THURSDAY, DECEMBER 24, 1908.

THE ANATOMY OF DICOTYLEDONS.

Systematic Anatomy of Dicotyledons: a Handbook for Laboratories of Pure and Applied Botany. By Dr. H. Solereder. Translated by L. A. Boodle and Dr. F. E. Fritsch. Revised by Dr. D. H. Scott. Vol. I., Introduction, Polypetalæ, Gamopetalæ. Pp. xii+644. Price 24*s.* net. Vol. II., Monochlamydeæ, Addenda, Concluding Remarks. Pp. vi+645 to 1182. (Oxford: The Clarendon Press, 1908.) Price 24*s.* net.

THE long-expected translation of Dr. Hans Solereder's "Systematische Anatomie der Dicotyledon," which has recently been issued by the Clarendon Press, is the latest addition to the splendid series of English translations of classical German works for which all English-speaking people owe a deep debt of gratitude to the Oxford Press.

Except for the introduction and for the "concluding remarks," which appear at the end of the second volume, Dr. Solereder's work cannot be recommended for a course of continuous reading. As a work of reference, however, and as an exhaustive guide to the literature of the anatomy of Dicotyledons, the book will be found to be invaluable. Under each natural order the vast amount of material to be dealt with is arranged according to a common plan; a review of the anatomical features is first given, this is then followed by an account of the structure of the leaf, the subject being subdivided under the epidermis, stomata, internal structure, crystals, hairs, glands, and the structure of the petiole. The structure of the axis forms the third division, which is subdivided according to the peculiar needs of each natural order. Some account is also given of any anomalous or remarkable structures, and finally a complete list of the literature, brought, so far as possible, up to date, is placed at the end of each order.

One hundred and fifty-three figures in the first volume and thirty-six in the second are scattered through the text to illustrate typical or peculiar anatomical features in the various orders or genera. It would clearly be impossible to attempt to review or to criticise in detail the vast mass of material which has been compressed into the pages of these volumes, for the value of the book can only become apparent to anyone actually working in the laboratory at the comparative anatomy of a natural order or a group of genera.

Dr. Solereder's work will occupy much the same position as a work of reference for the morphological botanist as the "Index Kewensis" does for the pure systematist. One looks through its pages in the hope of finding that some light may be shed on complicated taxonomic problems, only to be disappointed. Dr. Solereder's book, however, serves as the key by which the door may be opened by both the plant anatomist and taxonomist to a common field of fruitful investigation. It is somewhat remarkable to notice the extent to which anatomical research tends to confirm the conclusions of the systematist, as, for instance, in the Loganiaceæ; all the genera of the Loganioideæ are found to have bicollateral vascular bundles, whilst all the Buddleioideæ have simple collateral bundles. Further, in the allied order Gentianaceæ, bicollateral bundles are characteristic of practically all the representatives with the exception of the Menyantheæ. As to the affinities of some of the orders, the position of which is uncertain, as, for instance, the Coriariaceæ, little further light, unfortunately, is shed by the anatomical method. On the other hand, the method may be of great service in the case of assigning a peculiar genus to its proper position in the natural system. The genus Chalepoa, for example, which had been placed with the Pittosporeæ, has been transferred to the Saxifragaceæ, owing to the absence of the resin canals characteristic of Pittosporeæ.

A yet more interesting case of the service which can be rendered to systematic work by the anatomical method was afforded some years ago by Radlkofer (British Association Report, Aberdeen, 1885), when he was attempting to determine some of the fragmentary material in old herbaria. From an examination of *Sideroxylon mite*, L., in the Linnæan herbarium, it was found that this plant did not belong to the Myrsineaceæ, as suggested by Sprengel, who named it *Myrsine mitis*, Spreng., but was in reality a specimen of *Ilex capensis*, Sond. Another supposed species of Myrsine, *M. marginata*, Hook. et Arn., was found, from the examination of a fragment of the plant, to belong to the Sapotaceæ, and to be a specimen of *Chrysophyllum marginatum*. Unfortunately, Solereder has misquoted these facts in his book (p. 508, footnote 1), and refers *M. mitis* to the Sapotaceæ and *M. marginata* to the Ilicineæ.

In the second volume the Monochlamydeæ occupy the first 158 pages; these are followed by 264 pages of addenda to the various natural orders, and the remainder of the volume is occupied by the concluding remarks (98 pages), a literature supplement embodying the latest papers, a brief index, and a glossary. It is of interest to notice, among other points, that on anatomical evidence the natural order Basellaceæ established by Moquin-Tandon is maintained as a distinct order from the Chenopodiaceæ.

In the concluding remarks the various characters which may be used in the anatomical method are passed in review under seven headings or chapters, and this summary is intended to serve as an aid in the determination of a plant by means of its anatomical characters. The seven subdivisions are:—(1) Structure of the lamina of the leaf; (2) structure of the petiole; (3) secretory and excretory receptacles; (4) hairy covering; (5) normal structure of the axis; (6) anomalous structure of the axis; (7) structure of the root. The treatment of the subject in these chapters is of a very exhaustive nature, and, so far as can be seen, every structure of importance in any part of the plant is carefully and systematically dealt with.

Dr. Solereder makes an earnest appeal to systematists to make use of the anatomical method so far as possible when publishing new genera and new species. In time, no doubt, this will be done, but at present the amount of material requiring careful and critical examination in our herbaria is so great, and

the work involved in the systematic adoption of the anatomical method is so enormous, that it seems hardly likely that great progress will be made in this direction for some time to come.

The value of chemical substances in the plant is also emphasised for helping to establish points of affinity, though cases do occur in which similar substances of a peculiar nature are found in quite unrelated plants. One of the difficulties of the method lies in making the choice of those anatomical characters which may prove to be of systematic importance. It is clear that characters, which are ancestral rather than adaptive, will be of most value from the taxonomic point of view. The value of an anatomical character, however, cannot be predicted, and at times exceptions will be found to a character which appears to be otherwise typical of the particular group or order. Much light may be expected to be thrown by the anatomical method as to whether certain features in a plant are to be regarded as ancestral or adaptive from a comparison with other closely allied plants; and it may be noted in passing that careful work in this direction is being done on the anatomy of seedlings in this country. A word of warning, however, is necessary, which is not forgotten by the author, to those adopting the method, since it is not yet known whether a given character may be constant in a single species under different conditions of cultivation. The tea-plant, for instance, may or may not possess spicular cells in the leaf.

Dr. Solereder concludes his excellent and interesting introduction with a summing up of the possibilities of and warnings against the dangers of the anatomical method. It only remains to praise most highly the way in which Messrs. Boodle and Fritsch, under the careful editorship of Dr. Scott, have carried out the very arduous work of translating a volume, every page of which seems scarcely large enough to contain the solid and pregnant matter with with it is crowded.

A word of thanks must be added to Dr. Fritsch for the glossary at the end of the second volume, in which the chief terms used in anatomical description are defined, or a reference to a definite passage in the work is given where such terms are explained. In most cases the German equivalents of the terms are given, making the glossary of considerable value.

A. W. H.

PROBLEMS OF THE PAPER MILL.

Chapters on Paper-making. Vol. v., Concerning the Theory and Practice of Beating. By Clayton Beadle. Pp. vii+182. (London: Crosby Lockwood and Son, 1908.)

THIS is a record of observations incidental to an analytical study of the process of "beating" in the paper mills, the process by which the fibrous raw materials are prepared, by wet milling, for the actual paper-making operations. The central importance of the beating process is generally recognised; it is also evident that it is a highly complex operation. The purpose of this volume is to suggest to paper-makers what are the factors of the result, and how they may be effectually studied by way of observations which can be recorded in terms of numbers.

The author's observations are in the main those of mechanical energy consumed in the various stages of beating, *i.e.* in the "breaking in," the "beating" proper, and in "refining."

Beaters of the various types have been analytically studied, and the results are discussed in reference to the general structural details of the machines themselves, as well as of the main working parts, that is, the roll and the bed-plate. The main purpose is to establish their relative economy and efficiency. Thus the Hollander is generally contrasted with the more modern types of beaters, *e.g.* the "Reed," the "Taylor," and the "Tait engine," and the separated operations of "refining" in such engines as the "Kingsland" or "Jordan." Chapter x., on "the relative merits of stone and metal beater bars," is a useful contribution to progressive problems.

The author generally avoids drawing positive conclusions in view of the fact that efficiency, or the integral result of the preparation, involves those still obscure factors of condition, that is, the relation determined between the beaten fibres and the watery medium in which they are carried in suspension, to be compacted into the wet web on the wire of the paper machine or mould. This is the subject-matter of a special chapter (chapter xvii.), which records the results of experiments in the grading or fractionation of pulps by dry or wet methods, the former giving results according to dimensions, the latter introducing the complicating factor of "hydration" or "wetness."

The book is certainly a record of progress in the technology of paper-making. It emphasises the criticism which paper-makers make on the realistic tendencies of our technical schools. A "model" paper-making plant, such as has been installed at the Manchester School of Technology, is so far illusive in its realism that a "model beater" is not a representation to scale of the working conditions of the ordinary engine; and as the beating process constitutes the essential preparation of pulps, the educational result of a model mill is weakened by the implication of an incorrect perspective.

Contrariwise, the author's observations suggest an individuality or idiosyncracy of beating engines, and this degree of unconformity to type entails special study of each machine in work, which study may be purely empirical or may be based upon selective quantitative investigations of the essential factors.

The technical records of this book are intended to serve as models of such investigations in the mill.

The educational value of this volume is weakened by its method or want of method. The author trusts his matter to evolve its own logical form and cohesion, wherein he so far abdicates the privileged position of teacher, which is to be didactic even when some risks have to be taken in stating conclusions; this is necessary to awaken and sustain the interest of the student.

The matter would be much improved by a clear *exposé* of principles, and the contributory factors of

aggregate effects, the experimental results being used to illustrate and develop the argument.

These criticisms do not depreciate the value of the volume as a record of serious, useful experimental inquiry. It is expressly to be commended to managers and workers in the mill, who will find in it much to stimulate observation and investigation with immediately productive results.

THE WORKS OF LINNAEUS.

Linnaeus. Door Dr. J. Valckenier Suringar. Pp. 106. (s'Gravenhage: Martinus Nijhoff, 1908.)

THE scope of this volume may best be given by a summary of the introduction. The author says that though much has been written about Linnæus, yet he is but imperfectly known, which is probably due to the fact that the various accounts and addresses only supply a very superficial picture of the man. His sexual system and binomial nomenclature are the warp and woof of his work, and many who are content to regard Linnæus as a great man are ready to ask if these two achievements are anything out of the common. With the exception of a few volumes of systematic descriptions, Linnæus's books are no longer read, for who in these days of rapid work can find sufficient time to read his Latin octavos?

With a view to remedy this state of things, the author proceeded to study the works of Linnæus, and the farther he went the more his wonder grew. From the very first, Linnæus was evidently a giant amongst his contemporaries, and from him a stream of science has flowed and has overpassed its boundaries, leading with titanic force into new paths. Linnæus's work may be taken as an example for all time of methodic application and achievement. The year of the festival (1907, when the preface was written) may be taken as a fitting opportunity to set out the result of the inquiries in honour of Linnæus.

Very little will be found in this volume of biographic detail which may readily be found elsewhere. The author's aim has been to display the man and his ideals, so far as practicable, in his own words. In addition to this, the contemporaries and correspondents of Linnæus have been drawn upon, especially two men of renowned personality, Dillenius and Haller, the latter at once friend and opponent, and so giving a truer notion than by any other means.

The author has thus produced a work which in many respects stands alone. Deliberately refusing to supply biographic details or speculations, it differs markedly from the admirable volumes of Prof. Fries and the unfinished fragment of the late Prof. Oscar Levertin. Dr. Suringar follows Linnæus in his publications from early years to maturity. He has scrutinised the text and any published letters which bear upon them, and has thus succeeded in setting before us the man and his aims, his astonishing powers of work, his poetic imagination, his magnetic attraction, his artless vanity, his real modesty—the modesty of a great worker who has higher aims than those attained. Full references are given to the illustrative passages, both in original and in translation.

Dr. Suringar dwells at some length upon four ideas promulgated by Linnæus in his "Systema Naturæ" and the "Genera Plantarum" which soon followed it. These four are:—(1) A clear generic idea, (2) natural description of genera, (3) the sexual system, and (4) generic nomenclature. In each one of these, Linnæus so immensely improved upon the notions of his predecessors that his improvements became predominant almost of necessity. Each of these is separately considered and their relative merits weighed.

We must confess that we should have been grateful if the author could have thrown more light upon the life of Linnæus during those three busy years he spent in the Netherlands. The record is marvellous, even bearing in mind that Linnæus brought several manuscripts with him, but the cares of proof-reading must have been great. Clifford, though liberal, was keen upon securing full value for his outlay, and the splendid "Hortus Cliffortianus" was entirely composed and printed whilst Linnæus was under Clifford's roof. He confessed in a letter that he was too busy to eat, and still more so to sleep. Small wonder that three such strenuous years should have broken down the strong constitution of the young Swede, and made his longing for home irresistible. Possibly his life was too devoted to natural history to have any noteworthy events.

No one can read the volume without gaining a better idea of the strong personality and genius of the Småland curate's son, who, by his genius and powers of work, transformed the whole conception of biology, and established it on a basis and with a nomenclature which permitted of its development according to modern needs. Everybody who was present last year at the Linnean celebrations in Sweden must have been struck by the deep hold Linnæus has upon the hearts of his fellow-countrymen. Dr. Suringar has brought together passages from various sources which go very far to justify the pride of the Swedes in their great naturalist. B. D. J.

PRACTICAL PHYSICS.

A Manual of Practical Physics for Students of Science and Engineering. Vol. i., Fundamental Measurements of the Properties of Matter and Heat. By E. S. Ferry and A. T. Jones. Pp. xi+273. (London: Longmans, Green and Co., 1908.)

THIS volume is a very sound introduction to the practical measurement of the properties of matter and the more important properties of heat. The book is strictly practical, no attempt being made to discuss theories; sufficient explanation is, however, usually given for a clear and intelligent appreciation of the succeeding experiment.

The book commences with a consideration of the value of errors, the principles of which are not afterwards given due importance. The section then ends with a somewhat elementary introduction to the

graphical expression and reduction of results, and a number of algebraical summations for the later application of calculus from first principles.

The measurement of distance, mass, and time calls for little remark. The apparatus described is not novel, but is fairly complete, comprising as it does all the common instruments of precision and the precautions necessary for correct use. Here particularly the absence of theoretical considerations is noticed, the derivations of the units not receiving notice, *e.g.* no definition of the second is given.

The third chapter deals with measurements of small quantities by means of the optical lever, a rather uncommon experiment on a spirit-level, and a very good treatment by simple algebra of Amsler's planimeter.

Then follows a very limited introduction to velocity and acceleration, the only acceleration determined being *g* by the usual pendulum observations. Specific gravities and the calibration of weights are treated exhaustively.

The chapters on moment of inertia and elasticity are somewhat difficult, as the explanations are complex algebraically. The experiment on moment of inertia by torsional oscillations is sound, but the experiment for Young's modulus is open to serious error due to slipping in the grips at both ends. The definition of "brittleness" is misleading; those of flexure and rigidity are difficult but correct.

The chapter on viscosity includes a good description of Poiseulle's capillary-tube experiment.

The measurement of temperature is, on the whole, accurately and completely given. The statement that gas thermometers can be used up to 1700° C. is not, however, correct so far as accuracy is concerned. Again, for the resistance thermometers difficulty of experiment has led the authors to evade the sulphur point and to minimise its importance. Mercury-in-glass thermometers are fully treated.

The experiments on the expansion of rods are open to the objection that the temperature must be indeterminate near the ends. The absolute expansion of mercury and the cubical expansion of glass are given more successfully.

The difficult subject of calorimetry receives considerable attention and is sound. The method of mixtures, the bomb calorimeter, and the Junker calorimeter are described fully as pieces of apparatus most suitable for their respective purposes.

An extremely short chapter gives an introduction to the principle of the conservation of energy, and the book concludes with some useful tables of physical constants. L. B.

THE EDIBLE CRAB.

L.M.B.C. Memoirs. XVI. Cancer. By J. Pearson. Pp. xviii+209. (London: Williams and Norgate, 1908.) Price 6*s.* 6*d.*

IT is a remarkable thing, perhaps, that although the edible crab is of so much importance as an article of food, and is also an easily obtained subject for the study of the morphology of the brachyurous Crustacea, this is the first concise statement of its structure and habits that has been published in any language.

It might have been advisable if the editor of the series had departed from his usual practice and allowed in this case the use of a short subtitle to the memoir, such as "the edible crab," since the books that have been published upon "Cancer" in recent years are without number, whereas this is the only one on the crab.

The need of a memoir on the subject has long been felt, as the records of investigation are scattered and somewhat difficult of access; but Mr. Pearson has evidently devoted very great care and patience to the collection of all the available information, and, having added to it a great deal that is new, he has produced a work which will certainly prove to be one of very great utility.

The author has a liberal conception of what is necessary in a memoir concerning a single species, and he gives not only a detailed description of the external features and general anatomy, but also some important and useful notes on the histology and physiology. There are two surprising facts about Cancer which may be learned from this memoir. The one is that we know very little about the larval development of an animal that is so common and so useful, and absolutely nothing about its pre-larval stages. It may be that the early development follows a course that we might expect from our knowledge of these stages in other crabs; it may be that the study of these stages would not produce any facts of practical importance; but it is an object-lesson on unexplored fields of marine biological investigation that we have to confess to such ignorance about a familiar type. The second surprising fact, but not a new one to those who study fishery statistics, is that the value of the annual catch of crabs on the coasts of England and Wales alone is nearly 60,000*l.* But notwithstanding this fact we are indebted to the energy of Prof. Herdman and his colleagues for the greater part of the necessary funds for the production of a memoir which must prove to be of great economic value.

For the advanced student of zoology the memoir will undoubtedly prove of the greatest assistance when he comes to the dissection of the crab, and he will learn to appreciate the concise and, so far as we have been able to test them, accurate statements of anatomical facts and the thirteen beautiful plates by which the memoir is illustrated. It would have been better if the descriptions of the figures had been in many cases extended, so that the reader could see at a glance the principal points that each figure is intended to illustrate. When there are so many plates, and no less than six full pages of reference letters arranged in alphabetical order, the system adopted becomes rather tiresome to the reader. It would also have been useful to the student if Mr. Pearson had given a short statement concerning the other common crabs of the coast for which Cancer might be mistaken and the principal features which distinguish them. But the memoir may be heartily welcomed as it is, and Prof. Herdman and Mr. Pearson congratulated on its publication.

THE ASHMOLEAN NATURAL HISTORY SOCIETY OF OXFORDSHIRE.

A Historical Account of the Ashmolean Natural History Society of Oxfordshire, 1880–1905. By Frank Arthur Bellamy. Pp. xvi+544. (Oxford: Published by the Author, 4 St. John's Road, 1908.) Price 10*s*. net.

THE volume before us should have an interest, not only for members of the society in question, but for all naturalists, who should be glad to possess a record of the doings of one of the largest, most active, and—in virtue of its amalgamation with the Ashmolean Society, founded in 1828—one of the oldest scientific societies in England. It is seldom that such an organisation finds so good a biographer; the precision of the astronomer can be traced in the author's attention to the minutest details of history, and the care taken to ensure accuracy with regard to every point mentioned. Owing to the arrangement adopted, it has evidently been impossible to avoid the slight overlapping of subject-matter, but there can be few if any questions relating to the society's existence and work which are not dealt with in this very comprehensive record.

It is probably true of almost all societies that they owe much to their officers, but especially has this been true of the Ashmolean Natural History Society of Oxfordshire in all stages of its chequered existence. Of the earliest officers of the "old Ashmolean" little is known, owing to the disappearance of the original minute-books; the "Proceedings" of that society were not published until some years after its origin, though we learn (p. xv) from the Radcliffe Observer in 1866 that

"At the time of its institution it was second to scarcely any similar society in Europe, either in the roll of its illustrious members or in the value of its contributions to science."

So late as 1880, however, it had not opened its doors to any but members of the university, and this fact gave origin to the Oxfordshire Natural History Society and Field Club, founded by the even then well-known botanist Mr. George Claridge Druce, with the cooperation of many distinguished men of science.

No circumstance is more happy in the history of the two societies than that when the "old Ashmolean" decided to unite the property and traditions of a glorious past and—shall we say?—a somewhat decadent present to the active existence and brilliant future of the society which now holds a well-deserved position as the senior scientific society of Oxford. The tale of how this was accomplished is fully set forth in Mr. Bellamy's pages, as well as the part played by many of the society's officers in bringing about this union. Perhaps a large share of honour may be felt to be due from English naturalists generally to Dr. V. H. Veley, F.R.S., whose strenuous exertions as last librarian of the older society alone saved from an ignoble fate and made available for all time one of the largest and most valuable *lending* scientific libraries in England, which included complete sets of periodicals no longer obtainable at any price, as well as single volumes of great rarity.

Mr. Bellamy's history shows that no "winter wind" of ingratitude ever blew over the Ashmolean Natural History Society, for are not all these things, as well as the labour of love of many presidents, treasurers, librarians, and secretaries, writ large in his chronicle? The only person whose unremitting if unobtrusive labours on behalf of the society receive a bare line of notice is the author himself (p. 121). But none who knows the inner history of the society will fail to give honour where honour is due. Such a record must necessarily contain many dry facts and statistics, which are of value mainly to those concerned, but there is ample evidence that such researches may be enlivened by flashes of humour, as in the account of the recovery of the ancient woodblock (p. 59) and of other quaint occurrences.

