on carriage, 50. The opinions expressed by the members at the meeting indicate that they are satisfied that these dimensions will amply provide for, not only ordinary commercial problems, but also for any special problems that may arise. One of the first systematic researches after the tank has settled down to its work will be the investigation of the many propeller problems regarding which little or no knowledge exists.

RURAL EDUCATION IN ITS VARIOUS GRADES.

THIS subject was discussed at a conference of the County Councils' Association held at Caxton Hall, Westminster, on March 31, under the presidency of Mr. Henry Hobhouse. The conference had been convened at the request of the Central Land Association, the Central Chamber of Agriculture, and the Farmers' Club, and was in every sense thoroughly representative.

A resolution was moved by Sir J. Cockburn to the effect that local education authorities should aim at securing better instruction in rural subjects, and that the teaching should be adapted to the circumstances of country life; school gardens and equipment for manual instruction should be provided, and elementary-school teachers should be specially trained for their work. The resolution was referred to a special committee.

To those unacquainted with country schools it must come as a surprise that such a resolution should be necessary nearly forty years after elementary education became the business of a Government department. Yet, as a matter of fact, it is only within quite recent years that the education of the country child has begun to have any sort of relation to his environment; he has been taught the same subjects as the town child, and in the same way, but often not quite as well. The teaching has been didactic, and has not necessarily involved any observation by the child of the things happening outside the school doors. For this the teacher has not been to blame, for country teachers, as a class, have as keen a professional spirit as town teachers, but the system has been at fault. Country children are sometimes said to be less intelligent than town children of the same class. This is emphatically not the case; on the contrary, the country child has often a larger stock of experience than the town child, and a proper system of education, based on his experience and dealing with the things about him, ought to give admirable results. It is much to be hoped that Sir J. Cockburn's resolution will be acted upon by those in authority.

After-education was also dealt with. The more promising children, it was urged, should be sent to secondary schools, where nature-study and elementary science teaching were given in close connection with practical work in the workshop and garden. The idea is admirable, but there would be considerable difficulty in getting to the school, especially in winter; while, if the children had to board at the school, the numbers would necessarily be very limited. Both elementary and secondary schools would remain under the Board of Education, but the more special agricultural education, the conference considered, should be dealt with by the Board of Agriculture. It was proposed that each group of counties should be connected with some agricultural college, which should be responsible for educating the students sent there, and for giving lectures and other instruction to farmers who cannot attend college. This system is already at work in some places, and was discussed in NATURE for March 25.

It will be observed that the resolutions were very comprehensive in their scope, and adequately covered the various problems of rural education. Whether the Boards of Education and of Agriculture could carry through so bold a scheme remains to be seen; it is undoubtedly to the interests of rural districts that they should.

To those wishing to learn the present position of higher agricultural education in England, a White Paper (Cd. 4569) issued by the Board of Education, giving certain tables of expenditure, will be useful. It was not possible to ascertain the exact amount spent on higher agricultural education, because in many cases agriculture only forms part of the work, and a fine estimate of what it receives is impossible. The Board of Agriculture grants are, of course, entirely *ad hoc*, but the Board of Education grants are for the whole institution. We find that the former Board gives 880*l*. a year to colleges of university standing in England and 3350*l*. to smaller colleges and schools. The Board of Education gives 72,856*l*. and 25,496*l*. respectively. In one way and another the County Council grants must be considerable, but as a whole institution is often involved it is impossible to work out the exact share that agriculture gets. Four counties, viz. Bucks, Cumberland, Herefordshire, and Wiltshire, all active in providing rural education, spend between them about 10,000*l*. annually. The paper goes on to point out that the Board of Education is prepared to give still higher grants when a properly coordinated scheme is submitted to it, and we should imagine that considerable advantage will be taken of the offer.

SOME MARINE AND FRESH-WATER ORGANISMS.

IN the first part of vol. xcii. of *Zeitschrift für wissenschaftliche Zoologie*, Mr. L. Luders gives a full description of the wonderful ostracod crustacean described by Müller in 1895 under the name of *Gigantocypris agassizi*, together with a brief reference to the second species of the same genus. The first evidence of the typical species was a specimen dredged in deep water off Prince Edward's Island during the cruise of the *Challenger*, which indicated a veritable giant in the group, the shell measuring no less than 25 mm. in length and 16 mm. in width. Of the soft parts only the head was preserved, but this and the shell were sufficient to indicate the distinctness of the species from all shallow-water forms, and it was suggested at the time that it might prove to represent a new family group. In 1891 other examples were dredged by the *Albatross* off the Pacific coast at depths of as much as 1700 fathoms, and these were duly described and named by G. W. Müller. Another specimen was obtained by the Prince of Monaco off the Azores, while later still several others were dredged in deep water by the *Valdivia*. It is these last which form the subject of Mr. Luders's paper, where full details of the external form and anatomy of the species are given. One of the specimens collected by the *Valdivia* was dredged in the Gulf of Guinea, while the others were obtained in widely separated localities. This, together with the structure of the shell, suggests that it is a deep-sea pelagic organism, which does not, like other ostracods, live in sand.

In connection with the foregoing may be conveniently noticed a paper by Dr. Esther Byrnes on the fresh-water species of Cyclops of Long Island, published in No. vii. of Cold Spring Harbour Monographs. The observations in this monograph, which are based on several years' work, have special reference to the variability displayed by the fresh-water species of these crustaceans. Those from Long Island agree generally with the forms from the western lakes, and indicate their wide distribution. Variation of a varietal type is strongly developed, but much more so in some species than in others; it attains its maximum in the forms inhabiting stagnant waters, which can only exist at all by the power of readily adapting themselves to environment. Size is largely dependent upon habitat.

