THURSDAY, APRIL 27, 1911.

A NEW CATALOGUE OF BRITISH BIRDS.

A List of British Birds, showing at a Glance the Exact Status of Each Species. Revised to August, 1910. By W. R. Ogilvie-Grant. Pp. 60. (London: Witherby and Co., 1909.) Price 1*s.* 6*d.*

THE old *order* changeth giving place to new, is true with a vengeance concerning lists of British birds, but there really does not seem to be any good reason for the changes. As all linear arrangements of birds must be unsatisfactory, why should we be annoyed with new anomalies of this kind, and constant changes in the arrangement and order of sequence of our birds in what ought to be works of reference? As if it really made any difference which comes first and comes last in the book! What the reader and student really does want to know is, whether he is to open the new book at the beginning or at the end to find, say, a crow or a duck, as the case may be. Unfortunately this is just what he cannot now know. We had become used to the change from the old arrangement which placed the birds of prey at the head, and had accepted that which began with the highly organised song-birds, but were not allowed to rest there. In the latest list now before us we begin with the game-birds (with which Seebohm ended), and end with the crows (which Sharpe put first)! And so on, and so on through all the miserable, useless changes.

The new list is printed in such a form that it can be cut up and used for labelling collections. The system adopted to indicate the status of each species is to assign each, by the use of numbered columns, to one of these five groups:—(1) Resident, breeds; (2) regular summer visitor, breeds; (3) regular autumn, winter, or spring visitor, does not breed; (4) occasional visitor, used to breed; (5) occasional visitor, never known to breed. When species have not occurred more than six times references are given to the works in which they have been recorded. But these are not, except in a few cases, to the original records. Occasional explanatory or amplifying notes are given, rendered desirable perhaps from the difficulties of grouping the birds which soon arise. For instance, the black-necked grebe seems out of place in the third column, for it is known to have bred here for years, and its breeding is mentioned in a note. The difficulties of grouping birds in this way are evidently great, and a system can hardly be considered satisfactory which leaves the avocet and great bustard (both now occasional visitors, which used to breed) in different columns, because apparently the great bustard is the rarer of the two as a visitor nowadays, and was *formerly* a resident, while the avocet was a summer visitor. Here again a note is necessary to qualify the latter's exclusion from the column "used to breed." Saunders's simple and masterly plan of indicating the status of a species by the type or fount, in his well-known list, if it did not indicate so much as the new catalogue (which the numerous additions to the British avifauna since 1907 have rendered necessary), at least had the merit of indicating that little very clearly.

The nomenclature in the present list differs somewhat from that used in the British Museum catalogues and guides, especially in the matter of such genera as Totanus and Tringa, which the author thinks (and we agree with him) have been split up for no very apparent reason. The author is clearly not a "splitter," as is evidenced by his leaving the black-headed bunting in the genus Emberiza. Mr. Grant does not use trinomials, and his acceptance of forms and races seems a little arbitrary. We may be thankful that he does not accept the British goldcrest, hedge-sparrow, tree creeper, &c., &c., although he does accept the British robin, another supposed local race, the existence of which as a subspecies is certainly not universally recognised. The square brackets, indicating species of which the history is doubtful, or which have, perhaps, been artificially introduced, seem to be somewhat arbitrarily applied; but this, it must be admitted, is largely a matter of individual opinion.

But to criticise the inclusion and exclusion of species, and the forms allowed and disallowed, would occupy too much space. Very largely, too, these are matters of opinion, and the opinions held are very diverse—the doctors differ. Yet some allusion must be made to the present attempt to indicate the modern status of our birds, insomuch as the difficulties encountered in the attempt, and already alluded to, become more apparent as we read through the list—difficulties which do not seem to be always satisfactorily surmounted. To take the honey buzzard, for instance. It is here stated to be a regular autumn, winter, or spring visitor, which does not breed, and there is a note appended that it formerly bred in Great Britain. The statement that it does not breed is a bold one, for nobody would be surprised at the discovery of a honey buzzard's nest in England any year. Its former status was undoubtedly that of a breeding summer visitor. It has become very rare, as such, of late years, and there is no recent record of its nesting. But there is no reason why birds should not arrive any year, and, if they escaped being shot by gamekeepers, breed. As in the case of other summer migrants, individuals from more northern countries pass here in autumn.

This bird and the golden oriole and hoopoe show the difficulties of this kind of concise classification. The original status of all three was "Summer visitor; breeding." But on account of their rarity, in different degrees, and the use of the word "regular" in column No. 2, a difficulty has been made of putting them all therein. Yet the hoopoe is put there with a qualifying note in almost the same words and to the same effect as that appended to the golden oriole (placed in column 4), and the honey buzzard is relegated to column 3, although the last-named bred more regularly in this country than either of the others, and while none of them breed regularly now it is not very improbable that any one of them might do so any year. The marsh harrier is included in column 3 among those birds which do "not breed," with a note appended saying that it "occasionally breeds." This really

amounts to saying that it retains its original status in the country, viz., resident. And this we should say is its real status—if status it has—although its numerical strength has gone down almost to vanishing point, and, as in the case of many other birds, wanderers from other parts occasionally occur. The fact is that it is almost impossible to indicate adequately the varied and often complex status of some of our birds by the present method without using such a number of columns as would make the method very cumbersome.

The "bridled guillemot" is included by name but not numbered as a species. Whatever this bird really is, its status is similar to that of the common guillemot. The greenshank, entered here as a summer visitor simply, is a winter visitor to Ireland at all events, and a spring and autumn migrant to England. Some reference is wanting to the migration of the ringed plover and to the small dark migratory race, regarded by some as a good subspecies. The claim of the stone curlew to be a resident is remarkably small and applies to one locality only. A qualifying note in the case of the little bittern might well have expressed the strong suspicion entertained of its former and recent breeding, and of its claim to be a rare summer visitor. The willow tit is not a subspecies of *P. borealis* but of *P. atricapillus*, of which *P. borealis* is itself a form. The occurrence of the latter is doubtful in the extreme. The tawny pipit is put in column 4 indicating that it "used to breed," with a note that it had bred in Sussex. But there is only one record of its ever doing so, and the reference given is to a local publication not generally available. Yet the wood sandpiper is relegated to the society of those that do not breed, and there is no mention of its undoubted former breeding in Northumberland. The shorelark is probably as regular a visitor as the Lapland bunting, yet they occupy places in 5 and 3 respectively. If the little owl (a weak candidate for the position of casual visitor until its introduction in large numbers) is to be called a "resident," there seems no reason for withholding the position from other introduced species which breed freely with us, and, given adequate protection, might maintain a wild existence in this country. The introduction is duly noted.

With regard to common names, great confusion might well arise from the quite unnecessary bestowal of the name "eared," as an alternate name, upon the Sclavonian grebe, for until recent years what is now generally called the black-necked grebe bore that name almost always. The pass to which the continual alteration of the Latin names of birds has brought us (by the raking up of ancient, doubtful, and little-known names under the plea of the law of priority) is well set before us in the present list by the fact that in order to show us exactly what bird is intended as the black-eared wheatear no fewer than five specific names (with their authorities) have been used for it and set down as synonyms; the one selected as the bird's right name (at the present moment!) being one which was long borne by another species! Thus is confusion worse confounded.

A new list of British birds was wanted, and the present one is clearly printed and well got-up. As it is printed on one side of the paper only, there is plenty of room for additions and any alterations the owner of a copy may like to make.

THE CONSERVATION OF SOIL WEALTH.

Soil Fertility and Permanent Agriculture. By Prof. C. G. Hopkins. Pp. xxiii+653. (London and Boston: Ginn and Co., n.d.) Price 10*s.* 6*d.*

PROF. CYRIL HOPKINS, of the Illinois Agricultural Station, is well known in the United States as the initiator of a systematic policy for restoring the fertility of the land of the east and middle west, which is in many respects a supplement to the great work of conserving the national resources that the late President succeeded in bringing home to the American public.

The problem is one quite distinct from the agricultural questions prevailing in western Europe. Up to the present time almost, it might be said that American agriculture has been extensive in its charter and wasteful in its methods. It has depended entirely upon the natural resources of the soil, and in many districts has only succeeded in exhausting them. In Virginia, in New England, and in many of the older States one may see great areas of indifferent farming and even of derelict land; land which has been cropped without due regard to the future until it has ceased to be profitable with the style of farming there in vogue and is now occupied only by comparatively backward cultivators, who draw but the poorest living from the soil. Even of the rich prairie lands of the middle west, in Illinois, Iowa, and Ohio, notwithstanding the enormous stock of plant food present in the soil when it was first taken into cultivation, a similar story is told. The yields on much of the land are declining, and the tendency on the part of the enterprising men to move west to the virgin soil has been very prominent of late in the migration of American farmers into those parts of western Canada that have lately been opened out.

With certain conspicuous exceptions the American farmer has always been raising a succession of crops which drew upon the resources of the soil; wheat has been alternated with corn and Timothy hay, and each crop has been either sold away from the farm or consumed in the great barns in which the stock are housed through the severe winters. In many cases the shortage of labour has prevented men from even restoring to the land the manure made by the stock, while no root crops are grown and no sheep are kept to run over the land and restore to the soil the fertilising ingredients that have been drawn from it by the fodder crops. And though the fertiliser trade in the United States is of enormous dimensions, it is too much confined to a relatively small class of intensive farmers, and does not represent a very large outlay on the total area of land under cultivation. Thus in many respects the condition of farming has been similar to that prevailing in Europe before the introduction of artificial fertilisers, that is to say,

that the farmer has been dependent upon the resources of the soil alone. In Europe, however, the cultivator has been forced by the lack of further land to a system of conservative farming which would maintain the fertility of the soil and the production of crops, at a somewhat low level, perhaps, but one that would show no decline for a very long period of time.

In the Norfolk four-course rotation, for example, all that is sold away from the farm is meat and corn; the straw, the hay, and the roots are more or less completely returned to the soil. The growth of the clover crop once in the rotation was more than capable of replacing the nitrogen sold away and the inevitable wastage. The stock of potash in the soil is so enormous as to be practically inexhaustible, and cultivation will slowly make it available. Only the phosphoric acid suffers a steady and irreplaceable loss under such a conservative system of farming, but this loss is not a very large one. Prof. Hopkins has made it his mission to awaken the Illinois farmer and his neighbours east of the Mississippi to a sense of the inevitable decline of the fertility of their land unless they also work out a similar conservative rotation, and he has shown them how this can most profitably be effected with the fertilising resources now available.

In his system Prof. Hopkins lays less stress upon the nitrogen question than we are accustomed to do in Europe. Even to-day the old prairie lands are still rich in nitrogen, and he considers that the introduction of a vigorous clover or cow pea crop into the rotation will be sufficient to maintain the nitrogen at a profitable level for production. To secure a good clover crop it is necessary that there should be an ample supply of phosphoric acid and potash. Of the latter element the initial stock is large enough to last for many generations; all that is necessary is to bring it steadily into solution. To this end, and also to ensure the proper bacterial actions which both collect nitrogen and bring the organic nitrogen compounds in the soil into forms assimilable by plants, a neutral reaction is required in the soil, and Prof. Hopkins uses finely ground limestone in preference to the quick-lime which we more commonly employ. Then he turns to the phosphoric acid to complete the chain, and supplies this fundamental element by one of the mineral phosphates so abundant in Carolina or Florida in a finely ground condition, preferring the neutral finely ground rock to the artificially prepared acid superphosphates more common in Europe.