The book is excellently printed, and contains as frontispiece a portrait of the late Prof. J. O. Westwood.

L. J. V.

ELECTROCHEMICAL PRACTICE AND POWER DEVELOPMENT.

(1) *Cyanide Processes.* By E. B. Wilson. Fourth edition. Revised and enlarged. Pp. vii+249. (New York: John Wiley and Sons; London: Chapman and Hall, Ltd., 1908.) Price 6*s*. 6*d*. net.

(2) *Electric Furnaces. The Production of Heat from Electrical Energy and the Construction of Electric Furnaces.* By Wilhelm Borchers. English Translation by H. G. Solomon. Pp. ix+224. (London: Longmans, Green and Co., 1908.) Price 7*s*. 6*d*. net.

(3) *Hydro-electric Practice. A Practical Manual of the Development of Water Power, its Conversion to Electric Energy, and its Distant Transmission.* By H. A. E. C. von Schon. Pp. xv+382. (Philadelphia and London: J. B. Lippincott Company, 1908.) Price 25*s*. net.

(1) THIS book upon "Cyanide Processes for Gold Extraction" is evidently intended for those who know nothing about the extraction of gold by means of cyanide, and it is therefore written in a style to suit the tyro, and is also intended to help those who wish to take up the cyanide-extracting industry. It commences with a description of ores suitable for the cyanide process, and starts off with the definition that any material which it will pay to work is an ore. Ores are distinguished as free, milly, refractory, acid, and base-metal ores, and it is shown how these various ores behave towards cyanide solutions. We notice on p. 11 that tellurium is said to be soluble in the presence of sodium dioxide, but sodium dioxide is hardly a substance which one expects to find employed in the extraction of gold.

We regret to say that chapter ii. is very unsatisfactory. It deals with potassium cyanide and oxygen, and contains several equations, some of which are not correct; but chapter iii. is still worse, and this has to do with the chemistry of the operation. On p. 27 we notice that there are men working the cyanide process successfully who know little of its chemistry and no other chemistry at all. From this chapter they will not learn correct chemistry of the cyanide

processes, and they certainly will not learn other chemistry.

The author seems to be unaware of the elementary principle that both sides of an equation must balance; in one case, for example, where there is only one potassium on the left-hand side of the equation he has potassium carbonate upon the other side. He gets over the difficulty of lack of potassium by writing potassium carbonate KCO_3. We may also point out that ferrous sulphate is not Fe_2SO_4; one would have thought that he might have found a more recent equation for the action of ferrous sulphate than that of Berzelius. The chapter on laboratory tests is better, but until we get to chapter v. ("The Plant for Cyaniding") the author is out of his depth. It is evident, however, that he does understand the practice of the cyanide process.

It is interesting to note how, as the subject of "leaching" has become better known, and the methods of treatment of the ore more carefully worked out, so the strength of the cyanide solution employed has gradually become weaker and weaker, and the extraction of gold, more through loss of cyanide during the operation, has become less. When the author comes to dealing with electrocyaniding, that is to say, the recovery of gold by electrical means, we wish he had asked someone else who understood the subject to write this part for him. He has collected many facts jumbled up in a manner which would spell absolute confusion to anyone not versed with electrochemical methods. For example, speaking of anodes, and referring to platinum, he first of all says that the decomposition which takes place of the electrolyte at the anode is energy expended, not on work, but in setting free oxygen which will probably decompose the electrolyte; and then he goes on to write about the amount of platinum which should be liberated in an ampère-hour, but we do not profess to know what he means. The extraordinary thing is that all these mistakes of nomenclature and misprints occur in a book which is in its fourth edition. The practical part of the book with reference to leaching of the ores and so on can be recommended as being useful; we prefer not to say anything about the rest of it.

(2) The second book is of an entirely different class, and is written in quite a different style. Any book by Prof. W. Borchers upon electric furnaces is sure to attract interest. We notice, however—but it is perhaps not to be wondered at—that the furnaces designed by Prof. Borchers himself loom rather large. He certainly has done much pioneering work, and has had some extremely good ideas, but it is to be feared that others gained by his suggestions more than he himself.

The book commences with an introduction in which the conversion of electrical energy into heat is discussed. Each chapter of the book deals with a different class of furnace, and in every case the subject is treated in a more or less historical manner. Chapter ii. is devoted to direct-resistance heating, and deals in the first place with the production of aluminium, and we notice on p. 23, in reference to the Héroult furnace, a mistake in which the word "anode" twice occurs instead of "cathode." The chapter also has an account of the various induction furnaces, the description of which is all too short; this is such an important branch of electrometallurgy that it would have been well worth while to have given a much fuller and more descriptive account of it.

Chapter iii. deals with indirect resistance furnaces, in which the substance to be heated is in contact with another material, which is electrically heated; this may be a core running through the furnace, which, by means of its resistance, becomes highly heated. The substance which it is required to heat or reduce is placed round about it, and thus receives the heat from the core. Mention is also made of the kryptol furnace. Direct arc heating is the subject of the next chapter, and here the author deals with carbide furnaces, and refers to the acetylene arc furnace of Berthelot. The phosphorus arc furnace of Readman and Parker is also described. Indirect arc heating is the subject of the next chapter, such, for example, as is employed in zinc furnaces for the distillation of the metal.

The last two chapters are devoted respectively to the arrangement of furnaces for different modes of heating, and to the construction of electric furnaces in general. A short appendix by the translator is devoted to some recent developments in electric steel furnaces.

The book is decidedly useful, is very well illustrated, and carefully translated, but at times the description is scrappy, and we are rather afraid the reader who knows nothing about furnaces will hardly get sufficient information to be of service.

(3) The third book deals with hydro-electric practice, and is an extremely valuable contribution to the subject. The author has written it for two classes of readers. The first part is intended for those who have no engineering training or experience—that is to say, for the layman who may desire to know something about water-power schemes, and to whom it is necessary to have some idea as to whether it would be advisable to risk anything in the undertaking or not. The second part, entitled "Designing and Equipping the Plant," is written for the student, and the aim of the author has been to make the treatment of this part of the subject complete in all its phases, with the exception that he presupposes a knowledge of the principles of surveying and of the rudiments of hydraulics, hydrostatics, and dynamics. Occasionally in the first portion of the book, in order to make himself perfectly clear, the author gives definitions which are rather unnecessarily elementary; for example, is it necessary to say that all the water consumed by vegetation and vapourised is evaporation, and the portion which runs into the stream is the run-off?

The enormous amount of trouble which Mr. von Schon has taken in the compilation of his facts can be seen from the table of rivers, drainage areas, and low monthly flow, which extends from p. 10 to p. 26, and, of course, there are many other tables and diagrams interspersed throughout the volume.

Chapter ii. is entitled "Power Opportunity," meaning to say the possibilities of obtaining water from

any given source, and the author shows how the flow deductions can be estimated from the precipitations, that is, the amount of water obtained from rainfall, &c. He points out how, in one case, the failure to study this caused a syndicate to credit a certain source of output with 3500 h.p., where, as a matter of fact, the "opportunity" was good for about 1500 h.p., with 250 h.p. auxiliary plant to supplement the three months' low-flow output. It will be seen, therefore, that the reading of this book will help to prevent the investor from putting his money into "wild-cat schemes."

Part ii., as already mentioned, is for the practical man, and certainly contains too many formulæ for the uninitiated, although these are absolutely essential to the engineer. This portion of the book commences with a survey which embraces all operations by which the hydrographic, topographic, and geological characteristics are investigated.

Having obtained the data furnished by a careful survey, the next chapter deals with the development programme, and this part is remarkably well illustrated by means of line blocks, showing different methods of development; for instance, direct development in rocky gorge, short diversion development, distant development, and so on.

The space at our disposal will not allow us to go more fully into this extremely interesting work. The half-tone illustrations of various power houses and power schemes are exceedingly well got up, and are a valuable aid to the reader. It only remains to say that the author is to be congratulated upon having brought out a book which is useful to the general public, and also of great value to the specialist.

SOME NEW CHEMICAL BOOKS

(1) *Technical Chemists' Handbook.* By Dr. G. Lunge. Pp. xv+260. (London: Gurney and Jackson, 1908.) Price 10*s.* 6*d.* net.

(2) *Exercises in Elementary Quantitative Chemical Analysis for Students of Agriculture.* By Dr. A. T. Lincoln and Dr. J. H. Walton, jun. Pp. xv+218. (New York: The Macmillan Co.; London: Macmillan and Co., Ltd., 1908.) Price 6*s.* 6*d.* net.

(3) *Laboratory Manual of Qualitative Analysis.* By W. Segerblom. Pp. xii+136. (London: Longmans, Green and Co., 1908.) Price 3*s.* 6*d.*

(4) *Synthetic Inorganic Chemistry.* By Dr. A. A. Blanchard. Pp. viii+89. (New York: J. Wiley and Sons; London: Chapman and Hall, Ltd., 1908.) Price 4*s.* 6*d.* net.

(5) *The Fundamental Conceptions of Chemistry.* By Dr. S. M. Jörgensen. Translated by M. P. Appleby. Pp. viii+175. (London: Society for the Promotion of Christian Knowledge, 1908.) Price 2*s.* 6*d.*

(6) *Kurzes Repetitorium der Chemie.* I., Anorganische Chemie. By Dr. E. Bryk. Breitenstein's Repetitorien, No 7. Pp. iv+244. (Leipzig: J. A. Barth, 1908.) Price 2.85 marks.

(1) DR. Lunge's "Technical Chemists' Handbook" is a new and revised edition of the extremely useful little volume, well known under the title of "The Alkali Makers' Pocket-book," and later as "The Alkali Makers' Handbook." In many respects the new volume, in the preparation of which the author has had the assistance of Dr. Berl, is unlike its predecessors, which were intended mainly for the laboratory of the alkali maker. The scope is greatly enlarged, and covers a variety of industries. The old material is brought up to date, and there are new chapters on water for boilers, on coal gas and its products, on calcium carbide and acetylene, on fertilisers, aluminium salts, and calcareous cements. The book, although intended for the works, will also be found useful in a college laboratory in training the future professional chemist. It possesses, it may be added, a great advantage over many technical handbooks, for it embodies the results of long personal experience, and, being restricted in its scope, can afford space to enter into the minutiæ of each operation.

(2) The volume by Drs. Lincoln and Walton is intended for agricultural students. The first half is an introduction to the methods of ordinary quantitative analysis, and is written with great care and thoroughness. It might include with advantage a few more gravimetric exercises. The second part is technical, and is devoted to the analysis of milk, butter, foodstuffs, fertilisers, and soils, and concludes with analytical problems and methods of calculation under the title "stoichiometry." There is little which calls for criticism, for the volume is evidently written by experts who are thoroughly *au fait* with their subject. We would only direct attention to the fact that the standards given are mainly those of the U.S. Department of Agriculture, which are not in force in this country. The same may be said of some of the apparatus and methods. The Babcock method is, we believe, not used here, and the Hanus method is a modification of what is generally known as Hübl's method. It might be well to include in a subsequent reprint a figure of the Reichert-Meissl apparatus, and details of dimensions which are essential. The method of estimating potassium in soils is not given in sufficient detail for those special cases where modifications may be necessary.

(3) It is difficult to realise the particular aspect of qualitative analysis which compels teachers to add to the already extensive literature on the subject. It is rarely that one finds a new arrangement, new tests, new apparatus, or new reactions. The order of the groups, the disposition of principal and subgroups, and the general and special reagents, are always the same. We have examined Mr. Segerblom's volume in vain for something new or suggestive. We are inclined to question the utility of general definitions at the beginning of a book, and certainly some of those given are not very happy. "A reaction," we are told, "is any phenomenon exhibited by a substance." According to this, the breaking of glass would be a reaction. Although there is nothing that strikes one as new, it may be said that the description of the different operations is full and clear; the book is excellently printed, and there is a useful appendix of "study questions" to beguile the student's leisure.

(4) The little volume entitled "Synthetic Inorganic Chemistry" contains a description of a series of simple preparations of metallic compounds, and is

designed for the use of students in their second college term. Each preparation is introduced by a short theoretical discussion of the reaction involved, followed by details of procedure, and a number of suggestive questions which the student is required to answer in his note-book. The scheme is excellent, and if conscientiously followed should afford an intelligent student the full benefit of each experiment. He is not supposed to work right through the book, but the experiments are to be distributed among the students, who are encouraged to be inquisitive as regards their neighbours' activities, and so acquire indirectly all that the book contains. Considering that the matter is not very original, that there are no illustrations, and only eighty-nine pages of print, the price of 4*s*. 6*d*. seems rather high.

(5) If "The Fundamental Conceptions of Chemistry" were printed as an *aide-mémoire* for a candidate for the Inter. B.Sc., we should consider that the 179 small pages of compressed general chemistry might serve a useful if not very dignified purpose. The book is full of facts and theories laid down in didactic fashion and with that want of precision and clear exposition which characterise the tutorial text-book. We cannot agree with the author that the book will "accustom the student to the methods of chemical reasoning," unless, of course, chemical reasoning is, as one is sometimes inclined to think, a different mental process from other kinds of reasoning. Nor do we agree with him in admiring the elegance displayed in the get-up of his book. We must, however, commend one special feature, namely, the historical references, which are numerous and generally accurate. It is interesting to learn the Christian names of chemists, who do not usually appear to have any. Such, for example, are Cato Maximilian Guldberg, Peter Waage, and Eilhardt Mitscherlich; Dulong and Petit are, however, coupled together, as usual, without Christian names. We should dissent from Dalton being described as a Manchester schoolmaster, and from the statement that owing to the discovery of oxygen, "Lavoisier was able to realise what Mayow's genius had arrived at a hundred years before."

(6) Dr. Bryk's "Repetitorium" is what it professes to be—a mere compilation of important facts to assist the student's memory. It has been put together apparently with great care, and there are many useful tables containing a general summary of compounds of different elements. To anyone desirous of assimilating large quantities of information, the book may be safely commended; but we cannot promise that he will be intellectually stimulated by its perusal. J. B. C.

OUR BOOK SHELF.

Experimental Elasticity. A Manual for the Laboratory. By G. F. C. Searle, F.R.S. Pp. xvi+187. (Cambridge: University Press, 1908.) Price 5*s*. net.

The author has embodied in this volume in a connected form the contents of a number of manuscripts which he had from time to time written for the use of students attending his class in practical physics at the Cavendish Laboratory. Chapters i. and ii., consisting of 70 pages, give an account of the elementary theory of elasticity, with solutions of some special mathematical problems. Chapter iii., pp. 71–161, describes the experiments—numbered 1 to 14—prescribed for the student. Pages 162–183 comprise ten short notes, mostly on mathematical subjects. There is a table of contents and an index.

The experiments, which relate mainly to the determination of Young's modulus and the rigidity in materials assumed isotropic, are very carefully described. The apparatus, which seems mostly designed by the author, is usually simple, and the student who goes through the course intelligently should have learned a good deal. The illustrations of Saint Venant's principle of "equipollent" systems of force in chapter ii., due to Dr. Filon, are likely to be useful.

Notwithstanding the merits of the book, it is a little difficult to picture a student for whom it would form the best possible introduction to the subject. The reader who requires the notes at the end seems hardly likely to follow the mathematical investigations into the differences between adiabatic and isothermal elasticity in chapter i., or into the bending of a rod and the bending and twisting of a blade in chapter ii. The ordinary student would probably get a better grasp of the mathematical theory of elasticity from a study of the ordinary stress-strain and surface equations, and their application to a few really simple problems.

The author's attitude towards the application of isotropic elasticity to wires leaves something to be desired. On p. 113 he gives a table of values of Poisson's ratio obtained by the method of one of his experiments. In five out of nine cases the value is impossible, exceeding 0·5. The impossibility, it is true, is pointed out, the phenomenon being ascribed to lack of isotropy. But this is much as if a temperance lecturer illustrated the evil effects of intemperance in his own person. A safer course would be to confine the table to cases where isotropy is at least not obviously untenable, adding a warning that wires are frequently neither isotropic nor homogeneous, and that absurd results are often obtained by assuming that they are. It would also be as well to let physical students know that isotropy is not the only type of elasticity amenable to mathematical treatment. Vibrations in thin wires are theoretically a less satisfactory method of finding elastic constants for materials than are vibrations in long rods, but possibly Mr. Searle is reserving vibrations in rods for one of the further volumes adumbrated in his preface. C. Chree.

Beautiful Flowers and How to Grow Them. To be completed in 17 parts. Edited by Horace J. Wright and Walter P. Wright. With 100 coloured plates. (London: T. C. and E. C. Jack.) Price 1*s*. net each part.

The first part is concerned entirely with roses, and includes twenty-four pages of letterpress. The writer discourses upon roses from the point of view of the garden decorator rather than that of the exhibitor, and, indeed, the mere exhibitor is given very little consideration. This is very natural in such a work as this, which is undoubtedly intended for amateurs who wish to grow flowers for their own sake alone, and not for the glory that attends the winning of prizes at competitive exhibitions.

The style is pleasant, and the reader is given an insight into the classification of roses in order to enable him to understand the characteristics of the numerous types. Even the novice may soon acquire some knowledge of the hybrid teas, teas, hybrid perpetuals, noisettes, moss rose, polyantha rose (*Rosa multiflora*), the Wichuraiana roses (including such esteemed varieties as Dorothy Perkins, Lady Gay, and Hiawatha), and other types. Some of these are

suitable for cultivation in beds and borders, whilst others may be used for adorning pergolas, arches, pillars, summer-houses, or other structures. Directions are given for cultivation and propagation, the process of budding being explained fully and illustrated with appropriate cuts. Those who are not familiar with the varieties will find the selections of roses for different purposes of great assistance in choosing those which will be most suitable for their particular gardens.

The text is large, bold print, and this being upon parchment paper, the convenience of the reader has been obviously studied. The coloured plates have been prepared from paintings of well-known artists, and many of them are pleasing, but others are too impressionist in character, particularly that representing a Dorothy Perkins rose growing upon old trees. The effect of the rosy crimson flowers is depicted, but one cannot in the least trace any rose foliage, and even the plant itself takes no shape, and, therefore, cannot be distinguished.

The second part contains the concluding portion of the letterpress on roses, and the remaining pages are devoted to bulbous plants. The third part is a continuation of the matter concerning bulbs. It contains excellent coloured plates of *Lilium speciosum*, "Christmas Roses and Glory of the Snow," and "Madonna Lilies and Roses." These are the best plates in the third part, and the figure of a church as the background to the last-mentioned picture is an agreeable and appropriate feature.

The Philosophical Basis of Religion; a Series of Lectures. By Dr. J. Watson. Pp. xxviii+485. (Glasgow: J. MacLehose and Sons, 1907.) Price 8*s.* 6*d.* net.

PROF. WATSON, who is already well known to philosophical students by his work on Kant, has, by the publication of this collection of lectures, laid a still larger circle of readers under an obligation. The recent congress at Oxford gave sufficient evidence of the present widespread interest in religion as a social phenomenon—an interest largely independent of any attitude towards its claims upon the individual. There will be many scientific students who will turn with profit to Prof. Watson's addresses—admirably lucid as they are, and agreeably free from technicalities—for a treatment of the subject that forms an entirely necessary complement to the comparative method.

The author presents his argument as an attempt to solve the problem of re-building upon a basis of reason the theological beliefs which (he holds) no longer rest securely upon their ancient foundation of authority. The solution he develops takes the form of a "constructive idealism" based upon "the principle that the world is rational and is capable of being comprehended by us in virtue of the rationality which is our deepest and truest nature." The fulfilment of this programme necessitates an examination, first, of typical views on the nature and functions of dogma (such as those of Newman, Loisy, and Harnack), and, secondly, of certain current philosophical doctrines (personal idealism, the "new realism," and pragmatism) that offer solutions of the author's problem which for one reason or another he is unable to accept.

The layman will find Prof. Watson a fair-minded, an interesting, and, on the whole, a trustworthy guide in all these matters, as well as in the lectures on theological history which follow in somewhat loose connection with the rest. He should be warned, however, that the account of the "new realism" given in the fifth lecture contains elements that most of the supporters of that doctrine would repudiate.

Every reader of the book will be grateful for the excellent summaries of the preceding argument which appear at the beginning of most of the lectures.

A Manual of Bacteriology, Clinical and Applied. By Prof. R. T. Hewlett. Third edition. Pp. xii+638. (London: J. and A. Churchill, 1908.) Price 10*s.* 6*d.* net.

THE publication of Prof. Hewlett's manual in its new edition serves to remind us of the enormous strides in our knowledge of bacteria which have been made within the last ten years. Bacteriology in its early days meant little more than the study of the morphology of the newly-discovered causes of disease and the search for those undiscovered. Then came the investigation of the poisons manufactured by the organisms; and now the bacteriologist is largely concerned with the substances whereby the organisms are controlled and defeated. Much of the new knowledge of bacteria has come with the discovery that the organisms once believed to be unique are in many cases only members of groups which number dozens or scores of individuals; and the aid of organic chemistry has been invoked to differentiate the members of these groups.

With this constantly widening field of work it has become increasingly difficult to give within a moderate compass an account of our present state of knowledge, and we can therefore all the more congratulate Prof. Hewlett on his success. Within the 600 pages of his book he has contrived to give an adequate account of the methods used in bacteriological research; of the morphology, appearances in culture, and distribution of the chief pathogenic bacteria; of bacterial toxins; of immunity, and the various methods by which it is sought; and, lastly, of the details of disinfection, and the examination of water, air, soil, and milk. He has wisely omitted many of the details of the more complicated methods, but wherever he has done so he has been careful to give a full reference to a source where the reader can obtain the information. In his treatment of some of the more recent work in bacteriology he, in our opinion quite properly, reserves his judgment of its value, while stating fully and fairly the claims advanced. Thus, for example, he still hesitates to accept without reserve the *Treponema pallidium* as the specific organism of syphilis, but adds that the majority of observers hold the opposite opinion strongly.