The American snapping shrimps of the genus Synalpheus form the subject of a memoir by Mr. Henri Coutière, published as No. 1659 (vol. xxxvi., pp. 1–93) of the Proceedings of the U.S. National Museum. Previous to the appearance of this paper six American species of the group were nominally recognised, under the generic title of Alpheus, but the author is unable to retain more than three of these names. On the other hand, he names a considerable number of new species, not only from American waters, but from other parts of the world. In No. 1663 of the Proceedings of the U.S. National Museum (vol. xxxvi., pp. 173–7) Miss H. Richardson describes a specimen, from Wood's Holl,

Massachusetts, of the isopod crustacean *Ancinus depressus* (=*Noesa depressa*, Say), of which only two examples were previously known.

To the third part of the *Bergens Museum Aarbog* for 1908 Mr. Alf Wollebœk contributes an important and lavishly illustrated article on the decapod crustaceans of the North Atlantic and the Norwegian fiords. The article commences with an elaborate account, illustrated by eight out of the thirteen plates, of *Caloxaris crassipes*, for which the new subgeneric term Calocarides is proposed. The rest of the article is devoted to various species of Macrura, with special reference to their distribution, both horizontal and vertical, and their habits and life-histories.

In the serial last quoted, No. 1658 (vol. xxxv., pp. 681–727), Prof. C. C. Nutting reviews the alcyonarians of the coast of California, the paper being based on the collections obtained during the cruise of the *Albatross* in 1904. Out of a total of thirty-eight species, twenty are referable to the pennatulid group. Many of these species are described for the first time, and the memoir is illustrated with a large number of figures. The writer saw only two kinds of alcyonarians in shallow water—both pennatulids; and as the coast appears to form an ideal habitat for such organisms, their rarity requires explanation.

No. 2 of vol. vi. of the Zoological Publications of the University of California is devoted to the Leptomedusæ of the San Diego region. Of eleven species of these jelly-fish recognised by the author, Mr. H. B. Torrey, in the collection of the Marine Biological Association of San Diego, no fewer than ten are described as new, two of these indicating new generic types, namely Tiaropsidium and Phialopsis.

The last paper on our list is the first portion of a memoir by Mr. W. Gariaeff, of the Zoological Laboratory at Villafranca, on the histology of the central nervous system of the cephalopods, published in vol. cxii. of *Zeitschrift für wissenschaftliche Zoologie*. In this instance the author deals with *Octopus vulgaris*.

THE INFLUENCE OF MOISTURE ON CHEMICAL CHANGE.[1]

THE influence of a trace of water vapour on a chemical reaction was first noticed by Prof. H. B. Dixon in 1880. He found that it was possible to pass electric sparks in a mixture of carbon monoxide and oxygen without explosion if the mixture had been very carefully dried. Shortly afterwards Cowper proved that dried chlorine had little or no action on several metals. Further observations were made by Prof. Dixon's pupils, the author in 1884 showing that carbon could be heated red hot in dried oxygen, that sulphur, and even the very inflammable phosphorus, could be distilled in the same gas without burning. Later experiments proved that ammonia and hydrogen chloride gases could be mixed without uniting, and that the readily dissociated ammonium chloride could be converted into a true vapour, and sulphur trioxide could be crystallised on lime, provided always that moisture was, so far as possible, removed. In 1902 it was shown that tubes containing very dry and pure hydrogen and oxygen could be heated to redness without any explosion resulting, and in 1907 that nitrogen trioxide could exist in the gaseous state if carefully dried.

Taken altogether, some twenty-five simple chemical actions have been shown to be dependent on the presence of moisture, and a few only, the burning of cyanogen, carbon bisulphide, and some hydrocarbons, seem to take place as easily when dried as when moist. In 1893 Sir J. J. Thomson showed that a potential difference of 1200 volts was unable to cause the passage of electric sparks through very dry hydrogen, and in the same year the author was able to stop the passage of the discharge from an induction coil by carefully drying the gas between the platinum points.

The amount of water necessary for the bringing about of chemical action is extremely small, less, in all probability, than one part in three hundred thousand of the reacting gases. Many hypotheses have been suggested for the explanation of its action. Prof. Dixon believed, in the case of carbon monoxide and oxygen, that the water vapour acted as a carrier of oxygen by alternate reduction and re-oxidation of the hydrogen. Traube imagined an alternate formation and decomposition of hydrogen peroxide. Dr. Armstrong in 1884 suggested a theory of "reversed electrolysis," the impurity of the water vapour rendering it a conductor. Sir J. J. Thomson in 1893 published a paper showing that if the forces holding the atoms of a molecule together were electrical in their nature, these forces would be very much weakened in presence of liquid drops of any substance of high specific inductive capacity such as water.

In 1895 it was shown that the newly discovered Röntgen rays were able to cause a gas to become a conductor of electricity, and it was thought, at that time, that the molecules of the gas were split up into atoms by this agency. If this were so, it seemed likely that in these circumstances chemical action would take place in absence of water, but a joint paper of Prof. Dixon and the author, in 1896, showed that the Röntgen rays, at the ordinary temperature, had no measurable effect on the combination of dried gases. Since that time, however, the researches of J. J. Thomson, Rutherford, Townsend, and others have proved that the ionisation of gases is of a different character.[1] The negative ions are extremely small particles of the mass of about 1/1000th part of the mass of an atom of hydrogen, the positive ion being the residue, but whether it is the residue of a molecule or of an atom seems to be still doubtful.

With the view of illustrating the influence of ionisation of gases on chemical change, the author devised a new experiment. It is known that mercury vapour, in ordinary circumstances, contains only atoms of mercury, which exhibit little tendency to combine with oxygen. The vapour, however, is ionised in the mercury vapour lamp, and when the current is cut off and oxygen is admitted shortly afterwards, the mercury becomes covered with a layer of mercuric oxide. Since the temperature of the lamp is much below that at which ordinary mercury vapour combines with oxygen, it is evident that in this case ionisation can bring about chemical action.