To Prof. Hopkins the ground phosphate is the keystone of the arch. The carbonate of lime is necessary to prepare the ground and to liberate the potash, but the phosphoric acid provides the item that was necessary for fertility, not only to the grain crops themselves, but to the nodule bacteria on the clover, which have to maintain the stock of nitrogen. Prof. Hopkins has demonstrated the success of his system experimentally at Urbana, and on many a farm in Illinois, and has taken up the propaganda of this method of restoring the waning fertility of the older lands of the United States with the zeal and conviction of a missionary. In this cause he has been brought into sharp conflict with the opinions that have issued from the Division of Soils at Washington, where Whitney and Cameron have put out their theory, which in its crude form as summarised for popular consumption, would seem to say that all soils are inexhaustible and equally rich as regards their mineral constituents, and that nothing is more required for fertility than a proper rotation and due attention to the conservation of the water supply, expenditure upon fertilisers being in the main unnecessary.

On the value of this theory and its application to practice this is not the place to enter, but the book before us is to a large extent a detailed statement of Prof. Hopkins's position and the justification of his belief in fertilisers, more particularly in ground limestone and rock phosphate, as a means of raising the level of productiveness in the United States.

Prof. Hopkins's book is designed on rather different lines from the usual treatise on agricultural chemistry, or even upon soils. After a general introduction on the elements of plant nutrition, he discusses in some detail the types of soils to be met with in the United States, and then goes on to develop his system of agriculture with an account of the materials necessary to maintain fertility. Here the reader will find a number of experimental data concerning the value of ground limestone in comparison with lime, and particularly of ground rock phosphate as against superphosphates and other manufactured fertilisers.

After a chapter of polemics on the theory of soil fertility, Prof. Hopkins proceeds to discuss field experiments, taking the Rothamsted experiments as a type of what may be expected under European conditions, and then summarising in a very convenient and interesting form for the European reader the work that has been done in Pennsylvania, Ohio, Illinois, Minnesota, and other American States. Though the book is written for the educated farmer, on this side of the Atlantic it is rather to the teacher and student that it will appeal, because our farmers will be strange to the conditions which render its main argument of so much importance. To the teacher, however, it is a mine of information; as it is also written with such vigour and refreshing conviction of the fundamental importance of its doctrine, we can well understand how Prof. Hopkins has become one of the really inspiriting forces in American agriculture. A. D. H.

THE TERMITES OF CEYLON.

Termitenleben auf Ceylon, neue Studien zur Soziologie der Tiere zugleich ein Kapitel Kolonialer Forstentomologie. By Prof K. Escherich. Pp. xxxii+263.2 pls. and 68 figures in the text. Jena: Gustav Fischer, 1911.) Price 6.50 marks.

THE termites (or white ants, as they are frequently though improperly called), although they belong to the order Neuroptera, exceedingly resemble the true ants in their habits, and are of almost equal interest. They are, however, tropical insects, and extremely destructive, and although one species has

established itself as far north as Bordeaux, it is fortunate that no species has yet been able to do so in the British Isles.

Prof. Escherich first devoted his attention to the termites during a tour in northern Abyssinia (Erythrea) four years ago, and, wishing to continue his studies on the same subject, selected Ceylon as most suitable for his purpose. Incidentally he estimates the number of species of termites already described as about 500, whereas about 5,000 species of ants are known. It is probable, however, that the difference is not solely due to termites having been less studied than ants, but to the number of species of the former being really much less numerous. The number of termites now known from Ceylon is thirty-five, of which four are possibly forms of others, leaving thirty-one undoubted species, nearly all collected by Prof. Escherich himself. The species of ants collected by Prof. Escherich in Ceylon number about seventy. He must have worked hard during his short stay in the island (from January 22 to the end of the first week in April), of which he gives an interesting account.

The first chapter of the main work is devoted to the nests of the mound-making termites, which vary much in form and size, and usually contain large fungus-beds. The larger termite-hills in Ceylon rise to a height of from 2 to 2½ metres, and the subterranean part is said by the natives to extend to a depth of ½ to 1 metre. The inhabitants of the nests are also described, and compared with the African *Termes bellicosus*. The latter species, however, is far more formidable, for the mandibles of the soldiers draw blood at every snap, while those of the Ceylon species can hardly pierce the skin of the hands, though they cling on firmly, and discharge an irritating liquid. Prof. Escherich disputes the usual notion that light is intolerable to termites; but it seems to us probable that this sensitiveness varies in different species. The huge size to which the abdomen of the queen termite attains is well known, but still more remarkable in the opposite direction is the figure of a soldier on p. 54, the head of which is nearly as large as the body, and the head and mandibles together much longer.

Several species of termites often inhabit one nest, and different species of ants are often associated with them in the same nests, as well as many other insects, &c. One peculiarity of the termite hills is the so-called "chimneys," open above, and running down into the nest, and efficiently providing for ventilation.

The second chapter of the book deals with the genus Eutermes, the species of which make their nests in wood, and are exceedingly destructive, while others construct long galleries, through which they march from one place to another. A third chapter is devoted to miscellaneous observations on queens, soldiers, behaviour towards light, &c., and a fourth to the economic importance of termites. Prof. Escherich considers that they are much less destructive in Ceylon than in Africa, and he discusses the best means of preventing their ravages, or of destroying them.

The book concludes with a series of valuable appendices by various authors, including descriptions of a considerable number of new species collected by Prof. Escherich, comprising termites, ants, and various Coleoptera, Orthoptera, Thysanura, Myriapoda, and Nemotoda, inhabiting the nests of termites in Ceylon.

ORIENTATION IN ORGANIC CHEMISTRY.

Über die Bestimmung des chemischen Ortes bei den aromatischen Substanzen. By W. Koerner. Pp. 132. (Leipzig: W. Engelmann, 1910.) Price 2.40 marks.

WILHELM KOERNER had the good fortune to become a student of Kekulé, in 1865, at a time when the latter was developing his benzene theory. After a year spent in Otling's laboratory, Koerner returned to Ghent as private assistant to Kekulé, and remained for a year in that capacity. He rapidly imbibed the views of his teacher, and, realising something of their far-reaching consequences, set before himself the task of experimentally demonstrating the truth of Kekulé's theory, a task which he never afterwards relinquished. The object of his first paper, published in 1866 in the *Comptes rendus*, was to link together the three series of di-derivatives of benzene. Thus, by preparing the three iodophenols and converting them by fusion with potash into the corresponding hydroxybenzenes, he was able to connect quinol with iodoaniline, iodophenol with catechol, and nitraniline with resorcinol, incorrectly regarded as the ortho, meta, and para series respectively. At the same time he criticised the speculative methods adopted by Baeyer, Graebe, and others as a basis for orientation.

In his second paper, published in 1867, he foreshadows his future method by pointing out that the trihydroxybenzene derived from the three dihydroxy-compounds must have the hydroxyls in the 1, 2, 4 position. His third paper contains a clear exposition of Kekulé's views on the constitution of the aromatic series with which we are so familiar. It is dated 1869 from the laboratory of Cannizzaro at Palermo, whither he had gone in 1867 to re-establish his health. When, later, he became lecturer on organic chemistry at the new technical college in Milan, he continued actively engaged in experimental work connected with his method of orientation, which he embodied in his fourth paper, published in 1874 in the "Gazzetta chimica italiana." It is in this last paper that Koerner collected the enormous mass of material which had been steadily accumulating since 1867.

The work, establishing for the first time by direct experimental evidence the true orientation of the simpler benzene derivatives, has taken its place as one of the classics of chemical literature, and chemists will welcome this last addition to *Ostwald's Klassiker*. The papers have been translated from French and Italian by Messrs. Bruni and Vanzetti, who have added a few explanatory notes. They have overlooked a curious transposition of the ninth line from the bottom of p. 4, which should be read as the bottom line.

J. B. C.

A PHILOSOPHICAL EVOLUTIONIST.

Der Wert der Menschheit in seiner historisch-philosophischen und seiner heutigen naturwissenschaftlichen Bedeutung. By Dr. F. Strecker. Pp. xiii+392. (Leipzig: W. Engelmann, 1910.) Price 7.40 marks.

THE author expounds a new interpretation of nature—a "Pythagorean-atomistic" evolution principle—which correlates a recognition of necessitarian uniformity with the concept of a high degree of contingency in natural happenings. The first part of the book is devoted to a historical sketch of the development of philosophic thought, in which the author discerns an analogy to the phyletic evolution of organisms. He then passes to a survey of the world of energies, and the discovery of its principle of development. The third section is devoted to the position of living organisms in nature, and here the author recognises that there is truth both in the vitalistic and in the mechanistic interpretations. But the mechanistic interpretations of vital activity that work are not like those which apply to the inorganic; there is a dualism and antagonism separating the two sets of formulæ. In fact, the organism stands by itself "with an independent genesis and tendency." In the fourth part of his book Dr. Strecker investigates the factors in the self-evolution of the animate world, and subjects "Darwinism" to a detailed criticism, his sympathies being Lamarckian. The chief point in the criticism is not unfamiliar, that selection is a secondary and directive, not a primary and originative factor. In the concluding part of this section there is an interesting discussion of "purposiveness," for instance, in development. This is regarded not as a fundamental property which explains things, but as a secondary achievement which has to be explained. It is not primary, but an outcome of progressive evolution. The concluding part of the book is on man's place in nature, and contains a vindication of an "anthropocentric" cosmology.

It may be of interest to give some further indication of the author's indictment of Darwinism. He criticises the concepts of the struggle for existence and natural selection, and shows that they tend to distract the attention from the primary fact and problem of the active organism, asserting itself in relation to the environment, and expressing itself ever in fresh form. In the second place, he seeks to show that some of the postulates are inconsistent with the actual facts of the case, and he raises difficulties, some of which have been very often discussed, regarding over-multiplication, the selection-value of a few additional millimetres on a primitive proboscidean's trunk, and the struggle among members of the same species. He utilises the facts of mutual aid as arguments against Darwinism, and in so doing shows, as it seems to us, a Procrustean conception of what the struggle for existence means.

Dr. Strecker leads his readers in an interesting way from the errors of Darwinism to the truth that is in Lamarck, and we are left at least with the impression that some compromise must be arrived at between the two interpretations. Not the least striking part of the book is the thesis that Darwinism is wrapped up with mechanistic, and Lamarckism with vitalistic views, and from this the author goes on to show that a recognition of the partial truth on either hand is to be found in his own particular theory of the "anthropocentric position" of man in the universe.

J. A. T.

RECENT PROGRESS OF SCIENCE.

Fortschritte der naturwissenschaftlichen Forschung. Edited by Prof. E. Abderhalden. Vol. i., pp. viii+306. Vol. ii., pp. iv+364. (Berlin and Vienna: Urban und Schwarzenberg, 1910–11.) Price, vol i., 10 marks; vol. ii., 12 marks.

THE plan of this new publication is to furnish summaries of recent results in selected departments of knowledge in which some degree of settlement and certainty has already been reached. This policy will avoid any risk of wasting time on raw speculations, and, under the able guidance of a man of Dr. Abderhalden's experience and prodigious industry, the series promises to be useful and judiciously chosen. In these first two volumes the subjects dealt with are colour photography (Miethe), fire-damp-resisting explosives (Brunswig), slow combustion and oxidation ferments (Bach), methods and recent results of gravitation measurements (Niethammer), development of picture telegraphy (Korn), recent methods of solar investigation (Guthnick), fermentation in living and "killed" plants (Palladin), origin of petroleum (Engler). Vol. ii.:—Inheritance of acquired characters (Semon), fossil lung-breathing aquatic animals (Stromer), volcanic research (Sapper), ions and electrons (Mie), utilisation of atmospheric nitrogen (Frenzel), cretinic degeneration, goitre, and deaf-mutism (Bircher), and muscular atrophy (Bing).

All these essays, written by men who have done some original work on the subjects dealt with (and sometimes a great deal of work), are well written, and occasionally only disappointing to the uninitiated on account of their caution. Thus Miethe regards a further sensational development of colour photography as very unlikely; Korn throws cold water on the problem of vision at a distance; and Sapper, after an exhaustive parade of recent volcanic theories (including Strutt's radio-activity speculations), calls for more facts. Some of the contributors are more positive. Brunswig confidently expects the discovery of a satisfactory explosive for coal-mines by judicious admixture of non-explosive material; Palladin considers the loss of coordination in the production of ferments after killing (by cold or narcotics) as definitely established; Semon commits himself to a modified Lamarckism on a basis of "mnemes" and "engrams"; and Bircher regards the influence of soil and water on cretinism as proven. Engler favours the view which ascribes the origin of petroleum to fossil animal fats.