The illustrations are for the most part reproductions of actual photomicrographs, and are particularly well chosen and clear in outline. The only fault that we have to find with Prof. Hewlett is an occasional obscurity of language; in most instances the context removes any doubt as to his meaning, but in a few cases it is difficult to comprehend. Thus on p. 343 the language seems to imply that there were two dead men who recovered, and though, of course, that is not the meaning, the whole sentence remains obscure, even after the obvious correction has been made.

Ticks. A Monograph of the Ixodoidea. Part i. (Argasidæ). (London: Cambridge University Press, 1908.) Price 5*s.* net.

THE study of parasitic and disease-producing Protozoa, which has received such a great impetus of recent years, has caused much attention to be paid also to those groups of animals which, by their blood-sucking habits, are instrumental in transmitting the parasitic organisms from one vertebrate host to another. Ever since Smith and Kilborne first made known the *rôle* of ticks in transmitting Texas-fever in cattle, much attention has been directed to this group of arachnids,

which were subsequently found to be the intermediary for the transmission of the remittent fevers, caused by the presence of spirochætes in the blood, of man in Africa, and of domestic fowls in various countries.

For those who are not experts on ticks, but are made practically acquainted with them from the pathological point of view, a comprehensive monograph or handbook of the group has become an urgent requirement, and this need will now be supplied by the monograph of the Ixodoidea which is being produced by Messrs. Nuttall, Warburton, Cooper, and Robinson. Part i., dealing with the Argasidæ, has appeared, and consists of 104 pages (not including the bibliography of 18 pages), with three plates and 114 text-figures. This monograph will undoubtedly be a most useful publication, and it is to be hoped that this example will be imitated with respect to other groups of blood-sucking invertebrates. A modern comprehensive monograph of leeches, for instance, is also a work urgently needed by those who desire to study the transmission of the blood-parasites of fishes and lower vertebrates.

Who's Who, 1909. Pp. xxiv+2112. (London: A. and C. Black.) Price 10*s*. net.

Who's Who Year-Book for 1909. Pp. vi+154. (London: A. and C. Black.) Price 1*s*. net.

The Englishwoman's Year-Book and Directory, 1909. Edited by G. E. Mitton. Pp. xxvi+372. (London: A. and C. Black.) Price 2*s*. 6*d*. net.

The Writers' and Artists' Year-Book, 1909. Pp. vii+121. (London: A. and C. Black.) Price 1*s*. net.

THESE four works of reference are so well known and widely esteemed that it is hardly necessary to say more than that each maintains its high level of excellence. "Who's Who" continues to increase in bulk; this year there are 72 pp. of additional matter, indicating the editor's desire to make his roll of honour as comprehensive as possible.

The "Who's Who Year-Book" is made up of the tables which were formerly published in "Who's Who," with many new lists, including, we notice, one of the Nobel prizes awarded since 1901.

Every particular of importance about the useful work women are doing is to be found in the "Englishwoman's Year-Book and Directory"; and as the Editor remarks, "no woman who takes any part in public or social life can afford to be without it." Even a glance through the volume will serve to show that women are making notable contributions to knowledge, and taking an honourable part in every form of activity intended to improve the conditions of human life.

The title of the fourth year-book sufficiently describes its scope; the volume should prove of great assistance to young writers and artists.

Arcana of Nature. By Hudson Tuttle. With an Introduction by Dr. Emmet Densmore. Pp. 471. (London: Swan Sonnenschein and Co., 1908.) Price 6*s*. net.

DR. DENSMORE'S introduction includes memoirs of Emanuel Swedenborg, A. J. Jackson, Hudson Tuttle, Cora Richmond, and W. J. Colville; and this fact—since all are described here as "psychics"—will serve to indicate the scope and character of the volume. "The Arcana of Nature" was published in 1860, and its subtitle, "The History and Laws of Creation," shows its ambitious aim. Dr. Densmore has been impressed with the phenomena to which attention is directed in this volume, and he feels they deserve consideration "from the psychic student as well as from the general public."

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.]*

Flying Machines and their Stability.

IN the early part of this year I suggested in a letter to NATURE (vol. lxxvii., p. 293, January 30) that it would be desirable for experimenters with flying machines to direct their attention to automatic stabilising appliances, and the character of the accidents which have occurred since that letter was written tends to emphasise the importance of this.

Among the six degrees of freedom possessed by any body free to move in three dimensions, viz. $\dot{x}$, $\dot{y}$, $\dot{z}$, $\dot{\theta}$, $\dot{\phi}$, $\dot{\psi}$ (x being horizontal in the direction of motion, y and z horizontal and vertical, and $\dot{\theta}$, $\dot{\phi}$, $\dot{\psi}$ angular velocities about x, y, and z), $\dot{x}$, $\dot{y}$, and $\dot{z}$ may be controlled by hand, but for steady motion it is requisite that $\dot{\phi}$ and $\dot{\psi}$ should be zero except when the course is changing, and $\dot{\theta}$ should be zero except when the horizontal curvature of the course is changing.

Of these angular velocities, any of which may be caused by instability, $\dot{\theta}$ is the most dangerous, and it is to the automatic extinction of this that attention should be directed in the first place. (This is the form of instability which most kites suffer from in strong winds.) $\dot{\phi}$ may be a source of danger if the pitching or diving is considerable, but $\dot{\psi}$, which corresponds to a wandering course in the horizontal plane, may be dealt with by steering.

There can be little doubt, I think, that for aëroplanes the best method of correcting for $\dot{\theta}$ is that adopted by the Wrights, namely, the alteration of the relative inclination of the wing surface on either side. In this they are following the practice of the long-winged birds, but the control should be automatic.

Automatic control of the wing surfaces could be effected by any device which would copy with power the position of a short pendulum without exerting any force on the pendulum itself.

The pendulum must be short, because $\dot{\theta}$ must be related, not to the absolute vertical, but to the direction of the resultant of gravity and the centrifugal force due to the horizontal curvature of the course (whatever that may be), and a pendulum with a short period and considerable extinction sets itself very quickly in this direction.

It may be remarked that the same class of device could be used for the automatic control of $\dot{\phi}$. The problem here presented offers a large field for invention.

Too much stress is often laid on the particular forms given to the wing surfaces. In reality, flight is possible with almost any form of wing if appropriate surface speeds are used.

In nature flight is conducted in two ways, of which, among birds, the albatross and humming-bird may be cited as extreme examples. With the first of these the body speed must be high, and much power has to be exerted in starting before the economical speed is reached. With the latter the body may be stationary, but the wing speed is always high.

This type of flight corresponds to "lifting screws" on a flying machine, and with this form, I believe, no success has hitherto been achieved. It seems not impossible, however, that with proper balancing appliances it will ultimately prevail, considering what great advantages it offers in the matter of starting and stopping. In the matter of economy of power, also, it is obviously better to use, if possible, the same surface both for support and propulsion rather than separate propellers as aëroplanes must do. If the aëroplanes could propel themselves by flapping their wings, the latter objection would not apply.

A. MALLOCK.

6 Cresswell Gardens, S.W., December 16.

Zeeman Effect in Weak Magnetic Fields.

ACCORDING to Voigt, the displacement of the outer components of the Zeeman triplet plotted against the strength of the magnetic field is represented by a hyperbola, when the light is observed at right angles to the field. The hyperbola approaches asymptotically to a straight line in strong fields, where most of the observations have hitherto been made by different experimenters. Moreover, the intensity of the component towards the red is greater than that towards the violet in weak fields, and gradually tends to equality as the field is increased. Gehrcke and von Baeyer examined the separation of the satellites of the mercury line 546·1 $\mu\mu$ in a field of 535 Gauss, but did not notice the asymmetry as indicated by theory.

On account of the double difficulty of obtaining fine spectrum lines and of using instruments having strong resolving power, the theory of asymmetry in weak fields has not yet been placed under thorough experimental test. When it is impossible to measure the effect on distinctly separated lines, we can infer the nature of the change by measuring the broadening of the lines, provided they are sharply defined. For this purpose, the gold lines $\lambda=627{\cdot}6$ $\mu\mu$ and $\lambda=583{\cdot}5$ $\mu\mu$ are characterised by having sharp edges in the spark spectrum, when the self-inductance and capacity of the circuit are properly adjusted. By using an echelon spectroscope made by Hilger, of resolving power $\lambda/\delta\lambda=430{,}000$ for $\lambda=500$ $\mu\mu$, I made numerous observations with Mr. Amano, and found that the effect for a triplet of the red gold line is measurable in a field of 240 Gauss, and on following the curve to strong fields it is approximately represented by a branch of hyperbola with very short axis, showing a slight bend in H=3000, which is probably caused by the asymmetry in the intensity of the component lines. A similar result was obtained with the copper line $\lambda=510{\cdot}5$ $\mu\mu$, which is divided into a triplet. The utmost care was necessary to have the electromagnet producing the field well demagnetised before each experiment, by a special device of alternately passing gradually diminishing current in rapid succession.

With the quartet of the yellow gold line, the nature of the change of the inner components is somewhat similar to the triplet before mentioned, but the curvature is more pronounced. The displacement of the outer components is more complex in weak fields, but from H=5000 upwards it keeps approximately linear relation with the field. Similar observation was also made with the magnesium line b_2.

The principal source of error in the present experiment is the uncertainty as to the difference in the intensity of the component lines; this will no doubt affect the breadth of the superposed lines. When the lines are separated by applying sufficient magnetic force, the difference in the breadth and intensity of the components is not to be distinguished by mere eye observation.

H. NAGAOKA.

Physical Institute of the University of Tokyo,
November 25.

Women and the Chemical Society.

THE council of the Chemical Society, at a recent meeting when it was determined to exclude women from the fellowship, but to admit them to the society as "subscribers," decided, "after mature deliberation"—the phrase is the senior secretary's—that the appellation "subscriber" should be printed with a big S!

Daughters of Eve! So zealous to pursue
The work in Life by which you seek to live!
When F.C.S. you claim, as is your rightful due—
The S alone is what they, grudging, give!

Be patient! Time is on your side.
Reason and justice will your cause defend.
Ignoble spite and arrogance of pride
Shall meet their retribution in the end!

T.

Autumn, and After.

THE following table may be of interest at the present time. It indicates the years in which (as in this) all three months of autumn have been dry at Greenwich (1841–1907), and the character, as regards temperature, of each of the three months of winter following (+ meaning warm and − cold).

	December	January	February
(1) 1847	+	−	+
(2) 1850	+	+	+
(3) 1851	+	+	+
(4) 1854	+	−	−
(5) 1858	+	+	+
(6) 1868	+	+	+
(7) 1881	+	+	+
(8) 1884	+	−	+
(9) 1890	−	−	−
(10) 1900	+	+	−
(11) 1901	+	+	−
(12) 1902	+	+	+
(13) 1904	+	−	+
Warm	12	8	9=29
Cold	1	5	4=10

Three things may here be noted:—

(1) December has nearly always been warm (twelve cases out of thirteen).

(2) In the total of the winter groups, warm months have been about three times as numerous as cold (twenty-nine to ten).

(3) Excepting 1854–5 and 1890–1, each winter has had two or three months warm.

The present December promises (December 15) to be warm. What the season as a whole will bring forth remains to be seen. ALEX. B. MACDOWALL.

THE DARWIN COMMEMORATION AT CAMBRIDGE (JUNE 22–24, 1909).

THE Darwin Celebration Committee appointed by the Council of the Senate to make the necessary arrangements has issued invitations to a large number of British and foreign universities, colleges, academies, and learned societies. The committee has already received the names of nearly 200 delegates who propose to attend the celebration in June. Among those nominated by universities and societies in the United States are the following:—Prof. Baldwin (Johns Hopkins University), Prof. Loeb (University of California), Prof. Farlow (American Academy of Arts and Sciences), Prof. Minot (Boston Society of Natural History), Prof. Coulter (Chicago University), Dr. Davenport (Cold Spring Harbour Experimental Station), the president of Cornell University, Prof. Chittenden (Yale University), Prof. Peck (the Connecticut Academy), the president of the Academy of Arts and Sciences (New York), Prof. E. B. Wilson (Columbia University), Dr. Biggs (New York University), Dr. Harrison (University of Pennsylvania), Dr. A. E. Brown (Philadelphia Academy), Dr. Osborn (American Philosophical Society), the president of the Carnegie Institute (Pittsburg), the secretary of the Smithsonian Institute, the president of the Carnegie Institute (Washington), Dr. Howard (Academy of Sciences, Washington).

The University of Chile, Santiago, is to be represented by the Envoy Extraordinary of Chile. From Austria-Hungary the following are expected:—Prof. Ludwig von Graff (Gratz), Prof. Apathy (Kolozsva), Prof. Vejdovsky (Prague), Dr. Steindachner and Prof. Wettstein (Vienna). The Belgian delegates include M. Laneere (pro-rector of the University of Brussels), Prof. van Beneden and Prof. Dupont (Brussels), Prof. Dorlodot (Louvain). Prof. Höffding and Prof. Jungersen are coming from Copenhagen. Among French delegates are Prof. Malaguin (Lille), Prof. Cuénot (Nancy), Prof. Dantec (University of Paris), Prof. van Tieghem, M. Perrier, Prince Roland Bonaparte (Institute of France), Prof. Papillaut, Prof. Metchnikoff, Dr. Manouvrier (Paris).

From Germany the following names have been received:—Prof. Stumpf, Prof. Waldeyer, Prof. Diels, Prof. Engler, Prof. Hertwig, Prof. von Luschan (Berlin), Prof. Schultze (Bonn), Prof. Kukenthal (Breslau), Dr. Roediger (Frankfurt), Prof. Verworn and Dr. Berthold (Göttingen), Prof. Bütschli (Heidelberg), Prof. Haeckel (Jena), Dr. R. Hertwig and Prof. Goebel (Munich), Prof. Ballowitz (Münster), Prof. Graf zu Solms-Laubach (Strassburg), Prof. Boveri (Würzburg).

Prof. Zeggelis will represent the National University of Athens. The delegates from Holland include Prof. de Vries, Dr. Kerbert (Amsterdam), Prof. van Bemmelen (Groningen), Dr. Lotsy (Haarlem), Prof. Vosmaer (Leyden), Prof. Hubrecht (Utrecht). The Italian Ambassador is to represent the Geographical Society of Italy; English delegates have been nominated by the University of Catania, the Società der Naturaliste of Modena, and the Accademia dei Lincei; the Universities of Siena and Turin have nominated Sig. Achille Sclavo, Dr. Fritze, and Sig. Renier.

Prof. Kuwaki and Prof. Ishikawa are nominated by the Universities of Kyoto and Tokyo respectively. The University of Christiania is to be represented by Prof. Brögger. The Portuguese delegates are Prof. Henriques (Coimbra), Dr. Telles (Lisbon), Dr. Lacerda (Porto). The Russian delegates include Prof. Kuznetsov (Dorpat), Prof. Timiriazeff (Moscow), Prof. Simkevic, Prof. Zalenskij, Prof. Borodin (St. Petersburg). Prof. Elfving is nominated by the Finnish Academy of Helsingfors. The Swedish delegates include Prof. Forssman, Prof. Nordstedt (Lund), Prof. Théel, Prof. Aurivillius, Prof. Leche, Prof. Nathorst, Prof. Mórner (Stockholm), Prof. Sven G. Hedin (Upsala).

The delegates from Switzerland are Prof. Tschirch (Bern), Prof. Chodat (Geneva), Prof. Béraneck (Neuchatel), Dr. Sarasin (Zurich).

Delegates have been appointed also by colonial universities and societies, and by universities, colleges, and numerous societies in the British Islands.

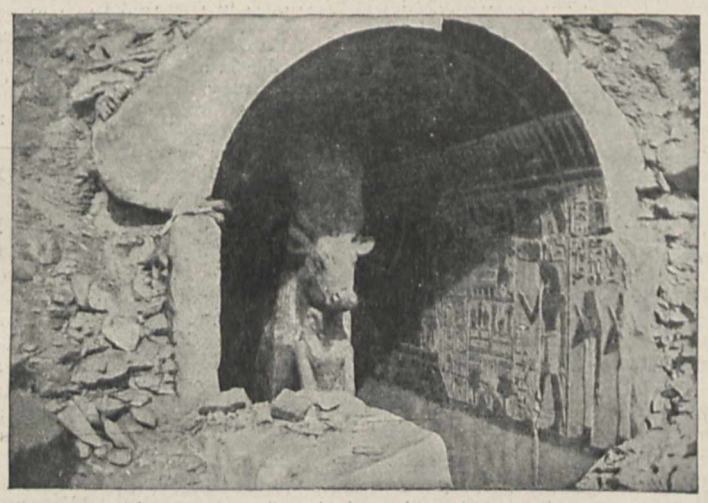
It is expected that the Chancellor of the University (Lord Rayleigh, O.M.) will hold a reception on the evening of June 22. On Wednesday, June 23, the delegates will present addresses in the Senate House; in the afternoon the master and fellows of Christ's College (the college of Charles Darwin) propose to give a garden party in the college grounds, and in the evening the guests of the university will be invited to a banquet. On Thursday morning, June 24, the Rede lecture will be delivered in the Senate House by the president of the Royal Society (Sir Archibald Geikie, K.C.B.).

A list of British delegates and other invited guests, containing additional names of foreign visitors, will be prepared at a later date. A. C. SEWARD.

NEW LIGHT ON ANCIENT EGYPT.[1]

"IT is impossible to understand the Present unless one knows the Past." This aphorism, trite enough, is in danger of being forgotten nowadays. Yet there are some who realise that we cannot properly understand nature's highest work, man, as he exists to-day, without knowing something of his history; and by that is not meant a catalogue of kings' names, battles, and dates (the "history" that is taught in most of our schools), but the story of the development, the evolution of human civilisation. It is only of late years that the history of Greece and Rome, of the civilisation which is still our own, has begun to be treated from this point of view; and the impetus to the new way of looking at things has undoubtedly been given largely by the scientific study of the results of archæological exploration in Egypt, Assyria, Greece, and Italy. The application to these discoveries of the methods of study that are, as a matter of course, used in dealing with natural science has had the consequence of revolutionising our views of ancient story; and as most of the spadework has been done in Egypt, it is Egypt that has told us most of our new knowledge.

In the present book Prof. Maspero has collected a number of articles that have appeared over his signature at various times, dealing with all the most important Egyptological discoveries, whether made by English or American spades in temples and tombs, or by German pairs of spectacles in papyri and inscriptions, during the last fifteen years.



The Shrine and Cow *in situ* at Deir-el-Bahari. From "New Light on Ancient Egypt."

No pen could describe them with more effect and with more literary grace than a French one, especially when it is wielded by the greatest master of Egyptological science.

The result, as Prof. Maspero says in his note at the beginning of the volume, is a "living picture" of Egyptian research during almost two decades.

It is a kaleidoscopic picture that is presented to us. We see temples, like Deir el-Bahari, white and glistening against red cliffs and blue sky, or, like Bubastis, ruined wastes of red granite chips amid the sand dunes. We explore, candle in hand, and with lowered head, the windings of tombs far beneath the earth, half-stifled by heat and foul air, until we at last reach royal interments four thousand years old, but still shining with gold and colour. We read the triumphal stela of Pharaoh Meneptah, the son of Rameses II., who tells us how he smote the mighty men of Israel in the hills of Mount Ephraim; this is the first mention of Israel in "secular" history. We see the priest-worked statue of the great god Khonsu-in-Thebes-Beautiful-Rest nodding its head "vigorously, vigorously," when Pharaoh Rameses asks if the god's smaller and port-

[1] "New Light on Ancient Egypt." By G. Maspero. Translated from the French by Elizabeth Lee. Pp. xii+315; illustrated. (London: T. Fisher Unwin, 1908.) Price 12*s.* 6*d.* net.

able image shall be sent to the far land of Bakhtan to cure the sick daughter of the king of that country. We read how an Egyptian statesman of the reign of Amenhetep III., Amenothes, son of Paapis, was deified by popular superstition after his death, and was eventually admitted to the pantheon. We see a half-comic kinematograph picture of a donkey driven by a fellah and accidentally kicking a half-buried pot, out of which falls the rich golden and silver treasure of Tûkh-el-Garmûs, now one of the "show pieces" of the Cairo Museum. We see the falling stones revealing the shrine in which stands the Hathor-cow of Deir-el-Bahari, once more greeting the light. We read an ancient Egyptian medical treatise and the philosophical dispute of an Egyptian with his own soul. So the pictures change swiftly, and the showman explains them with winged words.

The book is translated, on the whole, extremely well. There are, however, some faults in it. On p. 104, "l'impératrice Sabine" is translated "the Sabine Empress" (!) instead of "the Empress Sabina." This is dreadful, as is also "at Cyprus" on p. 51 for "in" Cyprus. One does not say "at England," though one has noticed "at Crete" in the newspapers lately. "Malgache chiefs" (p. 225) are, in English, Malagasy. But blemishes of this kind can be taken out in a second edition of the book, which, it is to be hoped, will appear in a few years' time with additions, and with one or two articles, which are somewhat out of date, such as that on "Archaic Egypt," omitted.