It is probable that this ionisation of mercury is different from the ordinary ionisation of gases. It may be regarded as the splitting off of an electron from the atom as distinct from a molecule, and the charged atom of mercury can then enter into union with oxygen. The cases mentioned above of combustions in oxygen which are apparently unaffected by the absence of moisture are perhaps to be explained in the same way. The gases are readily broken up into their elements, and it has been shown that carbon bisulphide breaks up at a lower temperature than that required for its burning. When these gases are heated charged atoms are probably formed, capable of direct union with oxygen.

To test further the question as to whether the ionisation of molecules, as distinct from atoms, as in the case of mercury vapour, can bring about chemical change, some recent experiments have been performed in which radium bromide was used as the ionising agent. Small quantities of this salt, contained in open silica tubes, were sealed up in tubes containing mixtures of hydrogen and oxygen and carbon monoxide and oxygen, the gases being very dry in some cases and moist in others. In no case was any chemical action observed, although the tubes were allowed to stand at 20° for more than two months. By means of a vacuum gauge the combination of 1/10,000th of the whole could have been detected. Another experiment showed that radium bromide was able to produce ionisation in very dry air, so that the want of chemical action in the above experiments must have been due to the fact that ionisation cannot of itself produce chemical action. There remained, however, the possibility of ionisation increasing the rate of union of two gases which were otherwise under conditions which would produce a slow chemical action between them. The reaction between nitrous oxide and hydrogen was found to be a suitable one for investigation, since it takes place

[1] Abstract of the Wilde lecture, delivered before the Manchester Literary and Philosophical Society on March 9, by Dr. H. Brereton Baker, F.R.S.

[1] The author finds that liquid water invariably collects in tubes containing salts of radium, though these salts are not at all deliquescent. In one experiment 10 mg. of radium bromide increased in weight by 1·5 mg. when allowed to stand for two days in an atmosphere saturated with moisture at 0° C. Examination of the crystals under the microscope showed that their edges were quite sharp, showing that the absorption of water was not due to deliquescence.

slowly and uniformly at 530°. It is known that many substances will, when heated, ionise gases. Lime is fairly effective in this respect, thoria to a much greater extent, and radium bromide is the most effective of all. Accordingly, tubes containing the mixture of not very dry hydrogen and nitrous oxide were prepared. One contained a little lime, a second some thoria, and a third some radium bromide. These tubes were heated in an electric resistance furnace side by side with comparative tubes containing the same gases in which was a small quantity of powdered Jena glass to make the conditions as similar as possible. It was found that the rate of combination was much quickened by the presence of lime, much more by the presence of thoria, while the gases in contact with radium bromide, directly the combining temperature was reached, combined with explosion.

When a tube containing thoria and the same mixture was dried for ten days by phosphorus pentoxide, the gases showed no measurable combination when heated for five minutes to 530°.

Hence increasing the ionisation in presence of moisture increases the rate of chemical change, while in absence of moisture it apparently has no effect.

An experiment of rather different type was shown which illustrates the way in which the ionisation of gases may exert its influence. A mixture of sulphur dioxide and sulphuretted hydrogen can be kept unchanged although water vapour is present in some quantity. If, however, liquid water is introduced, separation of sulphur is immediate. A small open tube of radium bromide was placed in such a mixture, and after standing some time the whole of the gases condensed in the small tube of radium bromide in the form of sulphur and water. There is little doubt as to what happens in this case; the water vapour condenses in liquid drops on the ionised particles in the radium tube, and in these drops the reaction between the two gases is completed.[1] In the other chemical changes at high temperatures it is conceivable that condensation to some form approaching the liquid state might take place, in which case Sir J. J. Thomson's theory would apply.

In support of this view must be mentioned some very recent experiments of Prof. J. S. Townsend, which show that a very great diminution in mobility of negative ions is produced when a mere trace of water vapour is added to a dried gas ionised by Röntgen rays. If there is any truth in this provisional working hypothesis, it should be found that ions and water vapour (or some similar substance) must both be present in a mixture of gases if action is to take place. Experiments already in progress seem to show that this is the case, but they have not been sufficiently often repeated for it to be desirable to publish the results at this stage.

The lecture was illustrated by experiments showing the influence of small quantities of moisture on chemical actions.

FUNCTIONS OF A UNIVERSITY.[2]

I AM often asked, What will the University of Bristol be, and what will it do? The obvious, if not very enlightening answer is, It will, in large measure, be and do that which the citizens of Bristol shall, in their wisdom, determine that it shall be and do. Bristol will have to show the educational stuff of which it is made. It must rise to the great occasion, and prove itself equal to the responsibilities of a city of the first rank.

A university is not primarily a place, or a group of buildings, or a board of examiners. A university is first of all a corporate body of men, and with us of women too, associated together for a definite purpose, and united by a common aim. A university is, or should be, I take it, a guild of learners. Mark you, I do not say a guild of so-called learned folk. I trust there will be learned folk in our guild, and I trust there will be those rarer folk, men of wisdom and character; but though learned men, and wise men, and men of character, help to make a university, they do not constitute the university which, as a guild of learners, is founded on a broader basis. Nor do the teachers constitute a university, though they too help to make a university of the first rank. The learners constitute the university, and when the teachers cease to be learners they ought also to cease to be teachers. If then the university, as a corporate body, is a guild of learners, and its buildings a temple of learning, all should be welcome in the university who desire to learn, and who have given evidence of adequate breadth of previous education, and the requisite ability to learn at the relatively high level which ought to characterise university work. That is the real and only value of the matriculation test. Each stage of a degree should guarantee not only a higher level of attainment, but also a further ability to learn, and to utilise what has already been learnt.