The remaining articles are more or less neutral, but no less admirable, summaries of recent work. Mie's "Ions and Electrons" emphasises Maxwell's views of the æther rather more than we are accustomed to

find in Germany nowadays. It shows that the school which would regard the æther as a mere "physical space" has not yet captured all the Continental seats of learning. The further volumes are to appear at the rate of two per annum, and the list of forthcoming essays is distinctly attractive.

DISJUNCTIVE GEOGRAPHY.

A Systematic Geography of America. By G. W. Webb. Pp. viii+108. (London: Methuen and Co., Ltd., n.d.) Price 1*s*.

"THIS book—the fourth of a series of five—deals with the geography of the New World. As in the previous volumes, the treatment of the subject is on logical and modern lines, and the book will be found to contain the kind of information that candidates preparing for fairly advanced examinations in geography are now expected to acquire." Instances of the absence of modernity in the treatment are striking; for example, the rain of California is attributed to the north-east trades, without mention of its characteristic winter maximum, and in disregard of Buchan's maps on wind directions.

The space devoted to Argentina is the same as that given to Peru, and but one-quarter of that given to Canada. In view of the information which is accessible in the "Statesman's Year Book," the "Atlas of the World's Commerce," and the publications of the United States Government, the treatment of minerals in Mexico, the reference to cotton ports and to the trade of the United States ports on the Pacific, as well as the arbitrary division between the "wheat" and "maize" belts by lat. 42° N. are curious, and, on the whole, misleading. Mexico is first as to the production of silver, and produces copper, but not iron and tin to any extent.

Much is made of "Sea-island" cotton, but the total production of that variety is, roughly, 1/200th of the United States cotton crop, and stress is laid upon Mobile, Wilmington, Charleston, and Pensacola as cotton ports when really about three-quarters of the cotton exports go from Galveston, New Orleans, Savannah, and New York. On the Pacific coast Portland is suggested as of more importance than the ports on Puget Sound, when its trade is roughly only about one-third of that of the more northern ports. There seems hardly any excuse for the limitation of the "wheat" belt by latitude, especially as Wisconsin is named in large type, and the fact that in relation to area of land in the respective territories Pennsylvania is more important than Michigan is ignored.

On the whole the book contains many isolated facts, but surely modern ideas in geography demand a statement of facts in relation to each other; *e.g.* climate is discussed in an introductory chapter, and on the "wheat" belt the author writes:—"The winters in this region are very cold; the summers are warm, but not warm enough to ripen maize"; yet S. Dakota, Minnesota, Wisconsin, and Michigan produce annually over 200 million bushels of maize on the average. It appears that the defects are due to indiscriminate use of statements made in other text-books.

B. C. W.

OUR BOOK SHELF.

Laboratory Notes on Organic Chemistry for Medical Students. By Dr. Paul Haas. Pp. viii+128. (London: Macmillan and Co., Ltd., 1910.) Price 2*s*. 6*d*. net.

IT is generally recognised that a knowledge of organic chemistry is becoming more and more essential for the proper study of physiology and the medical sciences, but, on the other hand, the complaint is frequently heard that the curriculum of the medical student is becoming seriously overcrowded, and that science work is encroaching too far on the more professional studies.

The new syllabus of the second medical examination, part i., of the London University is the result of a compromise between these two points of view, and an attempt is being made to teach organic chemistry with special reference to its applications in physiology, pharmacology, and pathology, and while giving a sound elementary knowledge of the principles of the subject to illustrate them as far as possible by means of substances of importance in the aminol economy.

The book under review covers the practical syllabus of the above examination, and we may say at once that it is a good book, though it suffers from the defects inherent in any work written for so special a purpose. The first half of the book contains a lucid and thoughtful account of the general methods of organic chemistry, illustrative methods of preparation, and the various quantitative exercises mentioned in the syllabus. The second half is devoted to qualitative tests for a number of substances of physiological importance; and the practical recipes for preparing these substances, many of which are expensive and difficult to obtain in the market, will be found exceedingly useful, particularly by those teachers who may not be specially familiar with biochemical methods. A sufficient account of the theoretical principle underlying the various exercises and tests is given, and, where possible, the bearing of the subject on the future work of the student is emphasised, so that he may realise that chemistry is not to be regarded merely as an examination subject, but rather as a valuable adjunct to his knowledge for the fuller appreciation of his clinical and other studies. The book will, we think, be useful both to students and teachers.

Die Kalte: ihr Wesen, ihre Erzeugung und Verwertung. By Dr. H. Alt. Pp. v+124. (Leipzig: B. G. Teubner, 1910.) Price 1.25 marks.

THIS little book is based upon a series of six lectures delivered in München during 1907 by the author. Dr. Alt has endeavoured to popularise the subjects of the production of cold and the physics of low temperatures so as to render them both interesting and useful to the beginner. No special knowledge of this particular branch of physics is assumed; a general intelligence and interest in natural phenomena is all that is expected of the reader. With this in view the author devotes the first two chapters to matter which finds a place in almost any elementary treatise on heat. In the first chapter the properties and laws of gases are discussed, and in the second, those of vapours, both being obviously necessary preliminaries to the appreciation of the remaining sections of the book.

The production of cold by means of the reversed heat-engine, together with descriptions of the various types of refrigerator, form the subject of the next chapter; the remaining three are concerned with the question of the liquefaction of gases. The different processes by which liquefaction has been secured are described in chronological order, starting with the earlier regenerative process and leading up to the

methods by which hydrogen and helium have been liquefied by means of various improvements. Attention is directed in the concluding chapter to the many uses, both in the laboratory and commercially, to which low temperatures may be applied, such as the separation of the various ingredients of air by fractional distillation.

Most of the important points in connection with the production and applications of cold are to be found, treated in an elementary and lucid manner, in this book, which should serve admirably the purpose intended by its author.

Was die meisten Amateur- und manche Fachphotographen nicht wissen: Ein Handbuch praktischer Ratschläge und Erfahrungen. By Prof. F. Schmidt. Pp. xiii+175. (Leipzig: Verlag Otto Nemnich, 1911.)

THE author finds that amateurs and even expert photographers often fail to take the trouble to understand their work, and are ignorant, not only of the principles upon which it is founded, and which are therefore the only safe guides to its successful application, but also of many simple practical and commercial facts concerning it. So he has prepared this volume in sections varying in length from a line or two to a page or two, each with a conspicuously printed heading indicating the subject treated. The arrangement is exactly the old style of question and answer, except that the question is put in the form of a statement or title, such as "What a landscape lens is," "When one may dilute the developer," and so on. The information is generally of the kind that would be called elementary, tending in parts perhaps to be too superficial, and may be accepted as evidence that even in Germany, where education is so well systematised, the general knowledge concerning so common an applied science as photography is behind the needs of the times. Many convenient and some apparently novel methods are given, as, for example, to facilitate necessary calculations. A drawback to the book from the point of view of the English reader is that in the lists of makers of different kinds of lenses, sensitive materials, &c., although there are included some little-known German firms, English firms appear to be ignored altogether.

The Fauna of British India, including Ceylon and Burma. Published under the authority of the Secretary of State for India in Council. Edited by Dr. A. E. Shipley, F.R.S., assisted by G. A. K. Marshall. Rhynchota. Vol. v., Heteroptera. Appendix by W. L. Distant. Pp. xii+362. (London: Taylor and Francis; Calcutta: Thacker, Spink and Co.; Berlin: R. Friedländer and Son, 1910.) Price 10*s.*

IN this supplementary volume, Mr. Distant describes a large number of species which have recently come into his hands, but most of which have already been described in advance of the present work in the *Annals and Magazine of Natural History*, the *Annales de la Soc. Ent. de Belgique*, &c.; and thus he completes his work on the Indian Heteroptera. This volume extends from the family Lygæidæ to the family Corixidæ, and we are informed that "A further volume, which will form an appendix to the Homoptera, will complete the enumeration of the Indian Rhynchota, with the exception of the families Psyllidæ, Aphididæ, Aleurodidæ, and Coccidæ." The species here described extend from Nos. 2769 to 3135, and are illustrated by 214 excellent illustrations in the text. The first page is devoted to controversial questions of nomenclature, and a few bibliographical notes.

Nigeria and its Tin Fields. By A. F. Calvert. Pp. xvi+188+259 plates. (London: Edward Stanford, 1910.) Price 3*s.* 6*d.*

THIS book is intended to provide information concerning Nigeria, to which special attention has recently been directed by the revelation of vast alluvial tin deposits in the province of Bauchi (northern Nigeria). The author discusses the present means of communication, the possibility of railway development, and the character of tin deposits, which are situated about 3000 to 4000 feet above sea-level. He states that it is estimated that the tin deposits are scattered over an area of about 2500 square miles, that the tin produced is considered to be some of the best ever imported into Europe, and that it commands a price equal to, if not higher than, that of the Straits tin. Details are given of the companies which are at work, and the new mining regulations are stated in full. One interesting feature of the book is the large number of illustrations, which are collected together at the end.

Mathematical Papers for Admission into the Royal Military Academy and the Royal Military College for the Years 1905–10. Edited by E. J. Brooksmith and R. M. Milne. Various papers, separately paged. (London: Macmillan and Co., Ltd., 1911.) Price 6*s.*

THE editors have provided answers to the questions set during the past six years for candidates seeking admission to the Royal Military Academy and College. Teachers whose duty it is to prepare candidates for these examinations should find the publication a convenience.

Huxley and Education. By Prof. H. F. Osborn. Pp. 45. (New York: Charles Scribner's Sons, 1910.)

PROF. OSBORN'S address at the opening of the college year at Columbia University last September is here printed in the form of a book for the pocket. Some of his remarks remind one of the aphorisms of his old master, Huxley. To quote one example:—"Do not climb that mountain of learning in the hope that when you reach the summit you will be able to think for yourself; think for yourself while you are climbing."

William Ford Stanley. His Life and Work. Edited by Richard Inwards. Pp. 82. (London: Crosby Lockwood and Son, 1911.) Price 2*s.* 6*d.* net.

THE first five chapters of this book are autobiographical, and in the remaining four the editor gives an interesting account of the late Mr. Stanley's active life. There are two appendices, the first being an article on technical trade schools, which was the last paper written by Mr. Stanley, and the second the events in Mr. Stanley's life arranged in chronological order. The book will be interesting to many readers.

Die Elemente der Entwicklungslehre des Menschen und der Wirbeltiere. By Prof. O. Hertwig. Vierte Auflage. Pp. viii+458. (Jena: Gustav Fischer.) Price 9.50 marks.

THE first edition of this work on the leading facts of embryological science was noticed in NATURE of April 26, 1900 (p. 610). The work has been enlarged by about fifty pages, and there are now 399 figures instead of the 332 in the original edition. For students familiar with the German language, the volume provides an excellent introduction to embryology.

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.]*

Daylight Saving?

MAY I make a few observations with regard to Prof. Milne's article in NATURE of April 6 on Daylight Saving? Leaving aside the inquiry as to whether the clerks of Cornwall are happier than those of Kent, to which I am not able to give an answer (though it is possible that, as these counties differ in other respects than that considered, a mere yes or no might have little value as evidence), one may direct attention to the next argument as to workers who have to commence their work at 6 in the morning. The graphic account which Prof. Milne gives as to the hardships which these workers would have to suffer under the proposed scheme, would be heart-rending, had he not thoughtfully supplied the remedy in his last paragraph. Why should they not start work an hour later in summer? later, that is, according to the new setting of the clocks? This is a "simple solution" on Prof. Milne's own showing.