H. R. HALL.

A PIGMENTATION SURVEY OF SCOTLAND.[1]

ALL interested in anthropology and sociology will welcome the recent increase of interest in and the renewal of extensive investigations into the physical characters of the population of the British Isles. The report by Mr. J. F. Tocher on the latest investigation, "A Pigmentation Survey of School Children in Scotland," carried out under the auspices of a committee of the Royal Society, is the most important that has appeared since the publication of Beddoe's "Races of Britain," which forms the basis of our knowledge of racial distribution in these islands. The general and local distribution of colour traits in the children has been accurately recorded, and the influence of various factors of race and environment determined.

The completion of this report is most timely in view of the survey of the school children of England and Wales now being undertaken under the Education Act of 1907. The Board of Education, in its circular, only requests information as to the stature and weight of the children, but it may be hoped that one result of the present publication may be the addition to the schedule of observations on the hair and eye colour, without which all evidences of race are lost and the whole investigation is rendered incomplete and possibly even misleading.

The Scotch survey was carried out by sending schedules and instructions to the masters in all the schools. These, fortunately, took the matter up so enthusiastically that returns comprising information as to some half-million children were sent in, for which they will receive the sincere thanks of all anthropologists, who are only too conscious that without the cooperation of the teachers no survey could be even attempted. The hair colours recognised were red, fair, medium, dark, and jet black; the eye colours, pure blue, light, medium, and dark, so that the schedule closely resembled that used by Beddoe. It was found after many experiments that satisfactory lithographic reproductions of the standard colours could not be reproduced, so that the returns refer to descriptions, not actual matches of the hair and eyes. It has, however, been shown that classifications based on written descriptions agree sufficiently closely with those obtained by actually comparing each child with standard samples of hair and artificial eyes.

The schedules having been received, the actual proportion of children in each colour class in each locality was determined, the divergence from the figures for the whole of Scotland being noted. By somewhat elaborate calculations it was ascertained whether these divergences were such as might have occurred in a chance sample of the whole population or were significant of the action of definite factors affecting the local type of pigmentation.

The Orkney and Shetland Islands, Lewis, eastern Caithness, the eastern boundaries of the Highlands, Lothian, and the Border counties contain a significantly fair child population. A significant excess of dark hair characterises the Highlands, Galloway, and the city of Glasgow. Jet-black hair is found in excess in the Highlands. Brown or medium hair is the feature of all densely populated areas. Red hair is only in excess among the populace to the north of the Grampians and to the east of the Caledonian Canal. The author points out that it is significant that this area should have been the home of the opponents of Agricola described by Tacitus as rufous. The fair-haired districts correspond to the areas occupied by the Scandinavian or Nordic race, and present another northern feature in the significant excess of pure blue eyes.

The characters of the Gaelic-speaking population were specially investigated, with the result that an excess of dark and jet-black hair was found. A large proportion of blue eyes was also discovered, possibly in part explained by intermixture of non-British elements now speaking Gaelic.

Glasgow was found to present such divergences from the general population as to require a special study. In no division of the city was there an excess of fair hair; medium hair was present in excess throughout the city and to a less extent in the suburban areas. Dark and black hair was found with unusual frequency in the Gorbals and Tradeston districts. Dark and medium eyes were significantly more prevalent in the more densely populated districts. Glasgow thus agrees with London and most Continental cities.

Tocher shows that three factors may be concerned in this selection. The darkening of the hair with age might take place earlier among fair-haired city children, and the process might be more intense. For this there is at present no evidence. The medium class might be the more fertile. The author shows that the number of births per family is greater than the average in areas characterised by an excess of medium hair and eyes, while it is below the average in areas in which fair hair and blue eyes are in excess.

Lastly, the excess of medium traits might be due to blending. The offspring of parents, one fair, the other dark, tend to present hair colours in the proportion of one fair, one dark, and two medium, which corresponds with the numbers found in densely populated areas. In the case of eye colours such blending does not seem to occur, so that the excess of dark and medium eyes in towns can only be explained by the preponderance of these colours among the poorer

[1] "Pigmentation Survey of School Children in Scotland." By J. F. Tocher. From *Biometrika*, a Journal for the Statistical Study of Biological Problems, vol. vi., Nos. 2 and 3. (Cambridge: University Press, n.d.)

and more fertile classes. The divergence in colour traits noticed in Glasgow is in part due to the presence of a considerable non-Scottish element.

Dark traits seem to be associated with imbecility, blindness, and deafness, because these defects are significantly more frequent in Gaelic-speaking districts than in Scotland as a whole. This is perhaps explained, as the author suggests, by the greater emigration of the fittest members of the community from the west than from the rest of the country. The author distinguishes five racial types :—The Scandinavian or Germanic type, with fair hair and blue eyes; the dark European type, with dark hair and dark eyes, which he subdivides into Mediterranean and Danish; the Scoto-Keltic type, with dark hair and blue eyes; the essentially Scotch type, with medium hair and eyes; and the Caledonian type, with red hair. The Scoto-Keltic, Scotch, and Caledonian types are probably crosses, while the Danish type may probably on further investigation be shown to have affinities to the Alpine race.

After showing that the pigmentation in Scotland is intermediate between that of northern and southern Europe, Tocher adds that even in southern Germany the hair is lighter than in Scotland. This will seem inconceivable to those who have worked in the two countries, while the figures quoted in support of this statement suggest the existence of some misconception of the limits of the terms fair and dark as used by different observers. The author has compared his results with those of Fürst in Sweden and Ammon in Baden, using the headings Fair, Red, Medium, and Dark as equivalent to Blond, Roth, Braun, and Schwarz, regarding Medium as Braun. The Continental use of the term Schwarz is practically identical with Black as used by Beddoe, who differs from Tocher in including therein the very darkest browns, only recognisable as browns in a very good light. This in a large measure accounts for the low proportion of dark hair attributed to Sweden. A further difficulty has arisen in comparing the Swedish Blond with the Scotch Fair. The "Blond" class was constructed by Fürst out of a combination of two others, "Gelb" and "Cendré." While the lighter members of the latter class might be included in the Fair division of Tocher, the darker members overstep the upper limits of his Medium division. Fürst, in his monograph on Swedish hair and eye colour, contrasting his results with those obtained by Sören Hansen and Westergaard from Danish children, compares his Braun class with the Dunkel class of the latter authors, and his Blond with their Hell and Mittel classes combined. Sören Hansen's divisions, Roth, Hell, Mittel, Dunkel, and Schwarz, are practically identical with those of Tocher.

When Blond—that is, Gelb+Cendré or Hell+Mittel—is regarded as equivalent to Fair, Braun to Medium, and Schwarz to Dark+Black, the Scottish results naturally show a different distribution from that obtaining in the rest of Europe.

The real comparative tables give the percentage distribution of hair colours as :—

Sweden (adult males)		Denmark (children)		Scotland (boys)		Baden (adult males)	
Gelb	23·3	Hell	41·8	Fair	24·9	Blond	41·6
Cendré	52·0	Mittel	40·9	Medium	43·3	Braun	38·7
Braun	21·6	Dunkel	13·0	Dark	25·0	Schwarz	18·0
Schwarz	0·8	Schwarz	1·4	Jet-black	1·2	Roth	1·7
Roth	2·3	Roth	2·9	Red	5·5		

The distribution in Scotland, then, agrees with that of Europe, and falls into position between Sweden and south Germany. The fact that the data cannot be directly compared points out the urgent need for an international nomenclature, or at least for international standards and authorised translations.

One of the most interesting features of the present survey is that it tends to show that the population of Scotland might have been derived from original blond and brunet elements in approximately equal proportions which are gradually blending to form a distinctive Scottish type.

Further details and correlations are promised by the author for some subsequent publication, and will be anxiously awaited, since, for completeness of detail and thoroughness of statistical investigation, the present memoir is unequalled. It is to be hoped now that the chance exists that the results of a similar survey may in time be available for England and Wales.

THE NEW WIRELESS TELEGRAPH STATION.

AS mentioned in our notes columns of December 17, the new wireless telegraph station at Bolt Head, South Devon, was opened by the Postmaster-General on December 11. This station is the first belonging to the Post Office to be opened for a regular service of communication with ships at sea, and has telegraphic connection with Exeter, through which town all messages will be transmitted. In accordance with the provision of the International Radio-telegraphic Convention of 1906, the station will establish public communication with all vessels carrying wireless telegraphic apparatus irrespective of the system of wireless telegraphy which they may have installed. The range of the station is 250 miles, though it is not anticipated that the general working range required will exceed about 100 miles. The cost of communication is expected to average about 8*d*. per word, made up of a shore charge of 3½*d*. and a ship charge of 4*d*., and the usual ½*d*. per word for the ordinary land rate.

The station is fitted with apparatus on the Marconi system. The aërial, which is 160 feet high, consists of two central conductors and four arms radiating to small poles placed around the main mast, thus being of what is now known as the "Umbrella" type. Power is obtained from a 3-kw. alternator supplying current at 100 volts 50 cycles, which is transformed up to 15,000 to 20,000 volts. The alternator is coupled to a direct-current machine, which can be run either as a motor, or as a generator driven by an 8-h.p. oil engine when it is required to charge the cells, in which case current can at the same time be taken from the alternator. The battery is also used for the lighting of the building. The signalling is effected by a key in the generator circuit which controls a magnetic key which only allows the alternator circuit to be open when the current is at zero, as is now usual with wireless telegraphic work where the power is supplied by an alternator in order to avoid sparking at the contacts of the signalling key. The sparking gap is of the standard Marconi type, and can be varied in length from 2 mm. to 8 mm.; it is completely enclosed in order to deaden the noise of the sparking.

The receiving apparatus consists of a Marconi magnetic receiver, which gives telephonic signals in the usual way, and a coherer circuit for calling up, which is disconnected when receiving signals on the magnetic receiver. The coherer circuit can also be used in connection with a Morse inker to record messages when the operator is not present.

The normal wave-length is 600 metres, but this can be varied, and apparatus is provided to enable the

circuits to be tuned accurately in order to obtain the clearest signalling.

Whilst this is the first State-owned station to be used for public purposes, it may be mentioned that the Marconi Company owns eight such stations which have been open for public communication since the Radio-telegraphic Convention came into force. It will be recollected that the Marconi Company somewhat strongly opposed this convention before ratification on the ground that it would destroy the business which they had built up, an opposition which, as we pointed out in NATURE at the time, appeared to be short-sighted and against the public interest. It is gratifying to learn that the company has loyally accepted the convention, and has steadily cooperated with the Post Office in carrying out its provisions, with what are stated to be beneficial results both for the company and the public, the traffic dealt with having increased in volume and the ships carrying Marconi apparatus having increased in number. Everyone will welcome this further evidence of the development of the utility of wireless telegraphy. M. S.

SWEDISH HYDROGRAPHICAL AND FISHERY INVESTIGATIONS.[1]

ALTHOUGH it did not need the existence of an International Council to point out the field for physical and biological research offered by the waters of the Baltic, there is no doubt that during the last few years of cooperative investigation great strides have been made in our knowledge of the hydrographical and correlated biological conditions of this sea, which presents phenomena of peculiar interest which do not exist in the case of the more economically important North Sea.

The third volume of the "Svenska Hydrografisk Biologiska Kommissionens Skrifter" contains the results of the investigations made by the Swedish men of science Pettersson, Trybom, Schneider, and Broch, up to the end of 1907.

The first-named describes and discusses at some length the results of his observations upon the water-circulation between the ocean and the Baltic, for the proper understanding of which it is necessary to measure the force of the in- and outgoing currents at the entrances to this sea. This the author has carried out by the use of his "Universalsinstrument," an apparatus designed to indicate the direction and velocity of the current, and, at the same time, to take plankton and water samples at a particular depth. The chief determinations were made at stations in the Great Belt at depths of 5, 10, 20, and 30 metres. In general, the water circulation in this channel consists of an outflowing surface current of low salinity and an undercurrent of high salinity entering from the Kattegat, with an intermediate layer of "mixed" water. Pettersson's work has shown in definite terms the various degrees to which these different layers are affected by the influence of daily tidal movements and also by the annual oscillation of Atlantic water—the Gulf Stream flood—and his chief result is to demonstrate that these oceanic factors are of far greater importance in their effect upon the water circulation of the Baltic than had hitherto been suspected from surface observations. In general, the water-layers at 10 m. and 20 m. depth move in opposite directions, except at the time of strongest ebb-tide, when the whole of the water moves seaward. For example, a series of observations at a station in the Great Belt give during flood-tide at 10 m. depth an average velocity of 8.0 cm. per second from south to north, and at 20 m. depth an average velocity of 27.6 cm. per second from north to south; during the ebb-tide an average velocity of 69.2 cm. per second, and at 20 m. of 9.7 cm. per second, both the latter being from south to north. The boundaries between water-layers of certain salinity are not horizontal, but the masses are wedge-shaped and are much closer together in the Kattegat than in the inner sea. The surface movements of the Baltic do not depend so much upon the influence of fresh-water supplies from the rivers, but are the results of forces set up by the intrusion below of ocean water of greater density, the effect of which is to cause a circulation of water from the lower layers to the surface. The interesting circumstance that the dissolved oxygen in the surface water is of distinctly greater amount in the inner (northern) Baltic than nearer the southern entrances is explained by reference to the fact that the southern water has a longer course as an undercurrent than is the case in the northern Baltic. The Little Belt was found to consist of "mixed" water practically homogeneous in temperature and salinity, the flood-tide passing the channel with almost equal velocity at all depths, while the ebb is swiftest at the surface. The Sound showed only one outflowing current of homogeneous Baltic water.

It is in their relation to hydrographical conditions that Dr. Schneider's observations on the distribution of pelagic eggs and larvæ of the food-fishes are of special interest. Under the particular physical conditions which prevail in the Baltic, the *vertical distribution* of these forms is characteristic. Pelagic teleostean ova were taken at considerable depths and were practically absent at the surface. Variation in depth distribution was shown for different species, and the same species was found at different depths in different months, while larvæ occurred, on the whole, nearer to the surface than the ova. The possibility of the existence of cod-larvæ in the northern waters of the Baltic is proved by new positive evidence of their occurrence, though in no great numbers, and a previously accepted theory that they only immigrate at a later stage is corrected. On the other hand, while it has been stated that the plaice stock of the Baltic is self-contained and needs no replenishing from other seas, the writer especially notes the absence of plaice larvæ from the catches of the Swedish expeditions, but draws no conclusion from this negative evidence, and leaves open the question as to whether, and at what stage, there is an immigration of plaice fry from the west.

Trybom contributes additions to the record of experiments with marked flat-fish and lobsters, and in collaboration with Schneider describes experiments with marked eels which have given interesting results. The eels showed practically without exception an oceanward tendency in their migration, moving in a southerly and westerly direction along the Swedish coast and through the Sound. The high rate of 104 km. travelled in two days was shown by one fish, and ten out of the 63 re-captured, from a total of 300 liberated, travelled at an average rate of more than 20 km. per day. Incidentally, these experiments tend to prove the assertion of fishermen that bright moonlight is unfavourable to the capture of eels.

The result of a long series of observations made by Trybom in the river Dalelf upon the piscine enemies of salmon and trout ova is to brand the grayling as by far the most guilty of spawn-devourers. Small trout prey upon the ova of their own and other species of Salmonidæ, and Coregonus, particularly when "spent," is destructive to its own spawn, though seldom found with salmon or trout eggs in its

[1] "Svenska Hydrografisk Biologiska Kommissionens Skrifter III." (Göteborg: Wald. Zachrissons Boktryckeri A.-B., 1908.)

stomach. The coarse fish—bleak, burbot, pike, bream, ruff, and lamprey—were found to be much less harmful, and roach and perch quite innocent of spawn-eating.

In an exhaustive account of the herring collection at the Göteborg Museum, Hjalmar Broch gives an analysis of 354 specimens according to locality, size, age, sex, and maturity, accompanied by a brief dissertation upon fish-scale investigation by means of which not only age, but also, in the case of the herring, racial characteristics can be determined. The same writer reports upon the distribution and age groups of Gadidæ, Pleuronectidæ, Homarus, &c., in the Gullmar Fiord.

Questions of wider interest than Baltic Sea biology are touched upon in an appendix which sets forth the scheme, recommended by the Swedish members of the International Council for the Investigation of the Sea at their meeting in Lübeck in 1906, for the establishment of an international agreement for the purpose of protecting and increasing the plaice stock of the North Sea and neighbouring seas. According to the present state of this fishery, and in the light of the knowledge of the life-history of the plaice, which the current researches have already afforded, it is stated that there is a need for the regulation of fisheries by international agreement, based upon scientific investigations, hydrographical and biological, as well as statistical. A size-limit below which plaice should be forbidden to be landed is the essential remedy recommended, and it is suggested that a progressive limit from 28 to 33 cm. should be agreed upon as the standard for plaice caught by deep-sea fishing, while coastal fisheries should have their special limits according to local conditions. The volume concludes with an appreciative review of the work done by those participating in the International Fishery Investigations, and suggestions as to the trend of future researches. A. E. H.

NOTES.

THE council of the Röntgen Society has now decided to act upon the advice of the committee appointed in 1906 to consider the possibility of preparing a standard for the measurement of radio-activity. This committee recommends that "The γ-ray ionisation from 1 mg. of pure radium be regarded as a standard, and called a unit of radio-activity." The council has deputed Mr. C. E. S. Phillips to prepare a set of three substandards of $RaBr_2$, and these are now maturing. By the kind cooperation of Prof. E. Rutherford, comparison will be made with a specimen of the purest $RaBr_2$ at the Victoria University, Manchester. The quantity of radium in other specimens will be capable of accurate measurement by comparison with the substandards. It is anticipated, therefore, that by this means the exact description of medical, physical, or other work with radium will be facilitated, and that the possibility of fraud in the sale of expensive radium preparations will be eliminated. The council proposes to lend the substandards to any competent person desiring to measure the amount of radium in his possession, or to arrange for authoritative tests to be made. For further particulars application should be sent to the honorary secretary of the Röntgen Society, at 20 Hanover Square, London, W.

A FORTNIGHT ago a disastrous railway accident happened in Algeria, and on Saturday last the sad news was announced that the Englishman killed had been identified as Mr. Joseph Lomas, the lecturer in geology at Liverpool University. Mr. Lomas was a well-known British geologist, and was a specialist on Triassic geology; he was making a visit to southern Algeria on behalf of the committee of the British Association appointed at Dublin to investigate the desert deposits of the Biskra oasis in reference to the origin of the New Red Sandstone. Mr. Lomas received his chief scientific education at the Royal College of Science, and in 1884 or 1885 settled at Liverpool as one of the peripatetic science masters of the Liverpool School Board. He soon joined the Liverpool Geological Society and the Liverpool Marine Biological Committee, and gradually took a leading place among the naturalists of that city. He was president of the Liverpool Geological Society in 1896–8, and was recently re-elected for a second term of office, that he might be its president at the approaching jubilee of the society. Though he retained his position under the Liverpool School Board and local education committee, he was appointed in 1887 special lecturer in geology in Liverpool University, and though never on the regular staff, he was responsible for the university teaching in physical geography and geology. He was for nine years one of the secretaries of the geological section of the British Association, and was the recorder for the last two meetings; his trustworthy service and never-failing tact will be greatly missed from that section. After his appointment at Liverpool he began work on the marine Bryozoa of that district; he discovered the presence of calcareous spicules in the Ctenostomata, and was thus led to the suggestion that that group was descended from Bryozoa with a well-developed skeleton. He also prepared a valuable report on the floor deposits of the Irish Sea. Subsequently, he worked mainly at the Trias; he made many interesting additions to our knowledge of the system, and inspired much of the work upon it by the members of the "Trias Committee." He was an enthusiastic champion of the desert origin of the English New Red Sandstone, and defended that theory in papers in the Transactions of the Liverpool Geological Society and the *Geological Magazine*. He was also keenly interested in glacial geology, and made several visits to Switzerland to study existing glaciers. His tragic and early death will be mourned by the wide circle of British geologists who knew his lovable character and his sound and suggestive scientific work.

BY the will of the late Lord Rosse, the sum of 1000*l*. is bequeathed to the science schools fund of Trinity College, Dublin. The famous Rosse telescope and all Lord Rosse's scientific instruments, apparatus, and papers are left to his sons in order of seniority successively, whom failing, to his brothers successively, whom failing, to the Royal Society, London; 2000*l*. is left upon trust for the upkeep of the telescope.

THE Convocation week meeting of the American Association for the Advancement of Science and affiliated societies will be held in Baltimore from December 28 to January 2. On January 1 a celebration will be held of the one hundredth anniversary of the birth of Darwin and of the fiftieth anniversary of the publication of the "Origin of Species." The celebration will consist of a morning and afternoon programme of addresses by prominent naturalists, to be followed by a dinner in the evening, at which further addresses will be delivered.

THE Home Secretary has appointed a Departmental Committee to inquire into the sufficiency of the existing regulations relating to the storage, use, and conveyance of petroleum spirit, and to report what further precautions, if any, are in their opinion desirable as tending to diminish the dangers attendant thereon. The committee

is constituted as follows:—Sir Henry Cunynghame, K.C.B., chairman, Sir Boverton Redwood, F.R.S., Major Cooper Key, and Mr. James Ollis. The secretary to the committee is Major T. H. Crozier, to whom correspondence may be addressed at the Home Office, Whitehall, S.W.