A university, then, is a guild of learners united together in a corporation in which, as Huxley put it, "thought is free from all fetters, and in which all sources of knowledge, and all aids to learning, should be accessible to all comers without distinction of creed or country, riches or poverty."

The university is not, and cannot be, a place for all; it must be a place for the *selected few*, those only who are capable and willing to do university work. What we have to secure is that there shall be equal opportunities for all, without distinction of riches or poverty. Like the polishing of gems, the higher education is a costly and a lengthy process. It is worth while to spend two years in fashioning a Cullinan diamond, and its value is thus enormously enhanced. To expend this time and labour on mere glass or paste would be a grave economic blunder. In the university we must select the material on which the time and labour of our educational lapidaries is to be bestowed; and it is worth while to take the most anxious care to find your precious stones if only they are true gems. If, say, within the next ten years the University of Bristol can find and fashion but one lad of real genius, who would otherwise be cut off from the highest training, Mr. Wills's investment of 100,000*l.* in the University will be economically justified. That is not merely an opinion of mine. Some of you may remember what Huxley said:—"I weigh my words when I say that if the nation could purchase a potential Watt, or Davy, or Faraday at the cost of a hundred thousand pounds down, he would be dirt cheap at the money. It is a mere commonplace and everyday piece of knowledge that what these three men did has produced untold millions of wealth, in the narrowest economical sense of the word." This is a point on which I feel strongly. As a matter of economic policy, from the national standpoint, I am convinced that 1000*l.* spent by a local education authority on the highest training of the best student will bear far higher interest to the community than the same sum spent in giving a smattering of education to a thousand evening students. Do not, however, misunderstand me. I am not denying that the latter expenditure is of value to the community. All I say is, this ought ye to do, and not to leave the other undone; but I do venture to add that we are not wise in the way in which we manage our national investment in education. As a nation we invest annually between thirteen and fourteen millions in elementary and secondary education in England and Wales. What is the amount of the Treasury grant to university education? About 142,000*l.*, a little more than 1 per cent.

The chief thing that should be learnt in a university is how the problems which arise in all serious work are to be approached, to be grappled with, and, if possible, to be solved. That is really the first and foremost thing to be learnt. A leading man of business, whom I met some years ago in the United States, told me that most of the younger men employed in responsible positions in his office held a university degree. I asked wherein lay the practical value of the degree for his purposes. He replied that such men had been trained to face and tackle problems, and he added that it did not much matter in what faculty they had been trained, or, in other words, what line of investigation they had followed during their university career. He contended that the university degree was the

[1] Since the phenomenon in gases is admittedly different from that in electrolysis, it is much to be regretted that the same term, ionisation, is retained for both.

[2] From a speech on the University of Bristol delivered by Prof. C. Lloyd Morgan, F.R.S., at the tenth annual dinner of the University College Colston Society, Bristol, January 14.

mark of a live man, and what he wanted in his business was live men. That was only one way of expressing the doctrine you have all heard preached. That doctrine concerns the value of research. For, after all, what is meant in this connection by research is just this, that the student is brought face to face with some of the living problems on the growing edge of his subject, and is shown how to deal with them. Such a training is invaluable; but it cannot be adequately tested by a written examination, nor even by a practical examination lasting only a few hours. Hence the importance of giving the teacher who has watched and supervised such work a voice—not, of course, the sole voice, but still an effective voice—in the selection of those on whom a degree is to be conferred. In all the provincial universities the teacher cooperates with the external examiner in gauging the capacity of an undergraduate, and so it will be in Bristol.

It must be remembered that the training of undergraduates, though an important part of the work of a university, is not its only work. A university is not only a place where knowledge is imparted, but where knowledge is made. Apart from the minor researches of undergraduates—which really constitute a training in research—there are the major researches of the staff and of postgraduate students. If the University of Bristol is to take its proper place in the community of provincial universities, the professors and lecturers must have the capacity, and must be given the requisite time, for such research. I will not enlarge upon this subject. I will only direct attention to the fact that there are important agricultural problems and some fishery problems which await solution in the district round us, and to the solution of which I trust the University of Bristol will contribute. The university should be regarded as the natural centre of research in such matters. There must be a great number of commercial problems on which skilled work is required. I should like to see the University specialise on some of these. We shall need, too, some local colour in our University. I cherish the hope that a Cabot chair of geography may be founded in Bristol, where a carefully organised training in this subject, both in its more academic and in its commercial aspect, will be developed.

I have, so far, refrained from making any reference to the system of education which has of late years been developed in Germany. Nor do I now propose to trouble you with statistics and details. On one salient characteristic I venture to comment. Mr. Haldane has directed attention to what he regards as a growing feature of German life, which finds expression in "the double aim of the German university system—pure culture, on the one hand, and on the other the application of the highest knowledge to commercial enterprise." Germany has realised, as England is only beginning to realise, and that somewhat slowly, that the application of the highest knowledge to commercial enterprise is the secret of industrial success. In England the university professor is too often regarded by practical men as an upper schoolmaster, whose doctrinaire notions are of little value outside his class-room or his laboratory; but when some months ago the Chancellor of the Exchequer went into one of the largest workshops of Germany, he was taken round by a professor. He asked what a professor had to do with it, and was told, "the professors are our experts." The Germans, Mr. Lloyd George said, get their ideas from their professors. He regarded the universities as factories where the future of the country is being forged, and he gave it as his opinion that there is no investment that will produce such a return, not to the investor, but to generations to come, as the endowment of higher education.