In my practical engineering days I found that one of my greatest privations was due to the fact that my evenings had to terminate (in order that I might rise early in the mornings) earlier than those of my friends, and evening engagements were generally inconveniently late. Now, under the proposed scheme all evening engagements, except such as are organised by these workers for their own convenience, would take place an hour earlier (absolute time), and consequently the effect of the change would be probably, if anything, an advantage to the 6 o'clock workers, provided they accepted the simple solution suggested. In fact, their day *is now* disjointed from that of the rest of the world, and under the new scheme this defect would be at least partially remedied.

Prof. Milne's fifth paragraph seems to be inconsistent with his simple solution. I am surprised to hear the "half-asleep" argument seriously brought forward. If one rises and retires an hour earlier, but works, takes meals, &c., at the old times, the argument is valid, but not, I think, when work, &c., fall in automatically with the new times of rising and retiring. On a journey to Vancouver and back I altered my watch more than twenty times, but felt no inconvenience whatever, because all engagements altered in the same way.

As to defects, inconvenience to meteorologists, steamship companies, &c., we must, of course, try to weigh these as justly as possible against the advantages of the scheme, but I think that technical and academic points, and even practical questions like the adjustment of steamship and boat-train times, should not be allowed to weigh very heavily against any large amount of real advantage to the workers of the country which the scheme might be calculated to afford.

With regard to the last paragraph of the paper, one may remark that the solution suggested, that business people should begin work an hour earlier in summer, really leads us on inevitably to the daylight proposal itself. For if business (apart from factories, &c., with which I have already dealt, which form an obvious exception) begins and ends an hour earlier, then the general activities of the country must follow suit. It would be impracticable, for instance, for shops to open at 7 instead of 8 and close at 6 instead of 7 (say) at night, while the shopping public still ordered their doings according to the old times; and if all business and other people adopted the plan suggested, then all other pursuits engaged in by them must follow. Thus all engagements, trains, and what not must be altered.

Now, manifestly, by far the simplest mode of carrying out this change would be to alter the clocks, and then allow all the activities of life to go on to the same time schedule as before. Not only is this the simplest way, but I think it will be admitted that it is the *only way* which would have the slightest chance of being *actually realised* in practice.

In conclusion, I may say that my object in writing has not been to support the daylight saving proposal itself, but rather to direct attention to what seemed to me to be vulnerable points in the arguments (as arguments) under discussion. L. SOUTHERNS.

IN my note on the so-called Daylight Saving proposal, I repeated a suggestion made by many, viz., that a simple solution to the whole question would be to commence work one hour earlier during the summer, and do this without confusing ourselves and others without altering the clocks. Why Mr. Southerns quotes me as saying *one hour later* I do not know. The main point, however, to which practically no reference is made is that the majority of workers in Great Britain will, if the time-saving scheme comes into force, have to rise at 4 a.m. instead of 5 a.m. for six months in the year. This is increasing darkness and not saving daylight. It is all very well to say that the total population in Great Britain will, if they go to bed one hour earlier, save two and a half million pounds on illumination, but it would only be fair if the promoters of this new-fangled idea would tell the inhabitants of Great Britain how many millions they would have to spend on extra illumination required in the morning. You cannot make a piece of cloth longer by cutting off one end and sewing it on the other.

Mr. Southerns says that he is "surprised" at hearing what he aptly terms the "half-asleep argument." To be surprised at an argument, however, is not the best way to refute it. Thus I may be surprised, even greatly astonished, at much that Mr. Southerns says in his letter, but I do not expect that the most dramatic exhibition of my personal feeling will carry conviction to his or anyone else's mind. I am therefore compelled to relate a few facts which have a direct bearing on this matter. Of these facts Mr. Southerns is evidently without knowledge, and it may be assumed that others who support this remarkable Bill are in a like state of darkness.

In the first place, as the result of innumerable experiments and observations by many distinguished investigators, it has been definitely ascertained that bodily and mental efficiency are not maintained at the same level throughout the day, and that the course of efficiency, if plotted diagrammatically, describes a curve with a morning maximum between ten and eleven; an afternoon maximum about five, and in late workers a third elevation, which has been termed "end-glow." With the afternoon and evening measures of efficiency I am not concerned; what I wish to emphasise here is that there is a gradual increase in bodily and mental efficiency from the hour of waking up to between ten and eleven in the great majority of workers of all kinds; *i.e.* that sleep imposes an inertness the influence of which passes away, only slowly on arising. There is, in fact, what Dr. Howard Marsh, in an interesting book on "The Diurnal Course of Efficiency," calls a "warming-up period."

Now for the important matter of habit. The results of experiments show that the immediate effect of breaking habits is apt to be detrimental to the output of work, whatever that habit may be. So firmly does habit impress itself upon the reaction of man to his environment, that Patrick and Gilbert, for instance, show that in subjects kept awake for seventy-two hours, and subjected to tests every six hours, the worst results were obtained invariably *at the periods ordinarily devoted to sleep*, thus showing the recurrent nature of an established habit, and how important is the influence of this upon the output of work, hence for some time after the shifting of time, should it be brought about, we should anticipate that the efficiency of workers would be impaired. J. MILNE.

Seiches in Windermere.

WINDERMERE is peculiar as regards seiches, since it is nearly divided in two by islands and shallow water near the middle. On account of this the two halves of the lake oscillate independently, but an oscillation can be detected which is due to the uninodal seiche of the whole lake. Because of the shallow water near the middle, this has only a small amplitude and a very long period (69·7m.), and is soon damped out.

A recording apparatus was first set up near the upper

end of the lower half of the lake. The water, however, was shallow in this part of the lake, and the records are rather disturbed by local effects due to wind. The periods of the seiches detected here were 20·4 minutes, 11·9 minutes, and 3·3 minutes. The 20·4-minute and 11·9-minute periods are due to the uninodal and binodal seiches of the lower half of the lake. The 3·3-minute period is probably

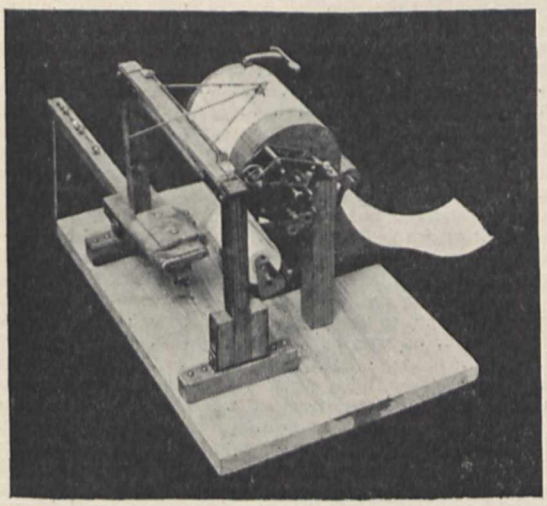


FIG. 1.—Recording Limnograph.

due to a transverse seiche. The maximum range recorded was about an inch.

After this, the recording apparatus was set up at the head of the lake. The upper half of the lake being much deeper than the lower half, better records were obtained. The maximum range recorded was about 1¼ inches. The periods here were well marked, and had the following times:—69·7 minutes, due to the uninodal seiche of the whole lake; 14·1 minutes and 6·6 minutes, due to the

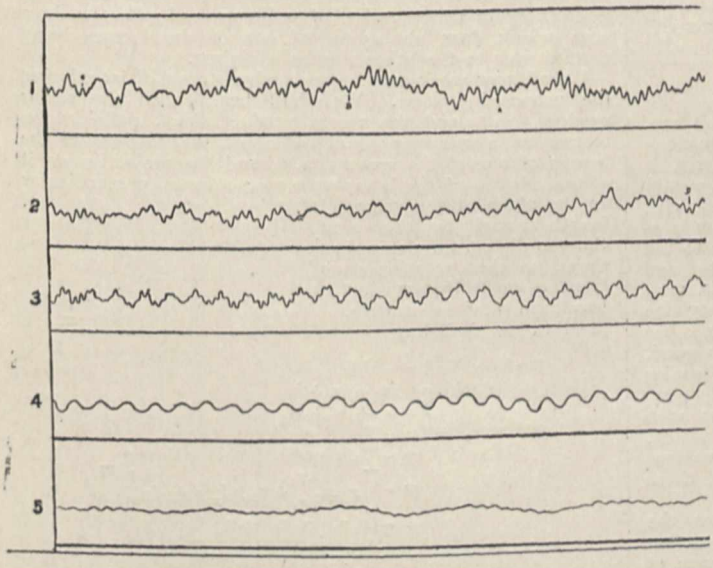


FIG. 2.—Traces obtained at Head of Windermere.

uninodal and binodal seiches, respectively, of the upper half of the lake; also a well-marked, short period of 3·4 minutes. This last period is probably due to the trinodal seiche, and also to a transverse seiche, which has nearly the same period. In some cases, the movement due to this oscillation alone was nearly an inch.

The figure shows some of the traces obtained. Nos. 1, 2, and 3 are typical traces obtained at the head of the lake. Nos. 4 and 5 are obtained from No. 3 by Prof. Chrystal's method of residuation. The 3·4-minute period is seen in the original trace. No. 4 shows the 14·1-minute and 69·7-minute periods, and is obtained by residuating out the 3·4-minute and 6·6-minute periods. No. 5 shows the 6·6-minute and the 69·7-minute periods, after the 3·4-minute and the 14·1-minute periods have been residuated out. In Nos. 1 and 2 the rate of movement of the paper was one inch in 18·8 minutes, and in No. 3 one inch in 23·2 minutes.

During the later experiments a form of apparatus was used which proved quite satisfactory, and, being simple to construct, may be worth briefly describing. A strip of paper, from a continuous roll fixed on the base of the instrument, passes up and over a horizontal wooden cylinder, 3 inches in diameter, and driven by clockwork. After passing half-way round the cylinder, the paper passes under a small roller carried on springs. This roller presses the paper against the wooden cylinder, and, since the paper passes half-way round the cylinder before passing under the roller, there is no possibility of it slipping.

A horizontal lever is pivoted to the base of the instrument, one end of which projects outwards, and is connected to the float by a string, while the other end carries a weight. The pen and holder are carried by a horizontal rod, which is supported by two upright arms, being fixed to them at each end by pivots. One of these arms is fixed to the lever, at the place where it is pivoted to the base of the instrument, while the other arm is pivoted direct to the base. As the float moves up and down, this horizontal rod moves backwards and forwards, parallel to the axis of the wooden cylinder. On the horizontal rod are bearings, which carry the light frame holding the pen, which rests on the top of the wooden cylinder. When the lever is half-way up or down, the bearings of the pen are about the same height as the top of the wooden cylinder, then, as the float moves the lever up and down, the pen moves in an almost straight line across the paper on the top of the cylinder.

This apparatus is simple to construct, and, since the only friction is in the pen and the four pivots, the whole system moves very freely, and a float 5 inches in diameter will work it easily, while Chrystal's "waggon" recorder requires a 10-inch float.

GORDON DOBSON.

Caius College, Cambridge, April 19.

The Flight of Exocœtus.

PRACTICAL difficulties will prevent the settlement of the question as to whether or no a flying fish supports itself by movement of its fins by the method suggested by a correspondent in NATURE of February 9, viz. kinematograph photography.

Anatomy and phylogeny converge to the support of those observers who declare that the "wings" are motionless during "flight."

(1) Any resemblance to the huge musculature of birds is out of the question, but if the wings vibrate to any purpose, something resembling in scale the muscular and nervous specialisation found in insects should obtain here. Has anything of the sort been found? On the contrary, the muscular development of Exocœtus is, like that of other fish, directed to propulsion by the tail.

(2) The structure and habits of the lower members of the family, Hemiramphus and Belone, indicate stages in the evolution of Exocœtus. The former is able to make great leaps nearly parallel to the surface, of such force, indeed, that the natives here tell me of men who have been pierced by the elongated lower jaw two inches deep in the flesh of the leg when wading among them. "When it is out of the water it is quite mad and strikes whatever is in the way, whether a man or a boat, and so kills itself," to quote their description.