THE Geological Society of Glasgow, instituted in 1858, has now entered the fifty-first year of its existence. The council has made arrangements to celebrate the event by holding a jubilee meeting in Glasgow University on January 28. Sir Archibald Geikie, K.C.B., F.R.S., the senior member of the society, has promised to be present and deliver an address. Sir Donald MacAlister, K.C.B., Dr. Teall, F.R.S., director-general of the Geological Survey of Great Britain, Dr. Horne, F.R.S., Mr. B. N. Peach, F.R.S., and other eminent men of science will take part in the proceedings. A history of the work of the society, with biographical notices of prominent members, is being prepared under the editorship of the secretaries, Messrs. P. Macnair and F. Mort, who hope to issue the book by the end of the year.

HARVARD UNIVERSITY has lost the senior member of her faculty by the death, on December 9, of Dr. Wolcott Gibbs, emeritus Rumford professor of the application of science to the useful arts. Dr. Gibbs, who was a son of George Gibbs, the mineralogist, was born at New York in 1822. After graduating as M.D. at the College of Physicians and Surgeons in that city, he pursued his studies under Heinrich Rose at Berlin, under Liebig at Giessen, and under Regnault at Paris. From 1849–63 he occupied the chair of physics and chemistry at the College of the City of New York. He held his active professorship at Harvard from 1863–87. During this latter period he distinguished himself by his researches in light, heat, and organic chemistry, particularly in reference to complex inorganic bases and acids. His investigations of the platinum metals are also well known. In 1886 Prof. Gibbs was elected foreign secretary of the U.S. National Academy of Sciences, and in 1895 its president. He rendered conspicuous public service on the executive committee of the Sanitary Commission during the Civil War, and was U.S. commissioner to the Vienna Exposition of 1873. He was one of the founders, in 1863, of the Union League Club, which gave valuable help to the Union cause in the struggle with the Confederacy.

THE first number of a very attractive monthly magazine of *Travel and Exploration* has just been published under that title by Messrs. Witherby and Co. The fundamental note of the magazine is that of human interest in the places, peoples, and products of the world. Travel in all its aspects—by land, water, or air—will be dealt with for the benefit of the general reader and the inspiration and guidance of the young explorer. Exploration is a comprehensive word, and can be applied to studies of the heavens above as well as the earth beneath, but apparently the magazine is to be limited to accounts of geographical exploration. In the first number Sir Clements Markham appeals to the spirit of adventure, and Lieut. Trolle describes the Danish expedition to north-east Greenland, which led to valuable scientific results gained at the price of the lives of the leader Erichsen and his two companions. Mr. L. C. Bernacchi predicts that Peru will gradually become one of the richest countries of the world, and Mr. E. S. Bruce describes the progress in the construction and performance of dirigible balloons. There are other contributions upon travel in the Balkans, photography for travellers, and New Guinea, and the pages are brightened with excellent illustrations. The magazine should appeal to a wide circle of readers.

ANOTHER remarkable aëroplane flight was accomplished by Mr. Wilbur Wright at Auvours, near Le Mans, on December 18. The flight lasted 1h. 54m., and the distance covered is estimated to have been more than ninety miles. The flight took place around a triangular course marked with flags at a measured distance apart, and the official record of the number of revolutions around this course gives the distance traversed as sixty-two miles, but the actual track of the aëroplane was often far beyond the measured triangle, thus making the distance much greater. By his achievement, Mr. Wright will probably win the Michelin trophy of 8001. for travelling the greatest distance in the air before December 31. He has won the prize of 401. offered by the Aéro Club of Sarthe for the first aëroplane flight at an altitude of 100 metres. The subjoined table, from Saturday's *Daily Mail*, shows the progress made in motor flight with heavier-than-air machines during the past five years:—

Date.	Name	Place	Miles	Yards	Min.	Sec.
1905						
Sept. 28	Wright Bros. ...	Dayton ...	11	125	18	8
Sept. 29	Wright Bros. ...	Dayton ...	12	—	19	35
Oct. 3	Wright Bros. ...	Dayton ...	15	25	25	5
Oct. 4	Wright Bros. ...	Dayton ...	20	75	33	17
Oct. 5	Wright Bros. ...	Dayton ...	24	20	30	13
1906						
Nov. 11	M SantosDumont	Paris	—	230	21	18
1907						
Oct. 8	Herr Wels ...	Trautenau...	—	350ft.		—
Nov. 7	H. Farman ...	Paris	—	1300		—
1908						
Mar. 22	H. Farman ...	Paris	2	1540		—
May 14	Wright Bros. ...	Manteo ...	6	—	9	—
June 23	M. Delagrange...	Milan ...	10	1105	18	30
July 6	H. Farman ...	Paris	11	—	20	10
Sept. 5	M. Delagrange...	Issy	15½	—	30	—
Sept. 5	W. Wright ...	Le Mans ...	16¼	—	19	50
Sept. 9	O. Wright ...	Fort Meyer	51¼	—	56	—
Sept. 9	O. Wright ...	Fort Meyer	37½	—	62	13
Sept. 10	O. Wright ...	Fort Meyer	—	—	65	42
Sept. 11	O. Wright ...	Fort Meyer	—	—	70	30
Sept. 12	O. Wright ...	Fort Meyer	45	—	74	20
Sept. 21	W. Wright ...	Le Mans ...	58	—	91	25
Sept. 30	H. Farman ...	Mourmelons-le-Grand	24	—	36	—
Oct. 6	W. Wright ...	Le Mans ...	42	— with passenger	64	26
Dec. 18	W. Wright ...	Le Mans ...	95	—	113	59

THE current issue of the *Fortnightly Review* contains an article by Dr. William S. Bruce on the aims and objects of modern Polar exploration. Supposing the object of an expedition to be a detailed investigation of the North Polar basin, Dr. Bruce gives a sketch of the equipment of such an expedition, the method of procedure, the *personnel* of the staff, and the relations which should subsist between the leader of the expedition and the master of the ship. This investigation is, Dr. Bruce says, the only piece of work in the North Polar regions that remains to be done on an extensive scale, though there is much Arctic work required in other directions. The Beaufort Sea, the islands and channels of the north of the American continent, offer a splendid field for topographical, hydrographical, biological, geological, and other research. Turning to South Polar regions, it is remarked that almost everything south of 40° S. requires a thorough investigation and overhauling, and vast stores of information are to be gathered from both sea and land. It is, in Dr. Bruce's judgment, a study of the sub-Antarctic and the Antarctic seas that requires investigation in the first place, including an exploration and definition of the southern

borders of those seas. More than anything that is required, the paper says, is a new expedition on the same lines as the *Scotia*, and Dr. Bruce is prepared to organise such an expedition as soon as funds are provided. He gives an outline of the way such an expedition might be conducted and the work it might accomplish.

WE have been favoured with an advance copy of the forty-seventh report of the Yorkshire Naturalists' Union, containing an account of the proceedings at the forty-sixth annual meeting held at Halifax on December 14, 1907, and of the general working of the society during the past year. Full reports are given of the condition of the bird-life of the county, which are for the most part satisfactory, although the numbers of the great grebe on Hornsea Mere have been sadly reduced by the ravages of egg-collectors.

AT a recent meeting of the North Staffordshire Field Club, Mr. F. W. Ash read a paper (of which we have been favoured with a typed copy) on the evolution of the cetacean tail-fin, in which it is attempted to rehabilitate the generally discredited theory that this structure includes vestiges of the hind-limbs as well as the tail itself. The chief argument brought forward in support of the theory appears to be based upon the expanded form and horizontal position of the cetacean flukes, which is likened to the complex formed by the hind-limbs and tail in seals. The tendinous structures in the whale's flukes are considered to represent limb-tendons.

WE have received from the publishers, Messrs. Vinton and Co., of Chancery Lane, a copy of the "Live Stock Journal Almanac" for 1909, which is a wonderfully good shillingsworth. The calendar portion contains ample space for entering the dates of birth of farm and other animals, while the rest of the volume is devoted to illustrated articles on different breeds of domesticated animals in 1908 and kindred subjects, most of these articles being by well-known specialists. Thus Shorthorns are discussed by the late Mr. John Thornton, while Mr. A. C. Beck treats of shire horses. Special interest attaches to an article by Sir Walter Gilbey on live stock a hundred years ago, where much information will be found with regard to the history and rise of many breeds.

THREE out of the four papers in No. 3 of the seventh volume of the *American Journal of Anatomy* are devoted to the Mammalia (other than man), Dr. Henry Fox treating of the pharyngeal pouches and their derivatives, Mr. L. W. Williams describing the later development of the notochord, and Mr. W. A. Baetjer discussing the mesenteric sac and thoracic duct in pig-embryos. In the second of these the author finds that the primitive vertebra consists of undifferentiated mesenchyma, which never undergoes longitudinal segmentation, while the cartilage of the actual vertebra arises, not from a primary condensation of mesenchyma, but from a secondary condensation following a loosening of the dense tissue of the scleromere, or primitive vertebra. This secondary condensation of the vertebræ and intervertebral discs gives rise to pre-cartilage. At this time the notochord expands slightly in each vertebra, this being suppressed at the commencement of chondrification, when most of the notochordal tissue is forced into the intervertebral discs, where it forms the nucleus pulposus. Primarily cellular and epithelial, the notochordal tissue eventually becomes cellular, and then closely resembles cartilage.

THE December number of the *Popular Science Monthly* is one of unusual interest to naturalists, as it contains the full text of Prof. W. Ridgeway's paper, read at the last meeting of the British Association, on the application of zoological laws to man; an article on the aspects of modern biology, by Prof. T. D. A. Cockerell; and one on the great Permian delta of Texas and its wonderful extinct vertebrate fauna, by Dr. E. C. Case. The remains of these animals are believed to have been carried down by the Permian rivers in flood-time and entombed in the mud of the delta. Restorations of several of the reptiles are given, and it is interesting to note that there appear to have been two distinct types of the "fin-backed" group, one of which (Dimetrodon) was carnivorous, while the other (Naosaurus) was probably omnivorous. The latter has perhaps the most wonderful dentition of any known animal, the incisor teeth being sharp and chisel-shaped, such as might be suited for cutting vegetable substances, while behind these are five pairs of sharp triangular cutting-teeth, these being followed by simple cones suited to holding a struggling victim. On the palate and the opposing portion of the lower jaw are heavy plates of bone covered by short, stumpy teeth of a type found in mollusc-eating fish. In the author's opinion, Naosaurus was probably omnivorous, but instead of possessing a dentition of a generalised type, like that of man or a pig, it had a special set of teeth for each kind of food.

THE ichthyosaurs of the Trias, and more especially those of North America, form the subject of an elaborate monograph by Dr. J. C. Merriam, published as the first part of vol. i. of the Memoirs of the University of California. For several years past the author has been working at these reptiles, and in the present memoir we have the result of his labours. After a discussion of their distribution, the author proceeds to point out in what respects the Triassic representatives of the Ichthyopterygia differ from their successors of the Jurassic and Cretaceous epochs. These differences consist, for the most part, of less special adaptation to the exigencies of a purely aquatic mode of life, thereby bringing them into closer connection with less specialised land reptiles. What their terrestrial ancestor may have been is, however, still unknown; but it probably existed at least as early as the Lower Trias. By the middle portion of that period we find an undoubted aquatic form—Cymbospondylus—which retains, however, sufficient indications of affinity with a land form to give a clue to the origin of the group. This reptile, it may be presumed, had abandoned the shore as a regular dwelling-place, but still resorted thereto on occasion, and probably swam in shallow water in place of frequenting the open sea. In contrast to this we have the highly specialised representatives of Ophthalmosaurus and the closely allied, if not identical, Baptanodon, which were evidently adapted to play the part in the Jurassic oceans of the whales of the present day. Even these, however, display great simplicity of structure in all parts of their organisation except those specialised for swimming, and it is thus abundantly evident that the ichthyosaurs trace their ancestry to an extremely generalised type of reptile, while it is equally clear that the group is one of the oldest in its class.

THE whole of the November issue (vol. liii., part i.), comprising 181 pages of text, is devoted to a paper by Prof. A. A. W. Hubrecht on the early ontogenetic phenomena in mammals, and their bearing on our interpretation of the phylogeny of the vertebrates, a paper to which it is impossible to do adequate justice in the space at our command. Naturally, the placenta and its modifications

loom very large in this communication, and it is noteworthy that the author regards the diffuse placenta, such as that of the lemuroids, as a specialised and simplified rather than a primitive type. The latter position, on the other hand, is claimed for the zonary placenta of the Carnivora, and it is noteworthy, in connection with the view that the creodonts are related to the mammal-like reptiles, that the author sees evidence of a placental relationship between marsupials, carnivores, and insectivores. Further, he expresses the belief (p. 132) "that the Didelphia furnish very conclusive evidence of their being very specialised descendants of placental mammals." This, of course, is in direct opposition to the views of Prof. J. P. Hill. As regards the Primates, the author is of opinion that they are widely sundered from the Lemuroidea, herein differing *in toto* from the recently expressed views of Messrs. Standing and Elliot Smith. It may be mentioned that Metachiromys, which the author still includes in the Primates, was regarded by Prof. H. F. Osborn in 1904 as an armadillo. The most startling part of the paper is, however, the proposal to divide vertebrates into the three groups of Cyclostomata, Chondrophora, and Osteophora, the first comprising the lampreys, the second the sharks and rays, and the third the whole of the remaining groups. A further suggestion is that the ganoid Polypterus, and perhaps also the lung-fishes, is the descendant of terrestrial tetrapodous ancestors, and the further suggestion is hazarded that a similar origin may be claimed for many teleostomous fishes.

THE announcement is made by the present editors of the *Botanische Zeitung* that at the close of this year they will withdraw from that office, and will, with the co-operation of Prof. L. Jost, start a new monthly journal, *Zeitschrift für Botanik*, to be published by the firm of Gustav Fischer in Jena. It is proposed to include original articles, reviews, and a summary of new literature in each part. Messrs. Gustav Fischer also announce that they are undertaking the publication of a new medical journal, *Zeitschrift für Immunitätsforschung und experimentelle Therapie*, that will consist of two parts, obtainable separately, the one devoted to original communications, the other to reviews.

PROF. W. TRELEASE has published a useful, although not fully determinate, note on the two species *Agave rigida*, Miller, and *Agave angustifolia*, Haworth. The first binomial has been applied by more than a dozen systematists to agaves of different kinds, but it appears that the original type named by Miller has to be rediscovered, and the author suggests a habitat between Venezuela and Yucatan. The discussion of *Agave angustifolia* leads to the view that this species includes *Agave lurida*, a common fence plant to-day in St. Helena, *Agave Wightii*, and other species that have received distinct appellations. The paper, with illustrations of the two species, is published in the nineteenth annual report of the Missouri Botanical Gardens.

IT is reported by Miss T. Tammes in the *Recueil des Travaux botaniques Néerlandais* (vol. v.) that in the species of Dipsacus a chromogen exists which on warming gives rise to a blue colouring matter; to the chromogen the name "dipsacan" is given, and the colouring matter is called "dipsacotin." The formation of dipsacotin is somewhat similar to the formation of indigo in the case of species of Indigofera. It is produced by the splitting up of dipsacan either by heating in the presence of moisture or by the action of benzin. Dipsacan occurs in all parts of the plant, especially in the growing region; it has been found in all genera of the Dipsacaceæ that have been examined, but is most abundant in species of Dipsacus.

THE quarterly issue of the *Trinidad Bulletin* (October) is an excellent number, containing much information, original and extracted, on the agricultural crops in Trinidad and adjacent islands. An article by Mr. A. W. Bartlett deals with cocoa-nut plantations and the preparation of copra. Mr. T. Thornton discusses the prospects for cotton cultivation in Tobago. Cotton of the "Marie Galante" type has been cultivated, but the Sea Island variety has not received much attention. Hints are provided on the propagation of cedar and cyp—*Cordia Gerascanthus*—seedlings for planting up areas; the latter requires more attention in the nursery, but will thrive on poor soil, and furnishes very good constructional timber.

APART from the information regarding trees and shrubs, the notes on Continental parks and gardens communicated by Mr. W. J. Bean to the *Kew Bulletin* (No. 9) will serve to direct attention to various horticultural and sylvestral localities that may with advantage be included in a Continental trip. At Tervueren, not far from Brussels, there is a comparatively new arboretum extending over 300 acres for the cultivation, in geographical groups, of such exotic trees as are sufficiently hardy. Within easy reach of Gouda are situated the nurseries of Boskoop, where the peaty soil provides an ideal home for rhododendrons, but where Japanese maples, wistarias, and many other valuable plants also luxuriate. The gardens at Herrenhausen and Sans Souci, the nurseries of Vilmorin at Verrières and Les Barres, of Lemoine at Nancy, of Späth near Berlin, and of Hesse at Weener, all famous horticultural centres, are briefly described.

DR. JURITZ discusses the underground waters of Cape Colony in recent issues of the *Agricultural Journal of the Cape of Good Hope*. He lays stress on the fact that an adequate water supply would completely alter the agricultural potentialities of the country, besides being of importance for all steam users, particularly railways, and then proceeds to set out a number of analyses of waters collected from different parts of the colony. The Table Mountain and Stormberg series were found to yield the purest waters, while the Uitenhage, Dwyka, and Bokkeveld formations gave rise to the most saline. Calcium chloride occurred in some cases, and sodium carbonate was found in the waters of the Middle and Upper Beaufort and Stormberg series, rendering the water quite unfit for agricultural purposes.

IN his "Vocabulary of Malaysian Basket-work," the late Dr. O. T. Mason, head curator of the anthropological department of the United States National Museum, made a notable advance towards a more scientific treatment of this important industry. Dr. W. L. Abbott has recently presented to the museum a large collection of baskets from Malaysia. This is now being studied in comparison with the extensive series obtained among the American Indian tribes and in the Philippines. To secure a scientific treatment of the subject it was found necessary to define accurately the terms applied to the various stages of technique and to the materials used in the processes of manufacture. Dr. Mason's glossary, all the more important articles of which are illustrated with excellent drawings, will do much to secure future accuracy of description and definition. Probably, for the present at least, his nomenclature will be accepted in describing the characteristics of the various groups of basketry among the lower races throughout the world.

THE National Museum of the United States has made a new departure in the formation of series of exhibits to illustrate the main religions of the world, a scheme which had its origin at the Chicago Exhibition of 1891. In pursuance of this idea, collections have been made to illustrate the ceremonies of the various Christian Churches, Brahmanism, and Buddhism. We have now, under the editorship of Messrs. C. Adler and I. M. Casanovich, a catalogue of a collection of Jewish ceremonial objects which is of considerable interest. It seems to be an amplification of a similar catalogue issued in 1901, which was confined to a collection of articles lent for exhibition by Hadji Ephraem Benguiat. It contains accounts, with good illustrations, of many curious and beautiful objects with which few but members of the Jewish community are familiar. Particularly deserving of notice are the veils of the Holy Ark, which are fine examples of embroidery; the mantles and wrappers of the Torah scrolls; some graceful hanging lamps; phylacteries and amulets; vessels used in the Passover service; implements employed in ritual, sacrifice, and circumcision. The collection, besides its ritualistic and artistic importance, possesses considerable interest for anthropologists.

THE publication of a new guide to the anthropological department at South Kensington, issued by the trustees of the British Museum, and sold at the modest price of 4*d*., throws an unpleasant light upon this series of exhibits. While the admirable new shilling guide to the Egyptian galleries occupies 325 pages, and contains 233 plates and other illustrations, thirty-one pages and sixteen photographs exhaust the anthropological series. Though not calculated to excite interest among those to whom the subject is unfamiliar, the guide, as might have been expected from the author, Mr. Lydekker, seems to be generally accurate. It is rather confusing, however, to divide the Dravidians of southern India into Telugus, Tamils, Malayalims, and so on, because these are linguistic, not ethnological, terms; and to speak of the first of these groups as if it were confined to the northern Circars is inaccurate. Possibly it is only from this corner of the tract occupied by the Telugu-speaking people that specimens are at present available. The inadequacy of the collections as they stand may be measured by the fact that while the attention of anthropologists has been in recent years attracted to the Pagan races of the Malay Peninsula by the great work of Mr. Skeat, they seem to be represented in the museum by a single photograph of a Sakai. When the Bureau of Ethnology gets to work these shortcomings in the national collection will doubtless be remedied; but in the meanwhile, Dr. Bowdler Sharpe is quite justified in remarking that in recent years the anthropological series has not increased so rapidly as is desirable, and in expressing a hope that the publication of this guide-book may stimulate public interest and induce British colonial officials and travellers to endeavour to supply the deficiencies in this important series.

THE Survey Department, Egypt, has issued its Meteorological Report for 1906, consisting, as before, of two parts:—(1) hourly observations and means for Helwan Observatory, to which the records of a self-registering electrograph are now added; (2) climatological, rainfall, and river-gauge observations at a large number of stations, with a chronicle of the chief weather conditions of each month. Rainfall at the Egyptian stations was in slight defect, but over the Sudan plains the excess was about 22 per cent. The Nile presented several features of interest during the year; these have been discussed by Captain Lyons in a separate publication.

THE *Annuario* of the Messina Observatory for 1907 has been received. We have previously directed attention to the useful work carried on by Prof. G. B. Rizzo and his small staff; meteorological observations made at several hours daily, with means and extremes, are given for the chief station, together with monthly and annual summaries for temperature, rainfall, &c., for a number of provincial stations. Particulars of earthquake phenomena registered at Messina and other places are also collected and discussed by Prof. Rizzo personally. In the year 1906 the director of the Potsdam magnetic observatory proposed to the Italian Government the establishment of a magnetic station in the south of Italy, as part of an international programme for the special study of that subject. For this purpose Messina has been selected as a suitable locality, thus making a useful addition to the study of terrestrial physics at the important observatory attached to the University of that city.