That, then, is one aspect of the function of a university. It should contribute to the work of the world at the highest level of efficiency. Twenty years ago Lord Salisbury said, "Man's first necessity is to live, his first duty is to work, and the object of education is to fit him for his work"; but man does not live by work alone. To achieve success in commercial warfare in the field of industrial competition is not the sole aim of education. This alone will not make a nation great. You will perhaps pardon one who is, in part at least, a philosopher by trade, for quoting Aristotle:—"The whole of life," we read in his "Politics," "is divided into two parts—business and leisure, war and peace—and all our actions are divided into such as are necessary and useful, and such as are fine. We have to be busy and to go to war, but still more to be at peace and in the enjoyment of leisure. We must do what is useful and necessary, but still more what is fine. These are the aims we have to keep in view in the education of our children, and people of every age that require education." This is the doctrine of culture, a doctrine which, I trust, the University of Bristol will strive to carry out in practice not less sedulously than that of the application of the highest knowledge to commercial enterprise.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

AT the monthly meeting of the governors of the Imperial College of Science and Technology on April 2 it was decided, subject to the approval of the King in Council, to recognise the metallurgical department of the University of Sheffield as being in association with the Imperial College of Science and Technology for the advanced metallurgy of iron and steel, as provided for in the charter.

ON April 2, at Edinburgh University, the honorary degree of LL.D. was conferred upon Mr. J. G. Bartholomew, hon. secretary Royal Scottish Geographical Society; Prof. A. Crum Brown, F.R.S.; Prof. W. Burnside, F.R.S., Royal Naval College, Greenwich; Prof. Taylor; Sir Alfred Keogh, K.C.B., Director-General of the Army Medical Service; Prof. C. H. Kronecker, University of Berne; and Dr. J. E. Sandys, Public Orator in Cambridge University.

AMONG recent gifts to higher education in the United States, *Science* announces a donation of 35,400*l.* from Mr. J. D. Rockefeller to the University of Chicago. The New York *Evening Post* states that the University of Missouri will receive 100,000*l.*, for the assistance of needy students, by the will of the late Mr. C. R. Gregory, of St. Louis. The Weyerhauser interests of St. Paul have given to the University of Minnesota 2200 acres of land in Carlton County for the use of experiments by the forestry department.

A COMMITTEE has been appointed by the Treasury to consider the statements of claims to additional State assistance and estimates of the amounts needed for the respective services, which have been supplied by the Scottish universities at the request of His Majesty's Government; and to report as to what assistance, if any, should be granted from public funds in the interests of the proper development of the work of the universities, due regard being had to the coordination of their work with that of other institutions in Scotland giving instruction of a university standard. The committee is composed of the following members:—the Earl of Elgin and Kincardine, K.C. (chairman), Miss Haldane, Sir Kenelm Digby, G.C.B., Principal Sir Harry Reichel, Mr. C. M. Douglas, Prof. A. R. Forsyth, F.R.S., and Prof. G. Sims Woodhead.

SOMERVILLE COLLEGE, Oxford, is offering, for the third time, a research fellowship of the annual value of 120*l.*, tenable for three years, for which application must be made before May 15 to Miss H. Darbishire, Somerville College, Oxford. The fellowship is now, for the first time, open to women students of Cambridge and Trinity College, Dublin, as well as of Oxford. The two fellows hitherto elected have done valuable original work. Miss E. Jamieson was engaged in researches among the archives in Monte Cassino, La Cava, and Sicily, with a view to the constitutional history of the reign of Roger II. of Sicily. Miss F. Isaac has been engaged in research on the nature and properties of supersaturated crystalline solutions and mixtures, and the results of her work have been published in the Proceedings of the Royal and other scientific societies.

THE Board of Education has published a volume which contains particulars of the application of funds by local authorities in England and Wales to the purpose of education, other than elementary, in the financial year ended March 31, 1907. The returns deal with secondary educa-

tion—including, not only secondary schools, but also the instruction of pupil-teachers—the training of teachers, the provision of scholarships, evening schools or the various forms of technical instruction, and higher education in science and in art generally. A diagram has been introduced into the Blue-book this year showing graphically, for three years, including 1906–7, the comparative rise and fall of certain selected items of expenditure, other than out of loans, of local authorities for classified groups of areas. The income from all sources for meeting the year's expenditure showed a total increase, as compared with the previous year, 1905–6, of nearly 213,000*l.*, and the increased amount raised from rates was equivalent to about 97 per cent. of that total. The total expenditure on higher education, as already defined, was, during the year, 3,680,718*l.*, as compared with 3,355,434*l.* in the previous year. In 1906–7 the expenditure under various headings was as follows:—for secondary education, 1,068,655*l.*; for evening schools and institutions for higher and technical education, 1,475,358*l.*; for exhibitions, including scholarships, bursaries, and the payment of fees, 448,769*l.*; for training of teachers other than pupil-teachers, 98,599*l.* In addition to these items, administrative and legal expenses accounted for 198,073*l.*, other expenses amounted to 120,320*l.*, and 220,480*l.* was paid in respect of loans.

THE thirty-sixth annual dinner of the "Old Students" of the Royal School of Mines was held on March 30, under the chairmanship of Mr. F. W. Rudler, supported by many distinguished guests and old School of Mines men, as well as old students of the Royal College of Chemistry and Royal College of Science. The "Royal School of Mines" was proposed by Sir William H. White, who referred to the admirable record of the school and to the intention of the governing body that its reincarnation should render it second to none in the world. Mr. Rudler, in replying, referred to the early history of the school and to the necessity for combining theory with practice on the lines which had been laid down in drawing up the plans for the new laboratories and testing floors, and expressed the hope that it might be possible to found a chair of economic geology. The toast of "The Visitors," proposed by Mr. Bedford McNeill, was responded to by Mr. A. H. Dyke Acland, who pointed out that "character and grit," as well as the admirable training in the reorganised Royal School of Mines, are essential to a student's success. In concluding, Mr. Acland referred to the proposed students' union building, which he hopes will worthily represent the governors' desire for the bodily and mental welfare of the students, both of the Royal School of Mines and of the other colleges, &c., connected with the Imperial College of Science and Technology. In replying to the toast of "The Chairman," Mr. Rudler referred to the loss sustained by the mining and metallurgical professions by the death of Bennett H. Brough. Provision for the widow and children has been made by the Iron and Steel Institute, and it is now proposed to invite subscriptions for an entirely different purpose, which is for the formation of some permanent memorial to perpetuate the memory of one who was widely honoured and loved. Notices will be sent out shortly with the view of the foundation of a scholarship at the Royal School of Mines. All who knew Brough will agree that such a scholarship is the very thing which he would have desired, and that a more fitting occasion could not have been chosen for this—the first official announcement of what had been in the minds of so many since the death of their old friend.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, January 21.—"The Photo-electric Fatigue of Zinc.—II." By H. Stanley **Allen**. Communicated by Prof. H. A. Wilson, F.R.S.