Belone can almost fly, its effort having the appearance of running on the surface on the tip of its tail, suggesting some use of this member, but not of the normal-sized fins, in extending the range of "flight." These two steps in the evolution of the habit of Exocœtus distinctly lead to the

idea of a parachute leap, but do not at all support an evolution of flight by beating wings.

Exocœtus is the natural parallel of the aëroplane, which, it is hoped, will rise from and descend upon water with ease and perfect safety. The flying fish, however, frequently strikes a wave with one fin and is overturned, or strikes it with violence. It would be very interesting to know whether Belone does aid itself by its tail, and so is in some way a parallel to the hydroplane boat.

CYRIL CROSSLAND.

Dongonab, Port Sudan, Red Sea, March 24.

The Stinging Tree of Formosa.

WITH reference to the letter on the Stinging Tree of Formosa in NATURE of March 2, it would be interesting if your correspondent would throw light on the exact mechanism by which the sting in *Laportea pterostigma* and *L. crenulata* is produced. *L. crenulata* is locally abundant in some parts of India. The curious point is that the leaves are often glabrous. Moreover, the stinging effects are, apparently, sometimes experienced without actual contact with the plant. I was one day walking through the hot, steaming forests near the Tista River, in British Sikhim, with a friend. The Laportea was abundant, and we carefully avoided it. On our way home my friend was seized with the peculiar stinging sensations of the Laportea in several parts of his body. These lasted several days, and on the night immediately after being stung became so bad that he was unable to get any rest and became feverish.

On another occasion I had to cut a survey line through dense forest with an undergrowth of *L. crenulata*. The coolies avoided the leaves as much as possible, and cut the stems low. Some of them were stung on the body, but all were attacked in different degrees with sneezing, violent catarrh, and ultimately vertigo. I myself, although at some distance from the actual cutting operations, though I had to walk up the cut line, suffered to a less degree in the same way. Yet I have often dashed a leaf across the back of my hand with no ill effects! Sir J. Hooker and others have noted that the effects are worse at some times of the year than at others. The inflorescence, it should be noted, is covered with hairs, and I have only been able to account for the facts above described by supposing that it is these deciduous hairs of the inflorescence which get into the clothes and become inhaled when the tree is shaken.

H. H. HAINES.

Camp, Central Provinces, India, March 24.

Fundamental Notions in Vector Analysis.

I SHALL be much obliged if you will kindly permit me, through the columns of NATURE, to make some suggestions regarding fundamental conceptions in vector analysis, a subject which was vigorously discussed in this journal about twenty years ago (NATURE, vols. xliii., xliv., xlvii., xlviii., xlix.). The discussion showed that the slow progress of vector analysis was in a large measure due to the want of unanimity as to its fundamental notions and notations, and to an unfortunate aspect peculiar to it, viz., a strong conviction on the part of the advocate of any one of the various systems of vector analysis, that the other systems, if allowed to grow, will do more harm than good, while it may be noticed that in our ordinary scalar analysis, although several systems (*e.g.* Cartesian, polar, pedal, trilinear, &c.) exist side by side, there is no such feeling. My object now is to suggest a system which, while it aims at a reconcilement between the various systems, will contain the best features of each of these known systems.

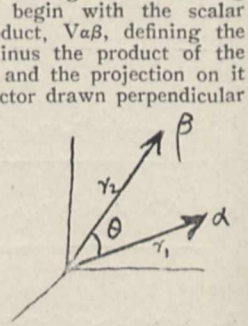
Dr. Knott (NATURE, vol. xlvii., p. 590) justifies the introduction of the quaternion as a fundamental conception by saying that it is only a generalisation to the case of vectors of the quotient (in the case of scalars) of two lengths. But a great objection is that the quaternion—a hybrid conception, in part a scalar and in part a vector—is not *by itself* capable of being defined in terms of the three fundamental entities, magnitude, direction, and position, as every *fundamental* conception ought to be. No such thing can, however, be said of the fundamental notions of the non-quaternionists, the scalar product and the vector product, which are defined in terms of only the fundamental notions of geometry and trigonometry. I may also repeat an argument of Prof. Gibbs (NATURE, vol. xlvii., p. 463) that the introduction of the scalar product and the vector product as fundamental conceptions will meet Prof. McAulay's observation (*Ph. Mg.*, vol. xxxiii. 1892, p. 477) that the arrest in the development of vector analysis is due to the circumstance that quaternions are "independent plants that require separate sowing and consequent careful tending." Besides, as is pointed out by Prof. Gibbs (NATURE, vol. xliii., p. 511), it is not desirable that the simpler conceptions should be expressed in terms of those which are by no means so. It is not sufficient to say, as has been argued (Heaviside, NATURE, vol. xlvii., p. 533), that vector analysis should have a purely vectorial basis: for that would only be a play of words.

Now, although the non-quaternionists thus avoid certain initial difficulties in presenting the subject, some of them, viz., Mr. Heaviside and Prof. Macfarlane, have made innovations which not only have no justification, but have created insuperable difficulties. We must have $\alpha^2=-1$, and we must recognise the versional character of the vector; the principles of vector algebra must differ as little as possible from the principles of scalar algebra, and we cannot be blind to the usual meaning of equations such as $ij=k$, &c., as was pointed out by Dr. Knott (NATURE, vol. xlviii., p. 148; vol. xlvii., p. 590). All these difficulties and others have arisen from an attempt to oust the conception of a quaternion, whether in the initial or at any later stage. So supreme is the contempt that Gibbs, while dealing with the theory of dyadics, regards $\alpha\beta+\lambda\mu+\gamma\nu$, a sum of expressions analogous to the quaternions, as indeterminate, merely symbolic, having physical meaning only when used as operator, although scalars and vectors are derived from it.

It is unfortunate that the advocates of vector analysis cannot work in harmony with one another, recognising superiority of each other in particular respects. Although Gibbs admits that the quaternionic method has advantages in certain cases, he would not tolerate its existence in the field of vector analysis, or rely upon it in places where he has found advantages.

With regard to the question of notations, I may refer to NATURE, vol. xlvii., p. 590, where Dr. Knott rightly says that the symbols used by the quaternionists for the scalar product and the vector product express at once and clearly the nature of the functions they represent, and that it is not proper to use the sign of ordinary multiplication in a case which does not admit of one of the factors being carried over to the other side as a divisor.

I shall now work out the successive stages of introducing the proposed system. We shall begin with the scalar product, $S\alpha\beta$, and the vector product, $V\alpha\beta$, defining the former as a quantity equal to minus the product of the length of one of the vectors, α, β, and the projection on it of the other, and the latter as a vector drawn perpendicular to the plane of the vectors, of a length equal to the area of the parallelogram determined by them, so that rotation round it from α to β through an angle less than 180° is positive. We see that we shall have



$$S\alpha\beta=S\beta\alpha,\quad V\alpha\beta=-V\beta\alpha.$$

Now if we take $\alpha=ix_1+jy_1+kz_1$

$\beta=ix_2+jy_2+kz_2$

we have, $S\alpha\beta=-T\alpha T\beta\cos\theta$

$=-T\alpha\times$ projection of $T\beta$ on α

$$=-\left[r_1.x_2.\frac{x_1}{r_1}+r_1.y_2.\frac{y_1}{r_1}+r_1.z_2.\frac{z_1}{r_1}\right]$$

$$=-(x_1x_2+y_1y_2+z_1z_2)$$

$V\alpha\beta=$ i (projection of area of parm. α, β on x plane)

$+j$ (projection of area of parm. α, β on y plane)

$+k$ (projection of area of parm. α, β on z plane)

$$=(y_1z_2-y_2z_1)+j(z_1x_2-z_2x_1)+k(x_1y_2-x_2y_1)$$

$$\therefore\ S\alpha\beta+V\alpha\beta=-(x_1x_2+y_1y_2+z_1z_2)+i(y_1z_2-y_2z_1)+j(z_1x_2-z_2x_1)+k(x_1y_2-x_2y_1)$$

$$=(ix_1+jy_1+kz_1)(ix_2+jy_2+kz_2)$$

$$=\alpha\beta.$$

We thus arrive at an auxiliary, $\alpha\beta$, connected with the fundamental notions by the relation, $\alpha\beta = S\alpha\beta + V\alpha\beta$, an auxiliary the geometrical meaning of which will be seen below.

We then note the special case $\alpha^2 = S\alpha^2 = -(T\alpha)^2$ so that $\frac{1}{\alpha} = -\frac{\alpha}{T\alpha^2}$. With the help of this relation, we shall assign meanings to $S\frac{\beta}{\alpha}$, $V\frac{\beta}{\alpha}$:

$$S\frac{\beta}{\alpha} = S\frac{-\beta\alpha}{T\alpha^2} = \frac{-S\beta\alpha}{T\alpha^2}$$

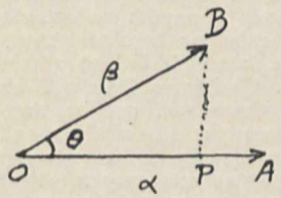
$$V\frac{\beta}{\alpha} = V\frac{-\beta\alpha}{T\alpha^2} = \frac{-V\beta\alpha}{T\alpha^2}$$

From these we have $S\frac{\beta}{\alpha} + V\frac{\beta}{\alpha} = -\frac{1}{T\alpha^2}(S\beta\alpha + V\beta\alpha)$

$$= \frac{-\beta\alpha}{T\alpha^2}$$

$$= \frac{\beta}{\alpha}$$

Apart from this, the following geometrical consideration will justify our introduction of the quotient and the conception of an operator :—



$$S\frac{\beta}{\alpha} + V\frac{\beta}{\alpha} = S\frac{-\beta\alpha}{T\alpha^2} + V\frac{-\beta\alpha}{T\alpha^2}$$

$$= \frac{T\beta . T\alpha \cos\theta}{T\alpha^2} + \epsilon . \frac{T\beta . T\alpha \sin\theta}{T\alpha^2}$$

where ϵ is an unit vector $+\perp$ to plane α, β

$$= \frac{T\beta \cos\theta}{T\alpha} + \epsilon . \frac{T\beta \sin\theta}{T\alpha}$$

$$= \frac{OP}{OA} + \frac{PB}{OA} = \frac{OB}{OA} = \frac{\beta}{\alpha}$$

We have *now*, but not earlier, the conception of our auxiliary, whether the product $\alpha\beta$ or the quotient $\frac{\beta}{\alpha}$, as an operator turning one vector into another, the former β^{-1} into α and the latter α into β; this would, as usual, justify our calling by their old name (quaternion) these auxiliaries which we have here *obtained from* our fundamental conceptions, the scalar product and the vector product. We may now proceed further and introduce into our system the conception of the axes and the angle of a quaternion. We may, and as a matter of fact shall, use the quaternion whenever we find it expedient, but we must not make it our fundamental notion.

In view of the diversity of opinion shown above, some modification and reconcilement on the lines suggested above or on some other lines are absolutely necessary, if the advocates of vector analysis are earnest in their desire to see it universally applied, and the Cartesian and other methods completely overthrown.

MAUMATHA NATH RAY.

Calcutta Mathematical Society, Senate House,
March 2.

This method of approach to the quaternion vector analysis is practically that adopted by Prof. Joly in his "Manual of Quaternions." The method is unsatisfactory, because it makes too great a demand at the outset upon the learner's faith. Why should $S\alpha\beta$ be put equal to $-ab\cos\theta$? The answer is, of course, because that is the simplest way of getting a vector algebra applicable to Euclidean space, and at the same time associative in its vector products. But the existence of so many varieties of non-associative vector algebra shows how absolutely unimportant this latter consideration is to many who find vector analysis useful. In these varieties not only is there no explicit recognition of a quantity $\alpha\beta$, where α and β are vectors, but there is a perfect hatred of the mere suggestion of it as a quantity worthy of general discussion, except (be it noted) in the particular case in which α is perpendicular to β. Mr. Ray shows, by a simple Cartesian process, how easily we may arrive at the recognition of this product if we start with the geometrical definitions of Hamilton's $V\alpha\beta$ and $S\alpha\beta$. But the method is unconvincing to the man who prejudges the whole matter by barring out the quantity or symbolic form $\alpha\beta$ as being fundamentally foreign to any well-regulated system of vector analysis! If they would not listen to Hamilton, Tait, or Joly, will they listen to any other quaternionist, charm he never so wisely?