THE *Neue Denkschriften* of the Swiss Society of Natural Sciences, vol. xlii., contains a useful discussion of the climate of Davos by Dr. Hugo Bach. Observations were commenced by the society in 1867, but are not quite continuous; the station is situated in a broad valley, at an altitude of 5118 feet, and owing to its surroundings the climate is of a much more continental type than is usual at ordinary mountain stations. The most important factor is the low pressure, corresponding to the altitude, as it affects to a considerable extent the conditions of radiation and temperature. The difference of absolute humidity between Davos and the lowlands is very great, especially during winter, and under these conditions the readings of the solar radiation thermometer on bright January days often record a temperature considerably above 100°, while the screen thermometer reads below 14° F.; this fact is naturally of very great importance to invalids. The absolute range of shade temperature between 1867 and 1905 is given as 110° F., the extreme readings being 84°·4, in July, 1900, and −25°·6, in January, 1905. The average percentage of possible sunshine is given as:—winter, 53·9; spring, 50·7; summer, 54·2; autumn, 56·1. The average annual rainfall amounts to nearly 36 inches; the wettest months are from June to September.

AN account of the first portion of the work on the gas thermometer which has been in progress in the geophysical laboratory of the Carnegie Institution at Washington since 1904 under the charge of Messrs. Day and Clement appears in the November number of the *American Journal of Science*. The constant-volume nitrogen in platinum-iridium thermometer is used, and the range of the instrument has been increased by enclosing the bulb in a gas-tight bomb containing nitrogen at the same pressure as that in the bulb. The expansion of the material of the bulb was determined to within $\frac{1}{2}$ per cent., and the unheated space between the bulb and manometer reduced to about one-third of its least previous value. The authors give the following melting points as accurate to within half a degree:—zinc, 418°·5; silver, 958°·3; gold, 1059°·3; copper, 1081°·0 C.

THE important series of papers on fluorescence and phosphorescence which have appeared in the *Physical Review* during the last two years from the pens of Profs. Nicholls and Merritt have shown that the present theories of these and kindred phenomena are quite inadequate, and that Stokes's law that the wave-length of the light sent out by a fluorescent body was greater than that of the exciting radiation, is not correct. These facts have led Prof. de Kowalski to put forward in the October

number of the Bulletin of the Academy of Science of Cracow a theory which will at the least serve as a good working hypothesis. It is based on the corpuscular theory of matter, and assumes that amongst the systems of electrons which constitute the atoms and molecules, there are a number in a state such that a small increment of energy will render them unstable, and one or more electrons will be shot out of the system. These are in turn supposed to enter systems in which the electrons are capable of executing oscillations without becoming unstable. It is these electrons which give out the fluorescent light when the former systems are rendered unstable by the incidence of radiation on them. The author shows that this theory is in keeping with the known facts of fluorescence and phosphorescence.

MESSRS. LEITZ AND CO. have put on the market a universal projection apparatus designed in accordance with the suggestions of Prof. Kaiserling. We have examined this apparatus, and find it most complete. It is available for projection on the screen under a variety of conditions, viz. by transmitted light for both lantern and microscopical work, and by incident light for the projection of woodcuts and natural objects. The special feature of the design consists in the ease with which the change can be made from one mode of projection to another. For episcopic projection it is arranged that the object may either lie horizontally on the table or be in a vertical position. Thus, if it be desired to project on the screen part of a hospital patient, the subject is simply placed at the side so that the part in question may be illuminated by the lamp and completely reflected by the mirror. The electric lamp employed is one of the type which this firm is adapting to several purposes. The carbons are at right angles to one another, the positive one being horizontal and lying along the optic axis. With this arrangement the full crater becomes operative in producing useful light. The result is considerably greater efficiency, a power of 10,500 candles being obtainable with a current of 30 amperes. It is unnecessary to state that the optical part possesses the excellence of this firm's work. The lantern condenser is sufficiently large to illuminate a half-plate transparency, and the whole of it can be simultaneously projected on the screen. For microscopic projection both objectives and projection eye-pieces are quickly changed by revolving carriers. For the lower power objectives the entire field is in focus at once; it is only in the case of the difficult projection with 1/12th inch (oil immersion) that the peripheral regions are blurred. At present there is no polarising device, but this is under design. The entire apparatus stands inside a curtained frame, which prevents the escape of light into the room except through the lens. It stands on the floor, with the optic axis about 144 cm. from it.

HAZELL'S Annual for 1909 has been received. The volume includes much information of scientific interest, and is a valuable, concise record of progress in many departments of intellectual, industrial, and social activity.

MESSRS. SIEMENS BROTHERS AND CO., LTD., have issued a convenient self-opening pocket diary for 1909. In addition to the usual calendar notes and diary, the book contains useful tables and illustrations of various dynamos and other machines made by Messrs. Siemens.

IN an article in the Johns Hopkins Hospital Bulletin for November, Dr. Peyton Rous describes the course of physiological pathology which is given in the school of medicine of the University of Michigan. It extends over three hours a day during three weeks, and includes the pathology of vascular, cardiac, and respiratory disturbances.

THE fourth quarterly bulletin, for the year 1906–7, of the results obtained during the periodic cruises and in the intermediate periods, has been issued by the Conseil permanent international pour l'Exploration de la Mer. The bulletin deals with the following points:—condition of the atmosphere; the temperature and salinity of the surface water; the temperature, salinity, density, &c., of sea-water at different depths; oxygen, nitrogen, and carbon dioxide dissolved in sea-water; and plankton. The bulletin is published by Messrs. A. F. Høst and Son, of Copenhagen.

THE recent address delivered by Mr. Rudyard Kipling to the students of the medical school of the Middlesex Hospital, at the opening of the present session, has been published by Messrs. Macmillan and Co., Ltd., in the form of a booklet bound in limp cloth, at the price of 1*s.* net. The title of the little book is "Doctors," and, in addition to the address, the book contains as frontispiece a photograph of Mr. Kipling and a preface describing the work of the hospital, written by Mr. Reginald Lucas. We notice that the book is being sold for the benefit of the Middlesex Hospital.

THE 1909 number of "Whitaker's Almanac" is the forty-first annual issue. It is difficult to imagine what one would do without this indispensable book of reference, which has again increased in size and usefulness. Among new articles which have been included we notice those dealing with the navigation of the air and the radio-telegraphic convention, while the following interesting features will continue to appeal to students of science:—progress of astronomical science, the year's weather in the British Isles, the storms and floods of the year, and the earthquakes and volcanic eruptions, the year being in each case that ending on October 31, 1908.

OUR ASTRONOMICAL COLUMN.

MOREHOUSE'S COMET, 1908*c*.—A further discussion of the photographs of Morehouse's comet, taken at Juvisy, is published by M. Flammarion in the December number of the *Bulletin de la Société astronomique de France* (p. 513).

M. Flammarion reproduces further photographs, and shows that, while the main features of the tail are explicable by the Maxwell-Bartoli laws of light-pressure demonstrated experimentally by Lebedew, there are other features which point distinctly to the operation of other causes. For example, the photograph of October 15 shows the now well-known dislocation of the tail, at some distance from the head, which might be due to the interference of meteoritic matter. On the photograph of October 17, however, there is no definite dislocation, although there is distinct evidence that the tail, as a whole, suffered some retardation in respect to the motion of the nucleus. Several possible explanations are offered, with full reserve, for this phenomenon. One is that the æther may have a density which is not homogeneous; another is that the sun is constantly repelling matter into interplanetary space, and that this matter would retard the masses of tenuous vapours forming the tail of the comet. A third explanation is that most generally accepted, viz. that the retardations and dislocations are probably caused by the interference of masses of meteorites with which space is probably peopled.

A note in the same journal (p. 534) announces that MM. le Comte de la Baume Pluvinel and Baldet have, since the publication of their preliminary paper in the *Comptes rendus*, obtained many more photographs of the

spectrum of the comet, including some taken with a calcite-quartz spectrograph, which show new radiations and will enable better wave-length values to be determined; the conclusions published in the first note are to be looked upon as only provisional.

OBSERVATIONS OF THE SURFACES OF JUPITER'S PRINCIPAL SATELLITES AND OF TITAN.—During the 1907–8 opposition of Jupiter, M. J. Comas Solá continued his observations of the principal Jovian satellites, and now publishes his results, with drawings of J iii. and iv., in No. 4290 of the *Astronomische Nachrichten* (p. 290, December 11).

Satellite i. appears to be definitely ellipsoidal, the flattening amounting to as much as one-fifth of the major axis. The direction of the longest axis is not, according to M. Solá's observations, parallel to that of Jupiter's bands, but has a position-angle some 28° greater than that of the bands.

With most other observers, M. Solá finds that the second satellite always appears round.

The observations of J iii. are given in detail, and many features on the satellite's surface noted. Among these, white polar caps, varying in intensity and size from time to time, equatorial bands, and shadowy areas were observed, and, from the varying appearance of the latter, it would appear that the effects of the satellite's rotation were seen.

Satellite iv. presented no feature which could be seen definitely, with the exception of a very faint north polar cap on December 24, 1907, but several were suspected from time to time.

The observations of Titan indicate that this member of the Saturnian family has a more or less dense atmosphere, for the limbs were always dark and difficult to see, whilst towards the centre of the disc lighter patches were visible. The drawing for August 13, 1907, shows two of these patches having the appearance of a very diffuse double star.

CORRECTIONS OF THE POSITION AND DIAMETER OF MERCURY.—From observations of the contacts during the transit of Mercury on November 13–14, 1907, Prof. Stroobant has deduced corrections for the position and diameter of the planet, and publishes the results in part i., vol. xii., of the *Annales astronomiques de l'Observatoire royal de Belgique*.

The observations were made at thirty-three observatories in different localities in Europe, South Africa, and the United States, and their discussion leads to the following results:—Instead of the diameter being 6″·61, at unit distance, as usually accepted, it is 6″·16, and, consequently, the actual radius, taking the equatorial radius of the earth as 6378 km., is 2232 km. From this it follows that, as compared with that of the earth, the volume of Mercury is 0·043 instead of 0·052, whilst the density is 1·42 instead of 1·17, if the accepted value for the mass be retained. The corrections to the position of the planet in the equatorial coordinates are $\Delta\alpha = +0.066s$. and $\Delta\delta = -0''.22$, and in the ecliptic coordinates $+0''.97$ and $+0''.04$ in longitude and latitude respectively.

THE SOUTH POLAR CAP OF MARS.—Bulletin No. 35 of the Lowell Observatory contains Prof. Lowell's measures, made from drawings, of the size of the south polar cap of Mars between March 22 and November 13, 1907.

The tabulated results give the history of the cap for about eight of our months, from about its maximum to near its minimum area, and show that its size decreased regularly from about 0·388 of a hemisphere to 0·002.

THE "COMPANION TO THE OBSERVATORY."—This useful annual, published by Messrs. Taylor and Francis at 1*s.* 6*d.*, contains the usual data and ephemerides for the observations of the sun, planets, eclipses, satellites, variable and double stars, &c.

Mr. Denning has revised the meteor notes, Mr. Maw has supplied a number of observations of double stars, and M. Baillaud has furnished advance proofs of the *Annuaire du Bureau des Longitudes* from which the list of Algol variables has been copied.

A useful list of the standard times of various countries using the Greenwich meridian is given on p. 32, and from the table of the magnetic elements for Greenwich Observatory we see that the "inferred" values for 1909 are:—declination, 15° 50′ W.; horizontal force, 0·1854; dip, 66° 55′.

THE NIZAMIAH OBSERVATORY AT HAIDARABAD.—The establishment by his Highness the Nizam of Haidarabad of a well-equipped astronomical observatory in his dominions is referred to in the *Times* of December 17. The equipment includes, besides the purely astronomical and meteorological instruments, a very complete photographic department and extensive workshops fitted with modern tools and appliances for both wood and metal working.

PRIZE SUBJECTS PROPOSED BY THE FRENCH ACADEMY OF SCIENCES FOR THE YEAR 1910.

GEOMETRY.—The grand prize of the mathematical sciences (3000 francs). The problem of finding all the systems of two meromorphic functions in the plane of a complex variable and connected by an algebraic relation is known. The analogous question is suggested for a system of three uniform functions of two complex variables, having everywhere at a finite distance the character of a rational function and connected by an algebraic relation. In default of a complete solution of the problem, to indicate examples leading to classes of new transcendental functions. The Francœur prize (1000 francs), for work in pure or applied mathematics; the Poncelet prize (2000 francs), for a work on pure mathematics.

Mechanics.—A Montyon prize (700 francs), for inventing or improving instruments useful to the progress of agriculture, the mechanical arts, or sciences; the Fourneyron prize (1000 francs), for an experimental and theoretical study of the effects of shocks of a hydraulic ram in elastic tubes.

Navigation.—The extraordinary prize of 6000 francs, for work tending to increase the efficiency of the French naval forces; the Plumey prize (4000 francs), for improvements in steam engines or any other invention contributing to the progress of steam navigation.

Astronomy.—Pierre Guzman prize (100,000 francs), for the discovery of a means of communicating with any planet other than Mars, or, failing this, the interest will be awarded for work leading to progress in astronomy; the Lalande prize (540 francs); the Valz prize (460 francs); the Janssen prize, for an important progress in astronomical physics.

Geography.—The Tchihatchef prize (3000 francs), for Asiatic exploration; the Binoux prize (2000 francs), for work on geography or navigation; the Delalande-Guérineau prize (1000 francs); the Gay prize (1500 francs), for zoological and anthropological researches in South America, especially in the region of the Andes.

Physics.—The Hébert prize (1000 francs), for a discovery in electricity of practical or industrial use; the Hughes prize (2500 francs); the Kastner-Boursault prize (2000 francs), for the best work on the application of electricity in the arts, industry, or commerce.

Chemistry.—The Jecker prize (10,000 francs), for work in organic chemistry; the Cahours prize (3000 francs), for the encouragement of young chemists; Montyon prizes (unhealthy trades) (2500 francs and a mention of 1500 francs), for improving the hygienic conditions of an unhealthy trade or calling; the Berthelot prize (500 francs); the Alhumbert prize (1000 francs), for an experimental study of the electrical properties of the metallic alloys.

Mineralogy and Geology.—The Delesse prize (1400 francs).

Botany.—The Desmazières prize (1600 francs), for a memoir on cryptogams; the Montagne prize (1500 francs), for work on the anatomy, physiology, development, or description of the lower cryptogams; the de Coincy prize (900 francs), for a work on phanerogams; the de la Fons-Melicocq prize (900 francs), for a work dealing with the botany of the north of France; the Bordin prize (3000 francs), for a study of the origin, development, and disappearance of the transitory tissues which may enter at various periods into the structure of the vascular plant.

To determine, in each particular case, the ephemeral *rôle* of the tissue considered.

Anatomy and Zoology.—The Savigny prize (1500 francs), for the assistance of young travelling zoologists, not in receipt of Government assistance, and who specially occupy themselves with the invertebrate animals of Egypt and Syria; the Thore prize (200 francs), for the best work on the habits and anatomy of one species of European insect.

Medicine and Surgery.—A Montyon prize (2500 francs and mentions of 1500 francs), for a discovery useful in medicine; the Barbier prize (2000 francs), for a discovery of value to medical, surgical or pharmaceutical science, or botany in relation to medicine; the Bréant prize (100,000 francs), for the discovery of a cure for Asiatic cholera or the definite cause of this disease. If the prize is not awarded, the interest will be given for researches bearing on cholera or other epidemic disease. The Godard prize (1000 francs), for the best memoir on the anatomy, physiology, and pathology of the urinogenitary organs; the Baron Larrey prize (750 francs), for a work treating of military medicine, surgery, or hygiene; the Bellion prize (1400 francs); the Mège prize (10,000 francs); the Dusgate prize (2500 francs), for the best memoir on the diagnostic signs of death and on the best means of preventing premature burial.

Physiology.—A Montyon prize (750 francs), for a work on experimental physiology; the Philipeaux prize (900 francs), for the same; the Lallemand prize (1800 francs), for works relating to the nervous system; the Martin-Damourette prize (1400 francs), for a work on therapeutical physiology; the Pourat prize (1000 francs), for a memoir on the action exercised by the X-rays and the radium rays on the development and nutrition of living cells.

Statistics.—A Montyon prize (1000 francs, and a mention of 500 francs), for the most useful work dealing with statistics.

History of Science.—The Binoux prize (2000 francs).

General Prizes.—These include the Arago, Lavoisier, and Berthelot medals; the Gegner prize (3800 francs); the Lannelongue prize (2000 francs); the Trémont prize (1100 francs); the Wilde prizes (one of 4000 francs and two of 2000 francs), for discoveries in astronomy, physics, chemistry, mineralogy, geology, or experimental mechanics; the Lonchampt prize (4000 francs); the Saintour prize (3000 francs); the Victor Raulin prize (1500 francs), for a work on the meteorology and physics of the globe; the prize founded by Mme. la Marquise de Laplace; the Félix Rivot prize (2500 francs); the Leconte prize (50,000 francs), for important discoveries in mathematics, physics, chemistry, natural history, or medicine; the Houllevigue prize (5000 francs); the Caméré prize (4000 francs); the Jérome Ponti prize (3500 francs).

Of these, the Pierre Guzman, Lalande, Tchihatchef, Delesse, Desmazières, and Leconte prizes are expressly stated to be offered with preference of nationality.

CHEMICAL RESEARCH AT THE UNIVERSITY OF MANCHESTER.

THE chemical schools at the University of Manchester, probably already the largest in the kingdom, are being enlarged by the addition of a new block of buildings at a cost of about 20,000*l*. Already considerable progress has been made with the building operations, and it is hoped that the new block will be ready for opening in the early autumn of 1909. The chief addition will be a new large laboratory having accommodation for forty students, and fifteen smaller research laboratories.

The following description of the objects of the new buildings is taken from a recent interview with Prof. W. H. Perkin, published in the *Manchester Guardian*. He considers that the loss of the coal-tar industry to this country was due, not only to the manufacturers not realising the importance of employing chemists and carrying out research work, but also to the universities, which were very greatly to blame. Organic chemistry was hardly taught at our universities, and such laboratories as they possessed were poor and ill-equipped. As a consequence, if manufacturers did require chemists they could not obtain them. It was in 1874 that the original coal-tar colour works at Greenford Green, near Harrow, were sold. The reason for giving up the works was partly owing to the natural dislike for an industrial career of the late Sir William Perkin and his desire to devote himself entirely to research chemistry; but it was also because he recognised that the works could not be satisfactorily carried on and be able to compete successfully with the rising industry in Germany unless he took into the works a large number of research chemists, as the Germans had done. But although inquiries were made at many of the British universities in the hope of finding young men trained in methods of organic chemistry, such men were not forthcoming.

The older universities at that time scarcely recognised organic chemistry; it is doubtful whether they thoroughly appreciated chemistry at all. The newer universities, which at present are doing such good work and of which we are justly proud, had not come into existence. Prof. Perkin said he was strongly of the opinion that the manufacturer of organic products during 1870–1880 was, owing to this neglect of organic chemistry by our universities, placed in a very difficult and practically impossible position.

But, in the meantime, organic chemistry had taken root in Germany, and great schools devoted to this branch of chemical science had been founded. History tells us how the German manufacturers made use of the young chemists who had been trained in these laboratories. Consequently, the works in Germany increased in size and in number, and obtained the world's trade in organic chemicals. Had our universities at this time pursued the same principle, in all probability the coal-tar colour and allied industries would not have been lost; but now this state of things has changed, and "I am convinced that failure on the part of the manufacturers to develop any industry connected with organic chemistry is no longer due to the impossibility of obtaining the services of young chemists of ability."

The scheme which it is hoped to develop in connection with the Manchester Chemical School is laid on the lines which have been found so valuable abroad. Two lines of procedure are open to the manufacturer.

He may send his sons to the university, and as soon as they have passed through the honours B.Sc. course, and have thus received a thoroughly sound general training, they will be fit to engage in research work dealing with problems of a technical nature, either suggested by the university professors or by the manufacturers. Such a course, extending over two or more years, will be the best preparation for an industrial career.

Another way in which the manufacturers can be helped if they wish to solve a difficult problem or invent some new process is to place at their disposal one of the smaller research rooms. In this room his own research chemist from the works can, under the best conditions, investigate the problem, either alone or with assistance from the university staff. If he happens to have no research chemist available for the purpose, one of the university graduates can be engaged to work under the professor's superintendence.

The University will, however, not open its doors to do purely routine analysis, ordinary commercial work, or patent litigation. It lays itself out to train research chemists or help by research work, and in this direction alone.

WATERS AND GLACIERS.