In a former paper (Roy. Soc. Proc., A, vol. lxxviii., p. 483, 1907) an account was given of the way in which the photo-electric activity of zinc diminishes when the metal is exposed to light from a Nernst lamp.

The experiments described in the present paper were carried out to determine whether the results were similar when using a source of light giving far more ultra-violet radiation than the Nernst lamp. A mercury-vapour lamp of fused quartz was employed.

The method of experimenting was similar to that described in the previous paper, but the testing cell, consisting of the zinc plate and a positively charged sheet of wire gauze, was in the open air instead of being enclosed in a brass case.

Conclusion.—The photo-electric activity of a zinc plate decays in such a way that it can be represented as the sum of two exponential terms. The constants of change are but little altered by considerable variations in the character and intensity of the illumination employed, though the value of the photo-electric current is changed considerably. The rate at which the surface is altered is not greatly affected by using a mercury-vapour lamp in place of a Nernst lamp.

Royal Microscopical Society, March 17.—Mr. E. J. Spitta, vice-president, in the chair.—The optical examination of a crystal section in a rock slice: Dr. J. W. **Evans**. —*Synchaeta fennica*, sp.n., and on the resting-egg of *S. pectinata*: C. F. **Rousselet**.

Mineralogical Society, March 23.—Principal H. A. Miers, F.R.S., president, in the chair.—A stage goniometer for use with the Dick pattern of microscope: Prof. H. L. **Bowman**. The form of goniometer, intended to be screwed to the stage of a microscope with rotating Nicols, which was designed by Principal Miers, has been slightly modified by the author with the view of securing increased rigidity and ease of control. The instrument is adapted for supporting and manipulating a small crystal during the examination of etching-figures or other features requiring high magnification, as well as for the determination of its optic axial angle in air or oil, and the extinction angles and other optical characters of the various faces. It is provided with screw motions for adjusting and centring the crystal, and for regulating the height of the axis above the stage.—The electrostatic separation of minerals: T. **Cook**. Conductivity is a much more important factor than specific gravity in determining the behaviour of mineral fragments under the influence of an electrostatic charge. The greater susceptibility of good conductors as compared with bad conductors can be made still more pronounced by providing for the escape of the repelled opposite charge, which takes place rapidly in good conductors and slowly in bad conductors. It was shown that, in consequence of this fact, grains of such good conductors as ilmenite, pyrites, galena, or wolfram can be easily separated by means of a rubbed piece of sealing-wax from admixed grains of bad conductors, such as calcite, quartz, fluor, or monazite. Minerals having a metallic lustre are good conductors, whereas those which are colourless and highly transparent are bad conductors. It is suggested that there is probably a much closer connection between the conductivity of a mineral and its general optical properties than has been hitherto suspected. —The identity of guarinite and hiortdahlite: Dr. F. **Zambonini**, with chemical analysis by Dr. G. T. **Prior**. The rare mineral guarinite, which occurs sparingly in small yellow crystals in the sanidinite bombs of Monte Somma, has been hitherto regarded as orthorhombic, and as essentially a complex silicate of lime, alumina, and soda. A new investigation made by the author on crystals showing terminal faces shows that the mineral is really triclinic, and identical both crystallographically and optically with hiortdahlite. Crystals of guarinite show polysynthetic twin lamellæ with oblique extinctions like those exhibited by crystals of hiortdahlite. The chemical analysis showed that the mineral is essentially a fluosilicate and zirconate of lime and soda, practically identical in composition with hiortdahlite, although the percentage of fluorine was lower than that given in Cleve's analysis of the latter mineral. The numbers obtained in the analysis correspond closely to a formula

$$3CaSiO_3.Ca(OH,F)Na.ZrO_3.$$

—Note to a paper on the comparison of refractive indices of minerals in thin sections: Dr. J. W. **Evans**. Parallel Nicols are placed so as to bisect the angle between the

directions of vibration in the adjoining crystal sections which make the smaller angle with each other, so that the Becke effect is mainly due to the relation between their indices of refraction. The author discusses in detail the effect of the refractive indices of the different directions of vibration on the result.