C. G. K.

An Abnormal Zebra.

IN reference to the note by Prof. Ridgeway on a photograph of a zebra, or boute-quagga, skin from the Athi Plains of British East Africa, published in NATURE of April 20, I write to say that a copy of the same photograph was received at this museum from Mr. Woosnam.

As I have mentioned in a note in *The Field* of April 22, Mr. Woosnam stated that there were only one or two of such abnormally marked animals running in a herd of *granti* at any one time. It is therefore clear that there is no ground for regarding the variation as of racial value. On this point Mr. O. Thomas, to whom the photograph was sent by Mr. Woosnam, is in complete accord with myself.

R. LYDEKKER.

British Museum (Natural History), Cromwell Road,
London, S.W., April 24.

A Robin and his Young.

LAST summer a pair of robins built their nest in an old fish-basket that was hanging in a shed at the back of my house. All went well until the young birds were about a week old—then happened what appeared to me to be a catastrophe. My Aberdeen terrier pup "Bebe," who must have had some natural desire to catch the mother bird, managed one morning to make a meal of her.

Contrary to what I should have expected, the male bird kept close to his young family. Day by day I turned over part of the garden to supply him with a little help in his task. In due course he taught the whole of his young family to fly.

I have made inquiries, but cannot find anyone who has had a similar experience, and wondered what your readers might know about such cases.

CHARLIE WOODS.

"Vectis," 2 Wellmeadow Road, Lewisham, S.E.,
April 18.

PROPOSALS FOR THE REFORM OF THE CALENDAR.

THE importance of a uniform and simple calendar is not a question which affords any ground for dispute. Whether regarded from the point of view of the chronologist, striving to evolve order out of regnal years and intercalary months, or from that of a business man in Cairo, transacting affairs with clients who adhere severally to the Moslem, the Coptic, the Hebrew, the Julian, and the Gregorian calendars, the diversity of system from time to time, from place to place, and between creed and creed, is an exasperating and unmixed misfortune. The New Year festival is celebrated by the motley races which go to make up the population of Singapore on dates which extend over several months. In Constantinople, until quite recently, even the division of the day was a source of grave inconvenience, since the day ended at local sunset. The persistence of such anomalies shows how hard is the way of the reformer. Tradition and religious scruple, and even the mere inertia of custom, are leagued against him. From the point of view of the whole world, a far greater advance would be made by any large step towards the adoption of one universal calendar than by making small theoretical improvements in a par-

ticular system, however important that system may be. Whatever happens, it is certain that the Gregorian calendar in its main features will survive. For this reason alone its reform is not to be lightly undertaken. A universal appeal can only be based on fixity of tenure as a necessary condition. The French Republican calendar should at least be useful as an awful example. Even the Chinese are considering the advisability of eliminating the lunar element from their calendar and following European practice. Hence changes in our calendar can only be admitted after their necessity has been absolutely proved, and then only with the utmost deliberation. It is not a matter in which a false step can be easily retraced.

It is an unfortunate fact that a calendar of ideal simplicity is precluded by the nature of things. Much difficulty would have been avoided had the tropical year, the synodic month, and the mean solar day been commensurate periods of time, and if, moreover, the number of days in a year had contained certain simple factors. With the Julian calendar, it is true, the lunar month has been placed out of consideration. But the week remains as a fundamental unit of time in human affairs. If only the year had contained 336 days, absolute simplicity would then have been attainable. We should then have had four equal quarters of three months each, each month containing exactly four weeks. As things are, we must be content with something less simple, and, even so, commensurability between the year and the week can only be obtained by placing one day (or two days in the case of leap year) outside the ordinary run of the calendar. This is the suggestion of Mr. Philip, of Brechin, who has proposed that the first day of the year should be thus set aside under the name of New Year's Day, while in leap years a second day of the same kind should be intercalated between the months of June and July. The idea is not, of course, original in principle, for it was used by Auguste Comte in a slightly different way, and has been attributed to Littré. It offers the only means of avoiding a change in the calendar from year to year, and is to this extent attractive. But it has the great disadvantage of introducing discontinuity at the very point where continuity has been preserved in the face of many other changes. The week can boast a most ancient lineage, uninterrupted by the slightest break. Prejudice in its favour must be anticipated, and weighty reasons must be adduced if this feeling is to be overcome.

It has already been pointed out that nature is greatly to blame for not having given us a year of exactly 336 days. Even when the one or two inconvenient extra days have been specially provided for, there remain over just 28 days, and it is in the disposal of these that the calendar reformers have expended their ingenuity. Comte's plan was simply to form them into a thirteenth month, with the extra days at the end of the year. Apart from the peculiar nomenclature in which his philosophy found expression, it is far from clear that this plan has been improved upon by contemporary reformers. The only drawback seems to lie in the introduction of an extra month, and in the fact that a quarter must contain three months and an additional week.

Another proposal is that of Mr. T. C. Chamberlin, which was fully described in these columns (February 2). This consists in dividing the 28 days into four special weeks placed at the end of each quarter. That this scheme should appear rather crude is not unnatural, and to this extent stronger support may be expected for a plan proposed by Mr. John C. Robertson at the fourth International Congress of Chambers of Commerce held in London in June of last year. This would incorporate the extra weeks in each third month, so that each quarter would consists of three months, containing respectively 28, 28, and 35 days. In this way each month would begin with a Sunday, but it is far from certain that the advantage thus gained would be generally regarded as a fair equivalent for the patent disadvantage involved in the disparity between the months. It would appear that approximate equality was more important in the months than in the quarters.

This consideration seems to have had weight with those responsible for the Calendar Reform Bill presented to Parliament by Mr. Robert Pearce. The Swiss Government, at the instance of the London Congress of Chambers of Commerce already mentioned, has invited an international conference on the subject of the calendar, a proposal now receiving the attention of the British Government, and the Bill is intended as a basis for imperial conference. It is proposed to divide the reduced year of 364 days into four similar quarters, each containing three months of 30, 30, and 31 days respectively. With twelve months no better approach to equality is possible. Moreover, the calendar becomes fixed, in the sense that any given date will fall on a particular day of the week, *e.g.* Christmas Day will always be on a Monday. But there will not be that simple correspondence between the day of the month and the day of the week provided by the other schemes. In practice it will be just as necessary to consult an almanac as at present, and the only difference will be that the almanac will be the same for every year. Is this an appreciable benefit? Almanacs are so common, and so often distributed gratuitously, that few people would probably feel the change from year to year, were it not for a circumstance which has purposely been left for separate consideration. As a matter of curiosity, it may be noted that the Royal Academy of Sciences at Stockholm receives a considerable income from a monopoly in the sale of almanacs.

The circumstance just alluded to is the varying incidence of Easter. Owing to the public holidays associated with this festival, and for other reasons, the desire for a fixed date has been very generally felt and often expressed. The Western Church has followed the ecclesiastical moon as defined by the Council of Nice, and the time seems ripe for removing this last remaining vestige of a lunar cycle from our calendar. It is understood that the Pope has raised no objection to this being done, and it is not to be supposed that the other churches concerned will prove "katholischer als der Papst" in this matter. The German Reichstag will be asked to pass a resolution in favour of the appointment of a definite Sunday on which Easter shall be celebrated. The Bill before Parliament proposes that April 14 shall be Easter Sunday. The fixing of this festival is an integral part of the schemes described above for reforming the calendar, and will engage the attention of the diplomatic conference proposed by the Swiss Government. The precise date must be fixed by international agreement, and the mere verbal definition of the date will naturally be facilitated if a fixed calendar has been previously adopted. But the two questions are essentially independent, and Easter can be fixed with all the precision required for practical purposes without any change in the present calendar. Thus if Easter were defined as the Sunday following April 10, it would never be more than three days from April 14, and would fall automatically on the latter date if the scheme now before Parliament were afterwards adopted. But other dates will probably be suggested for consideration.

The internal arrangement of our calendar is in the

nature of things a compromise, and the divergence between the schemes which have been brought forward proves that the reformers are by no means of one mind. The ordinary man does not seem impressed with the necessity for a change. It is alleged that the business man feels some inconvenience, but the English accountant would surely gain far more benefit from a decimal currency than from a fixed almanac. Meanwhile the Board of Trade is very properly taking steps to learn the opinions of the merchants and traders of the country.

It is, of course, mere child's play to invent a calendar. The objection to interrupting the consecutive run of the weeks must be strongly felt. One wonders therefore that none of those who appear to be so much impressed with the advantage of subdividing a year of 364 days have not, so far as we are aware, suggested another plan for getting rid of the superfluous days. This could be done by using the week instead of the day as the unit of intercalation. We begin by allotting 364 days to the common year. We then add at the end of every fifth year (the date ending with 0 or 5) a special "leap" week. This in itself would make the year on the average too long. We therefore omit the "leap" week every fifty years, when the date ends in 25 or 75; and, further, we omit the week at every century which is divisible by 4 (the reverse of the Gregorian rule). The result is to add 71 weeks or 497 days in 400 years, thus making the average length of the year 365·2425 days, or exactly the same as the mean Gregorian year. The special week would probably be found a nuisance, but it would only come once in five years, and it has been seriously proposed to introduce four such weeks into every year! Of course, under this plan, the date of the equinox would wander eight days on either side of the mean date. At the sacrifice of simplicity it would be more correct to intercalate eleven weeks in each successive period of 62 years, at the intervals:

6,6,5, 6,6,5, 6,6,5, 6,5 years.

By this rule the equinox would be kept within four days of a given date, while the mean length of a year would be slightly more accurate than in the Gregorian system. Such a variation from the mean date would not be likely to constitute a practical objection. The idea, however, is only suggested in order to illustrate the unexhausted possibilities which lie before the would-be calendar reformer. H. C. P.

THE UNVEILING OF NUBIA.[1]

LESS than four years ago practically nothing was known of the true history of that stretch of the Nile Valley, immediately above the First Cataract, which is known to us to-day as Nubia, beyond a few ancient Egyptian stories of raids and conquests, and the tales, often enough fantastic and unreal, of Greek and Roman tourists. In one brief winter's work (1907–8) Dr. Reisner and his collaborators have changed all that. For they have recovered from the soil of Nubia the materials for reconstructing the main phases of the history of that country's strange vicissitudes during the last fifty centuries, as well as a great mass of precise information concerning that crucial period in her evolution, when, about twenty-seven centuries before the Christian era, she began to lag behind Egypt and take her own wayward course, which earned for her the ancient byword "wretched" Nubia.

It has now been demonstrated that in predynastic times, *i.e.* before Upper and Lower Egypt became united under Menes, the first king of the first dynasty (*circa* 3400±100 B.C.), and until the end of the third dynasty (*circa* 2700 B.C.), Egypt and Nubia were culturally (and, as is shown in vol. ii. of this report, racially also) one territory; but, from the time roughly corresponding to the beginning of the period of the Pyramid-builders in Egypt, the histories of the two countries began to diverge the one from the other, Egypt advancing by rapid strides towards national greatness and the attainment of her highest artistic and architectural triumphs; while Nubia was not able even to maintain the old standard of archaic culture, for her people lost their cunning at the same time that their racial purity became tainted with negro blood.