UNDERGROUND waters play a considerable part in recent researches on French caves (*Spelunca*, tome vii., 1907–8, Nos. 47–52). M. Fournier's observations in the Jura (Nos. 47 and 50) are largely concerned with following out the courses of streams that are used for household purposes. He agrees with M. Martel that springs may be regarded with suspicion when their temperature varies by even 1° C. from that of water in the same region which is known to come from considerable depths. A number of caves in various levels of Jurassic limestone are drawn in plan and section, and the continuity of certain streams has been proved by the use

of fluorescein. As an example of the practical results of such researches, it may be mentioned that the village of Mouchard, on the west flank of the range, was found to be utilising an already contaminated water, which ran away out of the public fountain and reappeared as the main supply of Pagnoz, a hamlet on the Salins road. The author complains that it is hard to move local authorities; but, if Mouchard now becomes grateful, Pagnoz may be doubly so. Messrs. Albert and Alexandre Mary (No. 48) describe the artificial excavations in the chalk at Saint-Martin, Oise, and urge that the movement of water in chalk is controlled by fissures, which are in some cases fault-planes, and not by a general porosity of the rock. Where the chalk is fractured on a small scale, as in the Upper Senonian, owing to the yielding character of a particular series of beds, the water flows along the abundant and delicate crevices; where, however, there are only coarser joints, these become the prominent and effective water-ways (p. 13). The caverns in Oise may have been dug out by man as hiding places, but the fissures selected had previously been widened by natural waters. About the twelfth century they became used as quarries. This memoir by MM. Mary concludes with an account of the modifications that took place in certain plants removed by the authors from the outer air to the banks of one of the subterranean lakes. M. Ed. Rahir (No. 51) reports on caves in the Carboniferous Limestone of Belgium; and M. Paul Macey (No. 52) carries us away to Indo-China, and gives a spirited account of rivers that penetrate masses of limestone in the province of Cammon, of which he is Governor. His zeal for exploration is not more commendable than his regard for the religious feelings of his subjects. We wonder if all British cave-hunters would have sacrificed a pig and a few fowls before descending a haunted river in a collapsible bamboo canoe. The cheerful description of two days underground on this unknown water-way should satisfy even M. Martel, to whom it is presented. The tunnel of the Nam Hin-Boun, 4000 metres long, is, on the other hand, used as a high-way by the natives themselves when the river is low. The basin of Hang Nam-Thieng (vessel of holy water) reminds us of the miraculous stoup attached to an old church in Anglesey; it is about 15 centimetres in diameter, and re-fills itself up to a certain level after water is drawn from it. The French have again allowed the use of its water in ceremonial oaths, according to a practice that had fallen into disuse since the Siamese invasion of 1827.

The production of valleys and deltas has been studied artificially by Mr. T. A. Jaggar, jun. ("Experiments illustrating Erosion and Sedimentation," Bull. Museum of Comp. Zoology, Harvard, vol. xlix., 1908, p. 285). Various rock-powders are strewn over one another in layers, or slimes from a stamp-mill are deposited from water. The surface is then tilted at 20° and is subjected to a water-spray, furnished by a compression apparatus and an atomiser such as barbers use. Rill-systems arise on the slime-surface after one or two hours, and illustrations of river-capture (p. 299) occur among their details.

Mr. E. F. Pittman, Government geologist of New South Wales, in his Clark memorial lecture (Geol. Survey of New South Wales, Sydney, 1908), has reviewed the very important question of the artesian water-supply of Australia. He sees many reasons for opposing the view of Prof. J. W. Gregory, who has maintained that the water rises from plutonic depths under the influence of earth-pressure, and not as the result of hydrostatic flow in an artesian basin. Mr. Pittman believes that the rain-fall on the exposed edges of the sandstones in the Great Dividing Range in south-eastern Queensland and in the north of New South Wales is sufficient to account for the water stored in the artesian area. He agrees with Prof. J. W. Gregory in deprecating the waste of this water that is at present tolerated. In a coloured map he indicates the enormous area of the main basin, extending from the central part of the Darling River through Queensland to Cape York.

Passing to the solid form of water, the *Actes de la Société helvétique des Sciences naturelles*, for the ninetieth session at Fribourg, in 1907, contains much that is interesting in the study of glaciers. Prof. Mühlberg, of Aarau, reviews (p. 91) the state of Switzerland during the Ice age, which he properly regards as a world-wide phenomenon. He suggests (p. 94) that certain moraines in Alsace were recognised as the deposits of former glaciers so far back as the middle of the eighteenth century; but all that he really proves is that these ridges were called moraines by settlers from Switzerland. De Saussure tells us that this term, variously spelt in his day, originated in Savoy, where it was applied to any steeply sloping piece of hillside. Jean-Pierre Perraudin, the chamois-hunter of the Val de Bagne, seems still to hold his own as the first to realise that the Swiss glaciers were formerly of far greater extent. Prof. Jean Brunhes, curiously enough, emphasises the observations of Perraudin on glacial striæ in a paper on "Le Problème de l'Érosion et du Surcreusement glaciaire" (*ibid.*, p. 155). Prof. Brunhes seeks to show that there is little real distinction between geographical features that are claimed as of glacial origin and those produced by rivers. A main stream, he urges (p. 164), will cut down its bed below those of its tributaries, though the difference of level will diminish as the river-system grows older. We hardly follow him when he sees the U-form, commonly held to result from glacial action, repeated in the floor of the Colorado canyon; but he points out very usefully that the streams under the ice near each margin of a glacier often produce two parallel *surcreusements* of the valley-floor, with a glaciated rock-ridge between them (p. 166). This common phenomenon, which he illustrates by photographs, is very different from the trough-like form which the advocates of glacial erosion attribute to rapidly moving ice. While Prof. Brunhes believes that the subglacial water is the main agent in lowering the valley-floor, he shows how abrasion by ice may ultimately remove the central rib which characterises earlier stages of erosion. The two agents must be regarded as working together, and not in succession to one another, if we would correctly appreciate valley-forms.

The twelfth report of the Commission internationale des Glaciers, in which variations of glaciers are recorded from all parts of the world, appears in the second volume of the *Annales de Glaciologie* (1908), pp. 161–198. An abstract of this, by M. Forel, has been already reviewed in NATURE by Prof. Bonney (vol. lxxviii., p. 574). In *Naturen*, published in Bergen, vol. xxxii. (1908), p. 118, Herr J. Rekstad records both recessions and advances among Norwegian glaciers between 1900 and 1907. The cold summers of 1902, 1903, and 1904 are responsible for many advances and thickenings in the lower parts of the ice-streams, and the full results of that of 1907 have yet to manifest themselves.

Mr. H. H. Hayden's "Notes on Certain Glaciers in North-west Kashmir" (Records, Geol. Survey of India, vol. xxxv., 1907, part iii., p. 127) records the establishment of stations by which rates of movement may be determined. The Yengutsa Glacier has advanced about two miles since 1902, and has overwhelmed mills that then existed in a stream-cut stretching from its foot. The Hassanabad Glacier, on the evidence of competent native officials, advanced "about three years ago" six miles or more in two and a half months. It seems liable to extraordinarily rapid fluctuations, and is now said to be stationary. Clearly, accurate records will be of special interest in this case. Other glaciers in Kashmir show "steady secular retreat." One would like to learn if the local advances can be traced to exceptional snowfalls, or even to earthquakes, as in recent instances in Alaska. The great attraction of Mr. Hayden's paper lies in the superb photographic plates by which it is illustrated. That of the Hassanabad Glacier lying in its ravine is especially successful.

In the Bulletin of the American Geographical Society, vol. xxxix., March, 1907, Messrs. Tarr and Martin comment on Prof. Russell's conclusion that the Hubbard Glacier of Alaska has receded five miles since 1794. From their personal experiences in 1906, they hold that Malaspina's remarks on ice as an obstacle in the bay referred only to floating ice, and this seems confirmed by the evidence of the vegetation and by the occurrence of wave-cut shore-lines in the region which, according to Russell, would have been covered a century ago by glacier-ice.

Perhaps we may include in this notice Messrs.

Sheppard and Stather's account of a fine section made in England by the North-Eastern Railway Company in the glacial gravels of Holderness (Proc. Yorkshire Geol. Soc., vol. xvi., 1907, p. 171). A few molluscan species from the drifts are added by the authors to those already known; but the main interest lies in the bones of mammoth, bison, horse, walrus, &c., which are believed to have been pushed up inland from the beach by the encroaching ice-front. G. A. J. C.

THE TRANSVAAL AND INDIAN DEPARTMENTS OF AGRICULTURE.[1]

(1) THE annual report of the Transvaal Department of Agriculture recently to hand gives a vast amount of interesting information about the department and the work it is doing among the agricultural community of the Transvaal. The agricultural conditions at the time of its formation were about as bad as it was possible for them to be. Animal diseases were rife, and besides the ordinary diseases of the country a number of new ones had been introduced during the war. The harvests had been neglected, consequently there was a shortage of seed corn; indeed, some varieties were almost, if not quite, lost. The land was in the bad state into which it rapidly falls when neglected, and out of which it can only be brought by dint of much skilful labour. Only a strong agricultural department could have met the necessities of the case; a weak one might easily have done a great amount of harm.

The occasion was one when the ordinary British instinct would have been to send out a number of "practical" men to devise "practical" measures for coping with the various problems. Fortunately, the British instinct did not prevail; the various heads of departments were men of scientific training, who began by making a study on scientific lines of the conditions with which they had to deal. As might have been expected, the result has been eminently satisfactory. The Public Service Commission declared itself unable to suggest any alterations or improvements in the general plan, and even the commissioner who was appointed to go into the detailed workings only made a few minor alterations in the clerical staff; amid much retrenchment in other directions this department has been left practically untouched. To the director, Mr. F. B. Smith, belongs the credit of having boldly conceived the plan and vigorously executed it; to the scientific staff belongs the credit of having risen to the occasion, and, in the words of one of the Transvaal newspapers, "triumphantly vindicated the practical value of research work."

It is just this "triumphant" vindication that gives the department a world-wide, and not merely a local, importance. No one can read the report and the other publications of the department without being impressed with "the practical value of research work." The investigations of Dr. A. Theiler, of the veterinary bacteriological laboratory, afford admirable cases in point. A number of the animal diseases with which the country abounds have been studied; in many cases the particular organisms causing the diseases have been identified, and the method by which they are conveyed from animal to animal discovered. The knowledge thus gained has made it possible to devise means for controlling the disease. This year's experiments have dealt more particularly with *Piroplasma mutans*, an organism that had previously been confounded with the *Piroplasma begeminum* producing a South African redwater, and it is shown that the disease, sometimes contracted even after inoculation, and thought to be ordinary redwater, is really brought on by the newly discovered Piroplasma. "Horse sickness" and "biliary fever" in horses have also been investigated, and inoculation against the latter disease can now be satisfactorily performed, as also can inoculation against "blue tongue" in sheep. Great as is the immediate value of this kind of work, its future value is even greater; the Transvaal is essentially a stock-producing country, but stock cannot be raised in number until the diseases are more under control.

In the botanical section Mr. Burtt-Davy has been examining the native flora and more closely studying promising plants; the habits of troublesome weeds have also been investigated, and methods devised for their eradication. Satisfactory progress is also reported by the plant pathologist, Mr. Pole Evans. During the year 300 different kinds of fungi and plant diseases were dealt with, a large proportion of the latter being previously undescribed. Attention this year has been largely directed to bitter-pit in apples, a disease causing enormous loss to apple growers, on which a full report is promised at a later stage. Rusts affecting cereals and other economic Gramineæ have also been studied, and the "South African locust fungus" has been shown in its true light. Locusts are sometimes fatally attacked by a fungus, *Empusa Grylli*, Fres., and the Cape and Natal Governments cultivated and distributed what they thought was the fungus with the view of exterminating locusts. Mr. Pole Evans, however, found that the cultures were not Empusa at all; in fact, Empusa is a pure parasite which cannot be cultivated on artificial media, and is therefore of no practical value as an exterminating agent. On following the matter up, he found that Empusa had been the starting point in the Cape cultures, but the harmless *Mucor exitiosus* had appeared, and had been propagated and widely distributed under the impression that it was a destructive organism!

The working of the other sections—entomological, forestry, chemical, &c.—appears to be on equally sound lines, while the experimental farms have appealed strongly to the Boer farmer. At the Rand Agricultural Show the department's farms were very successful, both in the competitions and in their other exhibits.

Altogether the working of the department reflects great credit on all concerned, and affords abundant illustration of what science can do for agriculture.

(2) The history of the foundation of Pusa, the Indian agricultural experiment station, is too well known to need repetition here. The recently issued report shows the results already obtained, and indicates the broad lines on which work is to proceed; progress has been steady, and the character of the work promises well for the future of Indian agriculture.

Naturally we can only look for preliminary results at the present stage. Work at Pusa has hitherto gone on under a certain amount of difficulty. The buildings have not long been completed. The staff have had very little assistance; experienced natives to supervise field experiments and to give other help were not at first obtainable, and have had to be trained up. Some of the experimental plots were ruined by sudden floods, to which the estate is liable, owing to heavy, continuous rain. All this makes research work difficult, and the staff deserve high credit for having accomplished so much in these rather unfavourable circumstances.

Considerable attention has been devoted to the study of crops suited to Indian conditions—cotton, sugar-cane, jute, flax, tobacco, wheat, &c. The possibility of extending cotton cultivation in India is being carefully investigated, certain grants being made for the purpose by the British Cotton-growing Association; so far, the most hopeful line of development seems to be to make the best of the indigenous varieties rather than to introduce new and finer varieties. Serious attempts are also being made to strengthen the position of the indigo planter, and, in addition to the work being done by Mr. Bergtheil, a botanist has been engaged by the Planters' Association to improve the indigo plant by selection and breeding. The Indian wheats are being collected by Mr. Howard, and type-specimens separated from the mixed crop usually grown; these are described in a monograph, which will be awaited with considerable interest. Similar work on the native barleys and tobaccos is in hand. In all these cases cross-breeding, selection, and distribution of varieties true to type will follow.

The chemical department has, up to the present, been

[1] (1) Annual Report of the Transvaal Department of Agriculture, 1906–7 (received September, 1908). *The Transvaal Agricultural Journal*, vol. vi., 1908.

(2) Report of the Imperial Department of Agriculture for the Years 1905–6 and 1906–7. (Received October, 1908.)
The Agricultural Journal of India, vol. iii., 1908.
Memoirs of the Department of Agriculture in India.

largely occupied with miscellaneous analytical work, but chemists are now being appointed to each province, and Dr. Leather will be left free for research work. A pot-culture house has been built, and drain gauges made.

As might be expected, the mycologist, Dr. Butler, has a very large number of plant diseases to deal with, and the essential preliminary inquiries have been hampered by want of assistants and of a reference herbarium; these difficulties are being steadily overcome.

Mr. Maxwell Lefroy has already rendered considerable service to Indian agriculture by his entomological work; the life-histories of injurious insects are under investigation, and the insecticidal methods suggested have reached the stage of field trials.

The department issues two publications:—(1) the Agricultural Journal of India, a quarterly journal intended for the use of educated Indian agriculturists and general readers interested in agriculture; (2) the Scientific Memoirs of the Department of Agriculture in India.

The former must certainly rank among the most attractive agricultural journals published, if only for its beautifully illustrated descriptions of native husbandry; it also contains accounts, written for the practical man, of the experimental work done at Pusa and elsewhere. The Memoirs are the scientific papers by the members of the Pusa staff; they are widely distributed, and are readily obtainable on application. The system of publishing scientific work in this way has obvious disadvantages, but is said to involve less loss of time than if the papers were sent to a home journal. In most cases purely Indian problems are dealt with; we need only mention the Indian cottons (Gammie), Indian wheat rusts (Butler and Hayman), the composition of Indian rain and dew (Leather), of Indian oil seeds (Leather), Lefroy's papers on the tobacco caterpillar, the castor semi-looper, the rice-bug, and others. This is as it should be; general fundamental problems are best worked out here or in Europe or America, where the number of workers is greater and where it is easy to get into touch with those able to render useful assistance. E. J. RUSSELL.

WHO BUILT THE BRITISH STONE CIRCLES?[1]

STONE circles are prehistoric monuments of a kind which must be familiar to everybody who has seen Stonehenge or any of the other numerous examples to be found in the British Isles. They are to be found chiefly in Great Britain. I believe there are few, if any, examples in Ireland; but a complete chart showing the distribution of stone circles has yet to be made.

The genuine stone circle apparently occurs only in the British Isles. Most, if not all, of the circles found in other countries are merely "retaining walls" left after the tumulus which they retained had been removed. Avenues and dolmens, which are found associated with stone circles in Britain, also occur in other countries. The dolmens especially are widely distributed, generally near the sea coast of the Mediterranean, in the west of France, in the north of Germany, in Denmark and Scandinavia, and in the British Isles.

It would appear, therefore, that the stone circle was an improvement on the dolmen and avenue, not introduced from abroad, but invented in the British Isles.

The stone circles of Britain vary somewhat in the details of their structure. Mr. Lewis divides them into three classes:—

(1) The Dartmoor type, which is found mostly in Cornwall and Devon, and consists of a single circle.

(2) The Aberdeenshire type, of which the distinguishing feature is the large recumbent stone placed between two of the upright stones in the southern part of the circle.

(3) The Inverness type, of which the distinguishing feature is a large domed chamber with an alley leading thereto, covered by a cairn, with entrances towards the south. When the cairn is removed the foundations show three concentric circles.

[1] Paper by Mr. J. Gray read before Section H of the British Association at the Dublin meeting, September, 1908.

These modifications appear to be due to idiosyncrasies of different tribes of the same race. The type is simplest in Devon and Cornwall, and increases in complexity and elaboration in the Aberdeen and Inverness types.

The Distribution of Stone Circles in Britain.

Stone circles do not appear to occur in the eastern counties of England, nor in the north-western counties of the mainland of Scotland. They are found in the greatest number in Cornwall, Devon, South Wales, Shropshire, North Wales, Derbyshire, Cumberland, Wigton, Kirkcudbright, and Dumfries, Arran, Perth, Aberdeenshire, Inverness, Orkney, and Lewis.

Their distribution would be simply explained if we assume that the race who built them first settled in Cornwall and Devon, then migrated up through Wales and Lancashire into south-west Scotland. From thence they passed north to the mouth of the Clyde, crossed through the midlands of Scotland to the mouth of the Tay, whence they moved along the east coast through east Aberdeenshire, then west to Inverness, and after that north through Caithness to the Orkney Isles, the migration finally coming to an end in the Isle of Lewis.

That the direction of the migration was from south to north is supported by the fact that the structure of the circle becomes more elaborate as we move northwards.

Associated Place-names.

If these stone circles in Britain have all been erected by the same race, one would expect to find some common root in the oldest place-names within the stone-circle area. The river names usually are the oldest place-names, and in Britain, at least, they appear to be derived from the names of tribes, who at some very ancient time settled on their banks. According to Ptolemy's geography, the district now covered by Cornwall and Devon was inhabited during the Roman occupation by a tribe called the *Dumnoni*. There can be little doubt that this tribal name, by a process of phonetic decay, has been transformed into the modern name of *Devon*. If confirmation be required of this, it may be pointed out that a tribe also named *Dumnoni* is mentioned by Ptolemy as occupying the midlands of Scotland, and that they have left the same phonetic transformation of their name in the River Devon, a tributary of the Forth flowing through Perth, Kinross, and Clackmannan.

There are four rivers Dee within the stone-circle area and none outside. Now it is clear from Ptolemy's geography that the primitive form of *Dee* was *Deva*, so that Dee is from the same root as Devon. The following is a list of names of rivers within the stone-circle area, which apparently are phonetic modifications of the same root:—Tamar, Taw, Severn, Taff, Teifi, Dovey, Dee (North Wales), Dove, Tame, Dee (affluent of Lune), Devon (Perth), Tay (ancient Tavus), Dee (Aberdeen), Deveron.

There are only very few of these river names outside the circle area, as Thames, Teviot, Tweed.

The stone-circle race from Cornwall to Aberdeen appears to have had one common tribal name, "Devonian," or some phonetic equivalent of that name. No doubt they had other tribal names, but I do not propose to venture further in this direction at present.

Anatomical Characters of the Race with which Stone Circles are Associated.

I consider that a far more trustworthy guide than philology to the affinities and origin of a race is to be found in the analysis of measurements of its anatomical characters. This assumes, of course, that the average physical characters of a race will remain practically identical for vast periods of time if there is no great change in the racial environment. For example, the dimensions of the pre-dynastic Nagada skulls (measured by Miss Fawcett) have been found to be practically the same as those of the modern Egyptians living in the same district (measured by Dr. C. S. Myers). This means a permanency of average dimensions extending over 8000 to 10,000 years.

A change of environment (even though it is considerable) must, I believe, act for a very long period on a race before it perceptibly changes its racial characters.

At least, I know of no trustworthy evidence of the physical characters of a race being rapidly changed by its environment, except in modern industrial towns like Glasgow, and such rapid changes in the environment as have been produced by modern industrial development did not occur in the prehistoric times with which this investigation deals.

Assuming, therefore, this principle of the permanency of the average dimensions of a race, I proceed to inquire whether there is any special physical type of man associated with the British stone circles, and to determine, so far as is possible with the material available for comparison, the affinities and origin of this race.

In applying this method of anthropometrical analysis, it should be remembered that a significant difference between two groups of men in a single dimension proves that they cannot possibly belong to the same race. It does not, however, follow with the same degree of certainty that, if there is no significant difference between one or two dimensions, that the races are necessarily the same, but identity is the most reasonable assumption.

In one of the districts in which stone circles are most numerous, namely, in east Aberdeenshire, a very unique type of man has been found in short cists, associated with a special kind of pottery, namely, the "drinking vessel" which Mr. Abercromby has shown to belong to the transition period between the Neolithic and the Bronze age.

The average cephalic index of ten adult male skulls of this short-cist race, measured by Dr. Low, is 85·2, the average stature is 5 feet 3 inches, the average length of head is 181·1 mm., and the average breadth of head is 154·4.

Now the remarkable characteristic of this short-cist race is that its physical dimensions differ significantly from all the other groups of prehistoric races of Britain that have as yet been measured.

It differs enormously from the Neolithic race which preceded it. Of these we have two groups, one measured by Thurnam and Davis, having an average cephalic index of 71·9, and the other by Schuster, having an average cephalic index of 74·7.