Geological Society, March 24.—Prof. W. J. Sollas, F.R.S., president, in the chair.—Glacial erosion in North Wales: Prof. W. M. **Davis**. An excursion around Snowdon in 1907, followed by another in 1908, led the author to think that a large-featured, full-bodied mountain of pre-Glacial time had been converted by glacial erosion during the Glacial period into the sharp-featured, narrow-spurred mountain of to-day. The indifference of topographic form to the trend of formation boundaries and the insequent stream arrangement are what might be expected as the result of prolonged erosion upon a mass of complicated and resistant structure. The author is of opinion that the upland deserves classification rather with peneplains; he suggests for it a Tertiary date, and argues that Snowdon had a relief of some 2000 feet above the plain. It is considered that the dissection of North Wales must have been less developed in pre-Glacial times than in Devon to-day. On this assumption it is possible to make a tentative restoration of the pre-Glacial form of Snowdon. The chief abnormal features of Snowdon are the following:—Alongside the summit and slopes of a "moel" stand the head-cliffs of a rock-walled cwm, in the floor of which talus is accumulating. The cwm-floors are generally stepped, and the streams cascade down into the valleys. The slope of the main valleys occasionally decreases even to the point of reversal, as where lakes occur, and in the immediate neighbourhood of smoothly graded, waste-covered slopes, knobby or craggy ledges and bars of rock often appear. Two out of four possible hypotheses put forward are discussed—"that glaciers are essentially protective agencies" or that they "are active destructive agencies." It is found that certain facts, and especially those relating to rock-steps, cannot be explained on the protection theory, while the theory of a destructive agency seems to explain most of the facts. There is no systematic relationship between the height of the cwm-cliffs and the distance of the front rock-step; the serration of "cribs" or *arêtes* cannot be explained by pre-Glacial or post-Glacial weathering, according to the protection theory. No consistent explanation of the valley-steps can be found under the theory of ice protection, whereas they are explicable on the assumption of glacial erosion. The catenary curve of the cross-section of such valleys as those containing Llyn Gwynant and Llyn Cwellin might be expected to result from long-continued ice erosion, and the occurrence of great cliffs on the sides of these valleys is not inconsistent with such an origin. The most striking case of a glacial overflow is that at the head of the Nantlle valley, which appears to have carried much of the west Snowdon ice. The head of the pass would seem to have been farther westward and higher in pre-Glacial times.

DUBLIN.

Royal Dublin Society, March 23.—Prof. A. F. Dixon in the chair.—Black scab or potato-wart (*Chrysophlyctis endobiotica*, Schilb.), and other Chytridiaceæ: Prof. T. **Johnson**. The author gave an illustrated account of the origin, structure, and conditions of germination of the multisporous resting sporangia of the parasitic fungus *Chrysophlyctis endobiotica*, Schilb., the cause of black scab or black wart in potatoes. The successful germination of the "resting spores" was announced in a letter to NATURE in November, 1908. The author, basing his observations on the examination of type-material from M. Trabut, compared beet-tumour, due to Urophlyctis or *Cladochytrium leproides*, with potato-wart, and showed how they differ. He also discussed Magnus's views on the genus Urophlyctis, and stated that flax yellowing caused by *Asterocystis radicis*, de Wild., not uncommon in Ireland a few years ago, is now kept in check by potash manuring. *Eurychasma Dicksonii* (Wright), Magnus, and *Olpidium sphacellarum*, Kny, two Irish marine Chytridiaceæ, the latter being hitherto unrecorded for Ireland, were described.—The Scandinavian origin of the hornless cattle of the British Isles: Prof. James **Wilson**. The common opinion is that the British hornless breeds of cattle originated either as reversions to an older hornless type or as spontaneous variations, as Darwin believed, from the horned to the hornless condition. Both these theories are wrong, for these reasons:—(*a*) the self-same variation occurred in too many places—twelve or fifteen at least—in Britain; (*b*) it ought to have occurred as frequently among similar cattle elsewhere, in the Low Countries, for instance; and (*c*) it has ceased to occur within what might be called bovine historic time. The first suggestion that the British hornless cattle are of Scandinavian origin comes from the localities in which they were found in the eighteenth century. These were what might be called pockets round the coasts of Britain and in Ireland, viz. Suffolk, Holderness, Forfarshire, Aberdeenshire, Morayshire, Sutherland, Skye, Galloway, Somerset, Devon, and the north and west of Ireland. Besides being hornless, these coast cattle agreed in several other characteristics—they were light dun in colour, or bore colours derived from light dun; they were small, narrow chined, short legged, sickle-hocked, and good dairy cattle. They arrived in Britain before 1066, and not before the end of the Anglo-Saxon invasion. Cattle of the same kind were found in other Norse settlements, viz. Normandy, the Channel Islands, north Holland, Orkney, Shetland, and Iceland, and cattle of the same kind are still to be found from Norway to north Russia. In all probability they are descended from the cattle of the Scythians, referred to by Herodotus, and may be traced back either to Egypt or western Asia.—The osmotic pressures of the blood and eggs of birds: W. R. G. **Atkins**. The blood of *Gallus bankiva*, *Meleagris gallopavo*, Anas, Anser, and *Rhea americana* was examined, and the freezing point of the blood of each species was found to be almost constant, the variations being of the same order as those met with in mammals. The eggs of Gallus and Anas were studied; they are not isotonic with the blood, freezing at $-0°.45$ C., while the blood freezes at $-0°.61$ C. and $-0°.57$ C. respectively. This difference in the freezing point is more than accounted for by the diminution in inorganic salts in the egg as compared with the blood.

PARIS.

Academy of Sciences, March 29.—M. Bouchard in the chair.—Complement and summary of the observations made at Meudon Observatory on Morehouse's comet: H. **Deslandres**, A. **Bernard**, and J. **Bosler**. After summarising the work which has been done on this comet, the following are mentioned as noteworthy points:—the presence of three new lines or bands (λλ 456, 426, and 401) of unknown origin, noticed for the first time in the tail of Daniel's comet; the presence of only one group of cyanogen bands; and the presence of a characteristic nitrogen band.—The diffraction of Hertzian waves: H. **Poincaré**. A mathematical investigation which throws light on the striking effects of diffraction obtained in wireless telegraphy over great distances.—Some extremely simple formulæ relating to the coefficient of self-induction and to the time constant of a very long bobbin: Marcel **Deprez**. The formula given for the coefficient of self-induction is L^2/a, in which L is the total length of wire wound on the bobbin, and *a* the length of the bobbin.—Concerning *Trypanosoma pecaudi*, *T. dimorphon*, and *T. congolense*: A. **Laveran**. Two sheep inoculated with *Tr. pecaudi* became infected; at the end of six months they were cured, and were completely immune against this organism. Inoculated then with *T. dimorphon*, they were infected like new animals. One of these, after cure, had not acquired immunity against *T. dimorphon*, but the other proved to be immune. The latter animal, then inoculated with *T. congolense*, contracted the infection. All these observations confirm the original view that these three trypanosomes belong to entirely independent species.—M. Boudier was elected a correspondant in the section of botany in the place of the late M. Masters.—Certain cyclic systems: G. **Tzitzéica**.—A general principle of uniformisation: Paul **Koebe**.—An arrangement for measuring very small displacements of the lines of