In the time of the Middle Kingdom (*circa* 2000 B.C.), when Egypt for a second time was raised on the crest of a wave of prosperity, Nubia also felt the same influence, and began to exhibit marked signs of progress and the attainment of a distinct individuality; then for the first time her people began to manufacture wares that were not merely inspired by Egypt or imitations of Egyptian workmanship, but deserve to be called Nubian. And if it be admitted that the Nubian arts and crafts show obvious traces of their derivation from the archaic Egyptian, it is also clear that they were developed in a manner strikingly different from those found in Egypt in dynastic times. In the first products of these distinctively Nubian arts we can detect, as also in the remains of the people who made them, an underlying stratum of predynastic Egyptian influence, modified by negro admixture, but evolved in a manner quite distinctive of and confined to Nubia.

Egypt and Nubia each went its own way and evolved along the distinctive lines they had respectively chosen, until a time shortly before the inauguration of the New Empire in Egypt. The passing of Egypt under the sway of the Asiatic Hyksos domination had the effect of driving many Egyptians into voluntary exile in Nubia; this led to a displacement of the Nubian population southwards; characteristic Egyptian graves, containing Egyptian wares and the remains of Egyptian people, made their appearance in Nubia at this time; and evidences of Egyptian occupation of the country were abundant throughout the period of the New Empire.

But when Egyptian power began to wane, the Nubians came into their own once more; but as they returned from the south strangers accompanied them, and, ever after this event, from time to time there were incursions of aliens into Nubia; sometimes tall, Dinka-like negroid warriors, with their own distinctive burial customs; later still, Egyptians of the Ptolemaic and Roman periods occupied Nubia and left the characteristic evidence of their stay in the country, as well as the bodies of criminals of non-Nubian type—perhaps the notorious Blemmyes of the Eastern desert, the mysterious people to whom the classical writers so often referred—whom they had executed; then again, in the early centuries of the Christian era, but before the introduction of Christianity into Nubia, another group of Negroes came north into Nubia, and in the graves of their dead buried their own distinctive pottery, which is neither Egyptian nor Nubian; and in Christian times aliens from Syria and western Asia took refuge beyond the First Cataract.

Nubia was ever a poverty-stricken land; to add to her natural disabilities, her geographical position rendered her liable to be overrun by all these alien hordes, and made her the meeting-place of Egyptians and Negroes and the cockpit where they fought.

[1] "The Archæological Survey of Nubia. Report for 1907–8." Vol. i., Archæological Report. By Prof. G. A. Reisner. Pp. v+373+330 text-figures. Plates and plans to accompany vol. i. Pp. 24+73 plates+xxx plans. (Cairo: National Printing Department, 1910.) Price 2 l.e.

This distressful country well earned her ancient title, "wretched Nubia."

In the report of the archæological survey of Nubia there is presented a complete and impartial description of all the historical material thus rescued from the soil, critically sifted, arranged in chronological order, tested by Egyptian criteria, and explained and interpreted.

But in this volume Dr. Reisner has done something more than recover the lost history of Nubia, wonderful as is such an achievement in one short season's work, for he has also given the first adequate and trustworthy account of the earliest stages in the evolution of Egyptian civilisation. It is true that this has often been attempted by other writers: but in all cases fact has been so interwoven with fancy that the pictures painted have been more or less distorted travesties of the truth. Dr. Reisner's report will ever remain a storehouse of accurate information concerning the springs of Egyptian civilisation, and a work of fundamental importance to all students of the beginnings of culture in other lands.

FIG. 1.—The aspect of Nubia near Dabod during the inundation by water held up by the Aswan Dam. From "The Archæological Survey of Nubia."

In the preface to this volume Captain H. G. Lyons, F.R.S., formerly director-general of the Egyptian Survey Department, now lecturer in geography at Glasgow University, explains why this survey was undertaken, and describes the measures adopted to make it as thorough and searching as possible; but he does not tell the reader that to him belongs the credit of initiating and organising the excellent plan of campaign in Nubia.

When Captain Lyons was entrusted with the task of arranging for carrying out the proposed survey, he was singularly fortunate in securing probably the only archæologist competent (in the sense that his training and experience specially fitted him to cope successfully with the tangled problems of Nubia) to bring the work to the triumphant issue presented in this report. This is no mere idle compliment to Dr. George A. Reisner, assistant professor of Harvard University, who was chosen for this work; for he had a far more exact and intimate knowledge and experience of digging in Egypt such sites as were of crucial importance in Nubia, and had learnt thereby to appreciate the fine distinctions that enabled him to discriminate between archaic burials closely related in time, the one to the other, and to realise the early stages in the divergence between Egyptian and Nubian burial customs before they became obtrusive. It was the possession of this special knowledge that determined the issue in Nubia; and no impartial observer can deny that Dr. Reisner was the man most highly qualified to undertake this work.

No one who was privileged to witness the excavation of the first site dug in the course of this survey (see chapter iv.) can fail to realise the enormous difficulties that had to be overcome before even the alphabet of Nubia's history could be read, and that these difficulties were eventually resolved only by the employment of the most rigorous scientific methods and painstaking analysis of a complicated mass of data, and by the command of an exceptional knowledge and experience to explain them.

In the vast plain surrounding the southern terminus of the Egyptian railroad at Shellal there had been buried the remains of people who had died at every historic period during the last fifty centuries, not only in graves of known Egyptian forms, but in a variety of then unknown Nubian and Sudanese types. Every kind of confusing element was present to complicate the problem: cemeteries of one period intruded in those of earlier date, so that graves of the most varied periods and peoples were apparently inextricably intermingled; the results of the plunder-

ing of graves, both in ancient and modern times, added to the confusion; and the denudation of the plain by the forces of nature in ancient times had destroyed many, and seriously damaged still more, of the graves. The failure to reduce this chaos to order would have gone far to sterilise the essential work of the survey. The results obtained at Shellal gave Dr. Reisner at the outset the whole history of Nubia in epitome; and all the work since accomplished farther south during the last three years has confirmed the accuracy of the conclusions drawn from the study of "Cemetery vii.," while filling in the details of the story that it summarised.

One of the factors that greatly enhances the significance of this report cannot be appreciated without some reference to Dr. Reisner's work before the Nubian survey began. After acquiring a knowledge of Oriental work in Harvard University, he had studied Babylonian and Egyptian philology and archæology, and contributed to the work of cata-

Dynastic Cemeteries of Naga-ed-dêr, I.," by Reisner, 1908, and "II.," by Mace, 1910). It is this fact that renders the Nubian report of such importance, for in the remarkable chapter vii., Dr. Reisner draws aside the veil from his vast storehouse of knowledge of Egypt's archaic civilisation, and gives us more exact and detailed information of the pre- and proto-dynastic periods in the Nile Valley than has hitherto been published.

Another important factor that contributed in no small degree to the success of the Nubian excavations was the systematic training which Dr. Reisner's native workmen had received during their nine years' association with him in Egypt; each man had learned to do his allotted task as a matter of habit, and each became a specialist in some branch of the work, such as prospecting for sites, excavating, cleaning graves without touching or disturbing their contents, and doing all the routine work of making a complete photographic record of every stage of the survey. In

FIG. 2.—The earliest distinctively Nubian pottery. From "The Archæological Survey of Nubia."

loguing the collections in the Berlin and Cairo Museums; then in 1899 he began excavating in Upper Egypt as head of the Hearst Expedition of the University of California, and in 1903 at the Giza Pyramids, at first for California, but later, from 1905 onward, for the Harvard University and the Boston Museum of Fine Arts.

During these years, 1899–1907, he and his collaborators, Messrs. Lythgoe and Mace, had devoted the whole of their time and energies to the detailed and critical study of remarkably complete series of burials of the predynastic and early dynastic epochs, in the course of which they were able to sweep away a lot of myths concerning the practices of the early Egyptians, which the fertile imaginations of other explorers had created, and to piece together, bit by bit, the accurate information they themselves laboriously gathered. Unfortunately this expedition was so busily engaged in collecting information that its members found time to impart only a very small fraction of their rich harvest to the public ("The Early

chapter ii. Dr. Reisner describes these methods, and in the magnificent volume of plates—in itself one of the completest records of archæological research ever issued—will be found ample evidence of the skill displayed by these illiterate Egyptian boys in the practice of the art of photography and the no less difficult task of systematic scientific excavation.

In the work of excavation and the examination and recording of the results, Dr. Reisner was assisted by Mr. Cecil M. Firth and Mr. A. M. Blackman. The major portion of this report consists of their detailed and impartial record of every fact brought to light in the course of their work, illustrated by an exceptionally complete series of photographs and hundreds of text-figures. These results are presented in such a form that anyone who wants to draw his own inferences has all the facts presented to him without bias.

In the last three chapters there is a masterly summary of all the evidence acquired during the first season's work in Nubia, arranged and classified, and

compared with the collateral data obtained in the course of Dr. Reisner's work in Egypt.

In an appendix Mr. W. H. Crosthwaite describes the topographical work carried on by himself, Mr. T. D. Scott, and Mr. G. W. Murray, and their maps, printed in the Survey Department, appear in the volume of plates.

There are complete lists of cemeteries excavated, graves, objects found, and an index.

This report deals only with the first season's work. During the second season Dr. Reisner had to relinquish work in Nubia in order to take charge of excavations in Samaria and at the Giza Pyramids; but the first winter's work proved to be so illuminating that Dr. Reisner was able to hand over to Mr. Firth, who succeeded him, a knowledge of the history of Nubia, which has amply been confirmed at each new site. This winter the survey will reach Korosko and be brought to a conclusion.

When the final results are published the Egyptian Government may congratulate itself on having provided the means for completing the most thorough archæological examination of such an extensive tract of territory, as Lower Nubia is, that has ever been undertaken.

It only remains to express the hope that the unique collection of antiquities collected with such infinite care and skill, and constituting a tangible record of the history of Nubia, will receive the treatment they deserve.

G. ELLIOT SMITH.

GERMANY AND THE PROTECTION OF NATURE.

THE German intellect has a wonderful turn for organic science. Its achievements in this sphere are admittedly unrivalled, and the workers may be counted by the thousand. Such names as Hofmeister, Haeckel, Virchow, Weismann, Sachs, Pfeffer, and Verworn are only a fraction of one per cent. of the list. Consider, for instance, the contributions to a single department, as shown annually in Just's "Botanische Jahresberichte." The typical English attitude, on the other hand, to nature, and especially to organic life, is hardly that of sympathetic study. It may rather be described as amused, or patient, condescension. This patronising habit receives its only modification in the case of "sporting" animals, or the more spectacular birds and mammals; and these are but the materials for a "show," *pour passer le temps*. The Press pours out a flood of "nature books," as the factories pour out toys, to amuse the children. Popularisation is the curse of the age. An up-to-date book on any branch of organic science is not to be found. Instead of a regular issue of sane, scientific accounts of progress, we have outlines for the use of schools, or productions the aim of which is the titillation or excitement of the unintelligent by means of the illustrations, if it cannot be done by the text. Work that does count appears not more often than once in a decade. It is consequently soon out of date. Such books, moreover, are generally too encyclopædic, and their allocation to different departments is far from being scientifically impartial. The various meanings of the term "nature" supply a most interesting study: a corollary may be found in the meanings of the term "natural history." If so vague and obsolete a term is still to be used it should connote the science of all nature, as did the good old phrase "natural philosophy."

The practical English instinct also wastes much energy in exploiting the principle of "design" in nature, and in exercising the habit of "drawing a moral." But it is really far more practical to confine the attention to the mechanism of the phenomena, and to leave teleology to metaphysics. Here, and in other matters relating to the study of nature and to the practical application of science, the German intellectual habit can give us a lesson.

It is refreshing to see a great scientific, and veritably practical, movement carried on without any pandering to amusement, pedagogy, or sentimentalism about "nature." This is distinctly the character of the scheme, the progress of which has frequently been noted in these columns, to preserve the natural monuments of Germany. The term comprises the humblest lichen no less than human monuments, such as the Porta Westfalica.