Those who believe that the environment was capable of changing a race with an average index of 74 into a race with an average index of 85 must show that the Neolithic race was transported into an environment which is known, or at least surmised, to be capable of producing broad heads from long heads. It has been surmised that a mountainous environment has this effect, because we generally find broad heads inhabiting the great mountainous regions of Asia and Europe; but we find our short-cist broad heads in Britain, not generally in the mountainous regions, but in the lowlands lying adjacent to the sea coast.

There is no escaping the conclusion, therefore, that the short-cist brachycephals could not possibly have been evolved from the dolichocephalic Neolithic inhabitants of Britain.

There are, however, some prehistoric races in Britain that come much closer to the short-cist men than the Neolithic race.

The Bronze-age men of the round barrows have an average index of 79·3 according to Thurnam and Davis's measurements; another group from the east Yorkshire barrows, measured by Dr. Wright, give an average index of 77·3; and a third group, measured by Schuster, give an average index of 76·8.

Taking Thurnam and Davis's group as being nearest to the short-cist group, I find, on making the necessary statistical calculations, that the odds against short-cist men being a random sample of the round-barrow men are more than 25,000 to 1.

All the other prehistoric British groups, such as the Anglo-Saxon or Iron-age groups measured by Myers and Smith, are much further removed than the round-barrow men, so that there can be no question about these belonging to an entirely different race.

The modern Scotch skulls, taken principally from graveyards in the eastern counties of Scotland, and measured by Sir William Turner, evidently belong to much the same type as the round-barrow men, and are undoubtedly of different race from the short-cist men. The mediæval Kentish skulls at Hythe, measured by Dr. Parsons, though apparently belonging to a type not hitherto investigated, and having an average index of 79·3, nevertheless differ widely in their absolute dimensions, more especially in their breadth, from the short-cist skulls.

There is only one small group of five skulls found in Glamorganshire, and measured by Prof. Hepburn, which does not differ significantly in some one dimension from the Aberdeenshire short-cist skulls; and this group evidently belongs to the same race, and was found in a stone-circle district, two stone circles in this district being described in "Archæol. Cambr.," vol. v., 6th series.

Here, then, we have a race differing from all known racial groups, prehistoric or modern, in Britain. In Aberdeenshire and South Wales it is found closely associated with stone circles. No other prehistoric race, at least in the Aberdeenshire area, has been found associated with these circles.

The conclusion seems inevitable that the British stone circles were invented and built by a hyperbrachycephalic race of short stature which came from abroad, and apparently settled first, in the early Bronze age, in the district now known as Cornwall and Devon. From thence they migrated through Wales to Scotland by the route already described.

The Affinities and Origin of the Short-cist Race.

Since we can find no affinities to the short-cist race in Britain, we must examine the physical characters of the prehistoric races of the countries from whence migrations into Britain might be supposed to have come.

In Sweden, all the prehistoric races of the Stone, Bronze, and Iron ages have been measured by Retzius, and have average indexes, respectively, of 75, 74·1, and 70. There can be absolutely no affinity between them and the short-cist men. In Denmark, on the west coast, we have the Borreby type, which closely resembles our round-barrow men, but differs significantly from the short-cist men.

The most hopeful comparison appeared to be with the short, brachycephalic race in Switzerland, known as the "Disentis" type. This, according to His and Rütimeyer's measurements, has an average index of 86·5, but when the absolute dimensions are taken into consideration and the necessary statistical calculations have been made, I find that the odds against the short-cist men belonging to this type are more than 6000 to 1.

There appears to be no other likely race in Europe that could have sent, in the Bronze age, emigrants of the short-cist type to Britain.

We must look, therefore, to Asia, the habitat *par excellence* of brachycephalic man; and Asia Minor is undoubtedly the most likely starting point, at least for a seafaring race.

We have, unfortunately, no measurements of the prehistoric races of Asia Minor, but all authorities appear to be agreed that certain races who were the pioneers of civilisation in the East were brachycephalic, and apparently also of short stature. These brachycephalic races were known by various names, namely, Akkadians, Sumerians, Kassites, Khetan, and Hittites.

We have not the data absolutely to prove that this Turanian race of Mesopotamia and Asia Minor was identical with our short-cist race, but if we fail to find the mother race in Asia Minor we shall have to go much further afield.

There is one small item of positive evidence. The modern Chinese are said to be descended from the Akkadians, and of any type that has been investigated the modern Chinese skull most resembles in size and shape the short-cist skull.

If we should ever find a sufficient number of Akkadian or Hittite skulls to establish their physical type, the question would be settled. In the meantime, the physical evidence, so far as it goes, appears to me to be strongly in favour of the view that our short-cist men were a colony of Akkadians, Sumerians, or Hittites, who migrated to England by sea about 2000 B.C., probably in order to work the Cornish tin mines and the Welsh copper mines.

The Akkadians, according to Conder, in his recent book

on "The Rise of Man," were, in 2800 B.C., able to coast round Arabia and up the Red Sea to Suez. Why should they not be able a few hundred years later to coast round Africa and Spain and up the Atlantic to Britain?

In 2800 B.C., according to the same authority, the Akkadians were acquainted with silver, gold, bronze, and copper.

One of the most recent theories of the stone circles—that of Sir Norman Lockyer—is that they were astronomical observatories, by means of which the ancient priests made observations of the sun and stars, and were thereby able to regulate the calendar, to foretell and prepare for the festival seasons of the year, and to tell the time at night.

This theory is in remarkable agreement with the anthropometrical conclusions which I have just submitted to you, for the Akkadians were apparently the first inventors of astronomy. Gudea, the Akkadian prince, who lived about 2800 B.C., has left a stepped pyramid with an observatory on the top. The Akkadians were the astronomical race at the dawn of civilisation, and apparently the ideas of an astronomical race have been embodied in our British stone circles.

THE BRITISH ORNITHOLOGISTS' UNION.

THE British Ornithologists' Union celebrated its fiftieth anniversary in the rooms of the Zoological Society on Wednesday, December 9. A special meeting was called for the occasion, the president of the union, Dr. F. D. Godman, F.R.S., occupying the chair, and reading an address on the history of the union from its foundation. The idea of forming this society was due, he remarked, to the late Prof. Newton, and was first mooted in his rooms at Cambridge during 1858; but it appears finally to have taken shape when, in the following year, at the meeting of the British Association at Leeds, the opportunity was seized of calling together a number of the ornithologists there assembled. The details of the constitution of the union appear to have been then discussed, and a few months later took their final shape. Limited for the first few years of its existence to twenty members, it was at last found expedient to remove this restriction. To-day more than four hundred members are on the roll. From the first it was decided to start a journal, and the name chosen for this was that of the sacred bird of Egypt, the *Ibis*. The history of the birth and growth of this now celebrated journal was traced later by Dr. Sclater, its first and present editor. After the addresses by the president and Dr. Sclater, gold medals were presented to the four survivors of the original founders, Dr. Godman, Mr. Percy Godman, Dr. Sclater, and Mr. W. H. Hudleston. This pleasant ceremony was followed by an appeal to the members from Mr. Ogilvie Grant, of the British Museum (Natural History), wherein he urged that the union should commemorate its jubilee by sending an expedition to explore the Charles Louis Mountains of New Guinea, probably one of the richest unexplored zoological regions of the world, and this was unanimously agreed upon. The union, of course, could not find the whole of the money necessary for such an undertaking, but a considerable sum has been promised by others interested in this work. The meeting was brought to a conclusion by a dinner held at the Trocadero Restaurant, after which Mr. Boyd Alexander gave a lecture on his recent journey across Africa, and this was followed by a kinematograph exhibition of pictures of bird life.

At a special general meeting, held in the same week, the union considered the report of a committee on a motion brought forward by Mr. H. F. Witherby at the last annual meeting. It was then proposed that the taking or killing of certain birds, or the taking of any egg of certain birds, or the purchase of any such egg knowing it to have been taken in the British Islands by any member of the union, should involve the removal of his name from the list of members. The prohibition with regard to birds was to apply all the year round to the bearded-top golden oriole, hoopoe, marsh harrier, hen harrier, Montagu's harrier, common buzzard, golden eagle, white-tailed eagle, kite, hobby, osprey, common bittern, spoonbill, Kentish plover, avocet, and chough. To the crested tit, snow-bunting, grey-leg goose, dotterel, red-necked phalarope, ruff, whimbrel, black tern, Sandwich tern, roseate tern, great skua, black-throated diver, red-throated diver, and greenshank it was only to apply for the breeding season, but it was to be in force for the eggs of any of the species named. After discussion, it was agreed that if in the opinion of the committee any member shall have personally assisted in or connived at the capture or destruction of any bird, nest, or eggs in the British Isles, by purchase or otherwise, likely in the opinion of the committee to lead to the extermination or serious diminution of that species as a British bird, steps shall be taken, after due inquiry, to remove the offender's name from the list of members.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

THE Most Rev. Dr. Walsh, Roman Catholic Archbishop of Dublin, has been elected Chancellor of the new National University of Ireland.

THE Berlin correspondent of the *Daily Chronicle* announces that Prof. Ernst Haeckel, professor of zoology at the University of Jena, is about to retire into private life after forty-eight years' professorial activity. He will be succeeded by Prof. L. Plate, professor of zoology in the Berlin Agricultural High School.

UNIVERSITY COLLEGE, Reading, has issued a special list of courses in poultry keeping to be given there, with practical training at the college poultry farm, Theale, inclusive of theoretical and practical teaching in this subject. Additional lectures are given by members of the staff on zoology, soils, manures and pastures, chemistry of foods, and bookkeeping.

THE current number of the *Empire Review* includes an article on the Imperial College of Science and Technology by Dr. Henry T. Bovey, F.R.S., the rector of the college. After giving a brief historical *résumé* of the growth of the Royal College of Science, the Royal School of Mines, and the Central Technical College, Dr. Bovey explains the work of the Departmental Committee appointed by the Board of Education in 1904, the issue of the charter of July 8, 1907, creating the Imperial College, and the constitution of the governing body. The aims and objects of the new college are then dealt with, and in this part of his article the rector follows very closely the able address he delivered to the students at the opening of the session last October, which was published in full in our issue for October 15 last (vol. lxxviii., p. 613).

THE Department of Agriculture and Technical Instruction for Ireland has arrived at an agreement with the Commissioners of National Education in Ireland for providing means for the training of national-school teachers in elementary experimental science and domestic economy as part of local schemes of technical instruction. The Commissioners are prepared to recognise teachers, who hold certificates of satisfactory attendance at classes approved by the Department, as qualified to give instruction in the subjects named. The Department has circulated copies of the regulations which will govern the classes to be inaugurated and syllabuses of courses of instruction in both subjects. Each course extends over three years, is well graduated, and skilfully adapted to the needs of teachers in elementary schools. The third year's course in elementary experimental science provides instruction in rural economy, and it is so framed that in a few years' time Ireland should possess elementary-school teachers able and desirous of basing the science teaching of country schools upon the everyday surroundings and experiences of the children.

THE annual prize distribution at the Sir John Cass Technical Institute was held on Wednesday, December 16, when the chair was taken by Sir Owen Roberts, chairman of the governing body. The prizes were distributed by Mr. Lewis F. Day, after delivering an address, in which he dealt with the mutual dependence of design in art and craft work and their relation to trade, and concluded with

a statement of his views as to the aim and end of technical training. Mr. Day pointed out the value of the association of the work of the science side of the institute with the study of the artistic crafts and with the bearing of science upon design. It was, in his opinion, of great value to develop so far as possible a more intimate association than ordinarily exists between different branches of teaching, so as to familiarise the craftsman with the methods, the aims, and the applications of science. Previous to the distribution of the prizes, Mr. George Baker, chairman of the institute committee, in reporting on the work of the past session, referred to the fact that the prizes that had recently been presented to the institute by the Goldsmiths' Company for the department of metallurgy had been awarded for the first time. The first of these prizes was given for the best piece of research work carried on in the department of metallurgy during the past session, and he recorded with great interest that three very satisfactory investigations had been done during that period.

THE issue of the *Oxford and Cambridge Review* for the Michaelmas term contains an unusually large number of articles dealing with subjects connected with higher education. Dr. F. C. S. Schiller discusses exhaustively the whole question of scholarships at the public schools and the universities under the title of "Eugenical Scholarships." The particular title adopted is justified, because the thorough examination of recent proposals to restrict public scholarships to the children of poor parents leads up to a consideration of the matter from the point of view of eugenics. Intelligence and ability, says Dr. Schiller, are hereditary; the probability of getting able children is vastly greater if they spring from able parents; intelligence and ability lead to success among professional men; for men so situated the institution of scholarships is simply invaluable, since it acts as a great eugenical inducement, and is calculated to augment the supply of valuable citizens. Mr. R. J. MacKenzie, late rector of Edinburgh Academy, in an article on school examinations, points out how the multiplicity of examining bodies all examining for similar purposes leads to waste of time, money, and energy in secondary schools, and pleads for a universal "secondary-schools' leaving examination" for England and Scotland. The same issue of the *Review* contains an essay entitled "The Idealistic Interpretation of Prof. Ostwald's Theory of Energy," by Mr. J. Butler Burke, and articles on other educational matters.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, June 25.—"Dichloro-urea." By Dr. F. D. **Chattaway**, F.R.S.

There is probably no substance among the almost bewildering number known to chemists which surpasses urea in interest, or which has been more frequently and carefully investigated. It has been so much studied from almost every point of view that a new simple derivative was scarcely to be expected. Such a new simple derivative is, however, found in the recently discovered chlorine substitution product.

This is produced when chlorine is passed into a cooled saturated aqueous solution of urea. Action takes place without any considerable development of heat, and a compound crystallises out in which two of the four hydrogen atoms of the parent substance are replaced by halogen. Dichloro-urea obtained thus is a soft, white crystalline powder, consisting of thin transparent plates, which can be preserved for a considerable time in a dry atmosphere, although, as might be expected, it is not very stable.

Having regard to its composition and mode of formation, as well as to the structure of urea itself, its constitution must be represented by the formula

$$\mathrm{Cl{>}N{-}CO{-}N{<}Cl}$$

which explains its formation and such of its reactions as have yet been studied. From this structure, and the fact that heat is absorbed when it is formed, it might be expected to be highly explosive. When heated, however, it does not itself explode, but decomposes at about 83° C. with liberation of the vapour of nitrogen chloride. The latter, if it is not allowed to escape, and if the temperature is raised a few degrees higher, detonates with great violence.

Dichloro-urea is a compound of a marked acid character; it has a sour taste, recalling that of hypochlorous acid, and its aqueous solution strongly reddens litmus paper, which only becomes bleached after the lapse of some minutes. It acts very corrosively upon the skin, staining it yellow and destroying the tissues, and gives all the reactions characteristic of compounds in which chlorine is directly attached to trivalent nitrogen. It is distinguished from most other substances belonging to this class of compounds by the readiness with which it is hydrolysed, nitrogen chloride, carbon dioxide, a little nitrogen, and ammonium chloride being produced.

Dichloro-urea is instantaneously decomposed by a solution of caustic potash, two-thirds of the contained nitrogen being liberated as gas with violent effervescence, while the remaining one-third appears as ammonia, which, together with the alkaline carbonate also formed, remains dissolved in the liquid.

This behaviour of dichloro-urea gives an insight into the course of the reaction which occurs when urea is decomposed by an excess either of alkaline hypochlorite or hypobromite. This decomposition, which has received an extraordinary amount of attention, as it furnishes a quick, though not very accurate, method of estimating the quantity of urea present in a liquid, has never been properly explained, and is generally represented by an equation which makes it appear to be a case of oxidation. Dichloro- or dibromo-urea or some analogous compound is without doubt formed as an intermediate product, the action being thus one of halogen substitution followed by decomposition of the substituted urea by the excess of alkali present.

It may be noted that dichloro-urea is safe to handle, and promises to be of considerable use as a synthetic agent.

Royal Astronomical Society, December 11.—Mr. H. F. Newall, F.R.S., president, in the chair.—The determination of the apparent diameter of a fixed star: Major P. A. **MacMahon**. But little certainty is to be attached to existing estimates of the diameters of fixed stars, and a direct method, independent of the star's parallax, is much to be desired. The author proposed to apply the principle of the bioscope to the photography of occultations of stars by the moon. It was shown that a star might have an apparent diameter of 1/1000th of a second, and that the time taken by the moon to occult a fairly bright star might give an approximate measure of such a diameter. Prof. Dyson said he entirely agreed with the principle of Major MacMahon's method, and hoped that results might be obtained in the case of bright stars occulted by the dark limb of the moon. It would be necessary to employ a reflecting telescope of large aperture, and extremely sensitive plates.—The **Astronomer Royal** showed further photographs of comet *c* 1908, Morehouse, in continuation of the series exhibited at the last meeting, carrying the record to November 25, after which the moon interfered, and the comet got too low. The structure of the tail still showed detail of great interest, including the apparent dark rifts, though the cyclical changes seen in September and October did not appear to continue. A further series of photographs of the comet, taken by Prof. Barnard at the Yerkes Observatory from October 16 to November 19, was also shown.—The comet of 1556: its possible breaking up by an unknown planet into three parts, seen in 1843, 1880, and 1882: Prof. George **Forbes**. The three latter comets formed a group, closely related to each other, and the author gave his reasons for considering that the disruption of the comet of 1556 occurred through the influence of an ultra-Neptunian planet, which his calculations showed to exist at a mean distance from the sun of about 100 celestial units, with a period of about 1000 years and an inclination to the ecliptic of about fifty degrees. Some search had been made for the supposed planet, but only in the region of the Zodiac, so it was not surprising that the results had been negative.—An

improved telescope triple object-glass: J. W. **Gifford.** The method and formulæ for figuring and testing were described and illustrated.

Royal Meteorological Society, December 16.—Dr. H. R. Mill, president, in the chair.—Some forms of scientific kites: Eric S. **Bruce.** Some forms of scientific kites were described other than the well-known box-kite invented by Mr. Hargrave. This is heavier and more breakable than many other forms of kites, but it possesses the indisputable advantages of stability, ascending steeply and exerting great force. When there is wind enough to fly it, it would appear unsurpassed. It is, however, advisable that meteorological kite ascents should be carried out as continuously as is possible, and that as many as possible of those days when the heavier box-kite will not rise should be utilised for obtaining information. On this account Mr. Bruce considers that lighter forms of kites, which are specially adapted for use in very light winds, would be of great service. He then described the Brogden six-winged bird-kite, the Salmon eighteen-winged kite, the Barclay honeycombed-kite, the Cody bat-winged box-kite, the Balston butterfly-kite, and the Burgoyne aluminium kite.—The registering balloon ascents in the British Isles, July 27 to August 1, 1908: C. J. P. **Cave.** These ascents were made in connection with the extended series of ascents of kites and balloons arranged by the International Commission for Scientific Aëronautics. Some of the records show considerable differences of temperature between the up and the down traces, which seems to indicate that fairly rapid fluctuations of temperature may occur in the upper air. The average height reached was 10·2 miles, the greatest height being 14·3 miles. All the balloons except one reached the isothermal layer, and show that the diminution of temperature with height ceases after a certain point, or that there is a rise of temperature; the rise of temperature is quite marked, even in the case of balloons which have attained their highest point after sunset, and cannot, therefore, be the effect of solar radiation.—Balloon observations at Ditcham Park, near Petersfield, July 27 to August 2, 1908: C. J. P. **Cave.** The registering balloons which were sent up were followed by means of theodolites for the determination of wind velocities at different heights. The balloons were observed until after they had entered the isothermal layer, and in each case there was a well-marked diminution of wind velocity at its lower limit.

DUBLIN.

Royal Irish Academy, December 14.—Dr. F. A. Tarleton, president, in the chair.—Extensions of Fourier's and the Bessel-Fourier integral theorems: Prof. W. McF. **Orr.** Hankel's fundamental equation is obtained with an extension to functions of any order, real or complex; the parameter is regarded as complex, the ordinary line integral from zero to infinity being replaced by one taken along a contour in which the limits of the parameter are a positive and a negative infinity. This is done by first obtaining equivalent equations in the K functions, the contour being deformed into one everywhere at infinity; along this each function may be replaced by the dominant term in its asymptotic expansion, and when this is done the required results follow by Fourier's integral theorem. Precisely similar theorems are obtained in which the Bessel functions are replaced by their derivatives of any, but the same, order. Expansions are obtained suitable for the discussion of vibratory motion in the space outside a sphere or an infinite cylinder; for example, an arbitrary function of r is expressed, for values $>a$, by an integral the element of which is a multiple of

$$\{J_n(\lambda r)J_{-n}(\lambda a) - J_{-n}(\lambda r)J_n(\lambda a)\}d\lambda.$$

The author believes that the investigations are valid for functions which satisfy Dirichlet's conditions, and for no others.

NEW SOUTH WALES.

Royal Society, October 7.—Mr. W. M. Hamlet, president, in the chair.—The influence of infantile mortality on birth-rate: G. H. **Knibbs.** It is shown from the statistics of all countries furnishing accurate statistics that:—(1) For any one country uniform increments to the rate of infantile mortality tend to produce uniform increments in the birth-rate; that is to say, the birth-rate β_0, which would correspond to an absence of infantile mortality, is given by the equation $\beta_0 = \beta - b\mu$, where β is the actual birth-rate, μ the rate of infantile mortality, and b a constant peculiar to each community or country. (2) The coefficient showing the influence of infantile mortality on the birth-rate as actually deduced is in all cases very small. (3) No general law exists for the world as a whole. (4) The constant b does not appear to be influenced by the magnitude of the birth-rate itself, since it is approximately the same for a country with a low birth-rate (such as France) and a high birth-rate (such as the Netherlands). (5) That the *a priori* tendency of increase of birth-rate through increased rate of infantile mortality may be masked by other influences.

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