the spectrum: H. **Buisson** and Ch. **Fabry.**—The hydrolytic dissociation of chloride of bismuth: René **Dubrisay.** If the equation usually given for dissociation,

$$BiCl_3 + H_2O = BiOCl + 2HCl,$$

the solution should be divariant at constant pressure; from thermochemical data an elevation of temperature ought to correspond with a diminution in the degree of dissociation. Both these conclusions have been experimentally confirmed.—The calculation of molecular weights by means of vapour densities. The case of toluene: A. **Leduc.** The author has applied the formulæ developed by him in previous papers to the experimental data of Ramsay and Steele for toluene vapour. The molecular weight thus deduced is 92·083, as against 92·088 deduced from the atomic weights, the difference being less than the experimental error. The method of reduction used by Ramsay and Steele gave a result nearly 0·5 per cent. different from this.—The radioactivity of the thermal springs of Bagnères-de-Luchon: Charles **Moureu** and Adolphe **Lepape.** The radioactivities of the gases given off spontaneously by the waters, and those of the waters themselves, have been determined. It is noteworthy that, in spite of the close analogy in composition and geological origin of these twenty springs, the radio-activities found are very unequal, and cannot be connected with any other physical or chemical property of the waters.—The impossibility of predicting by thermochemistry the relative stability of comparable compounds of lead and silver: Albert **Colson.** A study of the comparative stability of the carbonates and nitrates of lead and silver. The results obtained do not correspond with the heats of formation of these salts.—The preparation of some new silicon chlorides of the silicomethane series: A. **Besson** and L. **Fournier.** When the silent discharge is passed through a mixture of silicochloroform and hydrogen a reaction takes place, an oily liquid being deposited. From this the authors were able to isolate $SiCl_4$, Si_2Cl_6, Si_3Cl_8, all of which have been previously described. In addition to these, two new compounds are obtained, possessing the composition Si_5Cl_{12} and Si_6Cl_{14}. The method of preparation ensures the complete absence of oxychlorides.—The purification of hydrated sulphuric acid from arsenic by freezing: M. **Morancé.** A crude acid was partially frozen, the crystals formed being about one-half the weight of the acid employed. The percentages of iron and arsenic in the solidified acid were much less than in the original sample.—The colouring and tinctorial properties of picric acid: Léo **Vignon.** The coloration of solutions of picric acid in various solvents varies in the same sense as the electrical conductivity of these solutions.—The condensation of methyldiketobutyrate with hydrocarbons and with aromatic amines: A. **Guyot** and V. **Badonnel.** This ester undergoes condensation readily with dimethylaniline, diethylaniline, and toluene. The chief properties and reactions of the compounds thus made are given.—Allylcarbinol. Passage to the furfurane series: H. **Pariselle.** An improved method of preparing this compound from magnesium, trioxymethylene, and allyl bromide is described. The addition of bromine to the allylcarbinol gives

$$CH_2Br.CHBr.CH_2.CH_2OH,$$

and this, under the action of caustic potash, gives monobrom-tetrahydrofurfurane.—The cyclisation of the acyclic diketones: E. E. **Blaise** and A. **Kœhler.**—The hybrids of barley and the law of Mendel: L. **Blaringhem.**—The natural immunity of snakes against the venom of batrachians, and in particular against salamandrine: Mme. M. **Phisalix.**—The incoagulability of the blood resulting from the ablation of the liver in the frog: M. **Doyon** and C. **Gautier.**—A method of coloration of the myelin of the peripheral nerve fibres, and on certain analogies between the microchemical reactions of myelin and mitochondria: Cl. **Regaud.**—Proof of the presence of *Treponema pallidum* in the cephalorachidian liquid arising from acquired syphilis of the nervous centres: E. **Gaucher** and Pierre **Merle.**—The therapeutical activity of d'Arsonvalisation: E. **Doumer.**—General experimental infection with hepatic localisation: A. **Le Play.**—Orientation in certain molluscs: Georges **Bohn.**—Cochineal of the south of France and Corsica: Paul **Marchal.**—A new genus of Zeinæ: A. **Cligny.**—The composition of the Lower Eocene in the south and centre of Tunis and Algeria: J. **Roussel.**—The Cretaceous escarpment of the S.W. of the Paris basin: Jules **Welsch.**—The age of the Primary limestones of the eastern Pyrenees: O. **Mengel.**—The Upper Cretacean of the basin of Seybouse (Algeria): J. **Blayac.**—Analysis of the Arctic submarine deposits: J. **Thoulet.**—Lithological study of the deposits of the pool of Thau: L. **Sudry.**

DIARY OF SOCIETIES.

FRIDAY, APRIL 16.

MALACOLOGICAL SOCIETY, at 8.—Description of *Pomatias Harmeri*, n.sp., from the Red Crag of Essex: A. S. Kennard.—Fossil Pearl Growths: J. Wilfred Jackson.—The New Zealand Athoracophoridæ, with Descriptions of Two New Forms: Henry Suter.—On the Family Ampullariidæ, No. 1, Ampullarina (*sensu stricto*), List of Species, Varieties, and Synonyms, with Descriptions of New Forms: G. B. Sowerby.

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