In Prussia the scheme is highly organised and is a State department. Here we see the cooperation of what we should call municipal and district and county councils with, practically, every man of science in the province, and every voluntary society or association. The German Emperor is patron of the committee for the Hohenzollern district. Every square mile of the country is investigated; when anything approaching a "centre," whether geological or ecological, or even for one characteristic species of animal or plant, is found, that centre receives State protection. The protection, it is well to note, is efficient. The maps printed in the first volume of the "Beiträge" show a remarkable list of such centres reclaimed for nature from man.

This volume of 500 pages records the work done in Prussia during the last five years. The editor, Dr. H. Conwentz, has from the commencement been the moving spirit of the scheme, and he is to be congratulated on a remarkable record of success. But, as we have tried to show, the ultimate factor in this success is the German scientific spirit, which here has the advantage of cooperating with patriotism. It will deserve still more of humanity if its example in this matter is able to inspire other countries.

A large proportion of the volume is occupied by reports, now collected, which were noticed in NATURE on their first appearance. The most noteworthy of the new matter is a long and very interesting account of the parallel movement in Denmark, with which the distinguished botanist, Prof. E. Warming, has had much to do. Even a country like Denmark is full of interesting centres of wild nature. The protected colony of *Sterna anglica* is particularly noticeable. The lengthy report of the second conference for *Naturdenkmalpflege* in Prussia, held at the end of 1909, reveals a remarkable combination of enthusiasm and organisation. What especially appeals to us in the whole scheme is its thoroughness and comprehensiveness. We read of a score of "bird reservations," and we find that the protection is more than a mere name. We also read—and to the English mind it reads very strangely—of State-protected wild flowers. Of protected landscapes, "beauty spots," Prussia has about forty: bits of geological interest number, so far, about thirty. What are significantly styled the "remains" of the plant-world and the animal-world are fairly numerous, but we should suppose the lists to be capable of considerable extension. The foreign reader may desiderate the Latin name in every zoological and botanical species cited. This is not always given, and the disentangling of identity from popular German terms is not easy.

[1] "Beiträge zur Naturdenkmalpflege." Edited by Prof. H. Conwentz. Erster Band. Pp. xi+510. (Berlin: Gebruder Borntraeger, 1910.) Price 10 marks.

A very precarious but highly interesting operation is that of assisting the development and propagation of wild creatures and wild plants in their natural homes. Some observations have been made on the subject now and again, and a few isolated experiments are on record, already suggestive of remarkable correlations between development and environment. The principles behind such correlations are wide reaching, and, as ecology has begun to show, of great practical importance. In due course, no doubt, the German scheme will include such experiments, care being taken to prevent that very easily obtained result, the absolute extinction of a species.

A. E. CRAWLEY.

THOMAS RUPERT JONES, F.R.S.

BORN in Wood Street, Cheapside, on October 1, 1819, Rupert Jones, after a long and eminently useful geological career, passed away in his quiet retreat at Chesham Bois on April 13, in his ninety-second year. His father, a silk merchant and throwster, had business premises in Taunton as well as in London, and Rupert Jones spent his early years in Somerset, receiving school education at Taunton and Ilminster. There the fossiliferous beds of the Lias attracted his attention, and the bent of his mind was directed towards science rather than commerce. In 1835 he was apprenticed to a surgeon at Taunton, and he completed his service at Newbury. Geology absorbed all his spare time, and many of his early observations in the neighbourhood of that Berkshire town were published in a pamphlet in 1854. After 1842 Rupert Jones was engaged for some years, chiefly in London, in medical practice. Familiar with the use of the microscope, he applied it with signal success to the study of fossil microzoa. His researches now brought him into contact with William Harris, of Charing, who had gathered a fine collection of Chalk fossils, including the minuter organisms. That geologist also possessed a daughter who became the first wife of Rupert Jones.

In 1849 his monograph of the Entomostraca of the Cretaceous formation of England, his earliest important work, was published by the Palæontographical Society. In the following year he was appointed assistant secretary to the Geological Society of London at Somerset House, where his ability and precision were shown in the editing of the society's quarterly journal. Ever busy, he edited during the years 1854–58 the last editions of Mantell's "Geological Excursions round the Isle of Wight," "Medals of Creation," and "Wonders of Geology." He likewise prepared for the Palæontographical Society further important monographs on the Tertiary Entomostraca (1856), and on Fossil Estheriæ (1862). In 1858 Rupert Jones was appointed lecturer on geology at the Royal Military College, Sandhurst, and four years later professor, when he resigned his post at the Geological Society, and removed to Farnborough, in Hampshire. In association with Dr. Henry Woodward he edited the first two volumes of *The Geological Magazine* in 1864–65, and among other works edited the "Reliquiæ Aquitanicæ" of E. Lartet and H. Christy (1875), and the second edition of "Dixon's Geology of Sussex" (1878).

His special studies were not neglected. He contributed to scientific societies and journals numerous original articles on recent and fossil Foraminifera, and Entomostraca (Ostracoda and Phyllopoda), subjects on which he came to be recognised as the leading authority in this country. Much work, moreover, was done in conjunction with his friends, W. K. Parker, H. B. and G. S. Brady, Henry Woodward, J. W. Kirkby, and others. Thus he received aid in the preparation of the monographs on the Foraminifera of the Crag (1866–97), and on British Carboniferous Entomostraca (1874–84). In 1880 Prof. Jones retired to London as the special teaching of geology at Sandhurst was then abandoned by the military authorities.

His interests extended over a wide geological field, and he had a profound knowledge of the literature. South African geology especially attracted him. In later years he gave much attention to the antiquity of man, and wrote on the plateau implements in 1894. Of sturdy build, though below the average height, he was of a cheery disposition, prone to jocularity, but ever ready to give earnest help to others. Proof-correcting he regarded as one of his recreations. Prof. Jones was elected F.R.S. in 1872, and the Lyell medal was awarded to him in 1890, by the council of the Geological Society. He was president of the Geologists' Association in 1879–81, and president of the Geological Section of the British Association at Cardiff in 1891.

H. B. W.

NOTES.

A MOST important discovery in regard to the existence of man in early Pleistocene or Pliocene strata has been made by the Marquis of Cerralbo in Spain. In the alluvial deposits of the River Jalon, which is an affluent of the Guadalquiver, he has discovered very abundant remains of undoubted *Elephas meridionalis* in contact with well-characterised implements of human workmanship of the proto-Chellean type. Photographs of the specimens and of the cuttings in which they occur have been received from the Marquis in Paris, and Prof. Marcelin Boule left Paris in Easter week in order to examine the site and the specimens. It is possible that *E. meridionalis* may have survived in the south of Europe from Pliocene into early Pleistocene times, but the association of implements of human workmanship with this early species of elephant is altogether new. This discovery tends to confirm the truth of Mr. Moir's contention that the admitted proto-Chellean flint implements discovered last year by him in Suffolk, and exhibited at the Geological Society in the autumn, are really anterior to the Red Crag deposit beneath which they occur. It is to be hoped that Mr. Moir will soon publish an illustrated account of his discovery.

A VERY interesting expedition is about to visit the neighbourhood of Astrakhan. It consists of a party of trained medical observers, provided with all appliances for research, organised in Paris, and under the personal direction of Prof. Elie Metchnikoff. The object of the expedition is two-fold. It will study the history of the endemic foci of plague in the neighbourhood of Astrakhan. The cause of the repeated outbreak of plague in this region, which although usually on a small scale is of almost regularly annual occurrence, will be investigated in the light of our present knowledge of the relation of rat-like animals and fleas to plague. A second object is to investigate the causes of the singular difference of susceptibility to phthisis presented by the Calmuck Tartars and the Russian town population. It appears that the Calmucks when living their usual nomadic life in tents are free from phthisis, yet when young Calmucks (semi-adult) are brought into the towns to be "educated," they invariably contract phthisis and die. What is the reason of the less susceptibility of the Russian town population? Is it due to immunity conferred by other microbes than that of tuberculosis which have escaped detection hitherto, and

are not present in the Calmuck communities, though regularly infecting and "immunising" the Russian town-dwellers in childhood?

THE death is announced of Dr. A. J. M. Bentley, distinguished by his knowledge of tropical diseases and as the author of "Beri Beri, its Etiology, Symptoms, Pathology, and Treatment."

THE death is announced, at sixty-six years of age, of Dr. B. S. Ringer, formerly medical officer to H.B.M. Consulate-General and the Chinese I.M. Customs, Canton, China, and the discoverer in Formosa of a parasitic worm known as *Distoma ringeri*.

THE Astronomical Society of France has just elected the following officers:—President, M. P. Puiseux, astronomer to the Paris Observatory; vice-president, Prince Roland Bonaparte; general secretary, M. Camille Flammarion; secretary, M. Jean Mascart; and treasurer, M. Maurice Ballot.

THE Christiania correspondent of *The Times* states that on April 20 a Bill was brought forward providing for the necessary grant for wireless telegraphy stations at Hammerfest and Spitsbergen. The Spitsbergen station will be kept open all the year round, and will be in charge of three or four men. The distance from the Hammerfest station is 750 miles.

A FUND has been opened for the purpose of presenting a testimonial to Mr. Henry Keeping, who has been for fifty years curator of the Geological Museum, Cambridge, and is now retiring from active work. There are probably many who will welcome this opportunity for expressing their appreciation of Mr. Keeping's long service in the cause of geology. Subscriptions should be sent to Mr. F. R. Cowper Reed, Sedgwick Museum, Cambridge.

A NEW system of wireless inductive telephony was inaugurated at Stratford-on-Avon on Thursday last, when Mr. H. von Kramer's "railophone" was tested on a train belonging to the Stratford-on-Avon and Midland Junction Railway. Two large frames—or coils—of wires are attached to the carriages, one being used for despatching messages and the other for receiving same. By means of induction between these coils and a wire running along by the side of the metals, but some distance away, and connected to instruments in the signal-cabins, messages can be received and despatched whilst the trains are in motion or standing. The test was successfully carried out, and a party of journalists and others were conveyed in the train for several miles, receiving or sending messages whilst *en route*. Eventually it is proposed to connect up the signal-cabins with the general telephone and telegraphic systems, thus making it possible to send and receive messages and telegrams to or from places far away from the railway whilst still in the train.

NEWS of Captain Amundsen's Antarctic Expedition has been brought by Captain Nilsen, commanding the *Fram*, which arrived at Buenos Ayres a few days ago. It appears from a Reuter message that Captain Amundsen arrived in Antarctic regions on January 14, and the ship dropped anchor safely close to a comparatively elevated coast. Camp was established on a hill near where the *Fram* was moored, and preparations were begun for a journey to the Pole. The *Fram* sailed on February 14, before Captain Amundsen had started for the south. In a few weeks the vessel will leave Buenos Ayres for scientific work during a voyage between Africa and South America, and will then return to Buenos Ayres to renew her stores. Captain Nilsen expects to be able to leave Buenos Ayres on October 1 in search of Captain Amundsen and his party.

THE death is announced of M. Edouard Dupont, director of the Royal Museum of Natural History in Brussels, and well known for his researches in many departments of geology. An appreciative notice by M. Cornet appears in *Le Mouvement Géographique* for April 9. M. Dupont was born at Dinant on January 31, 1841, and died at Cannes on March 31 of the present year at the age of seventy. His work in connection with the preparation of a geological map of Belgium is well known in the British Isles, and the complete skeletons of Iguanodon, discovered in the clays of Bernissart, were set up in the museum in Brussels under his care. While the palæontological collections were extended through his personal studies, he paid attention also to the stratigraphical conditions under which the rocks of Belgium were laid down. His researches were especially directed to the Carboniferous Limestone, in which he recognised a coral-reef type and also calcareous fragmental deposits of a pelagic character. In 1887 he made an expedition at his own expense to the Congo territory, the results being published in a book entitled "Lettres sur le Congo," in which geological, botanical, and anthropological observations were happily combined.

THE experiments of Mr. Glen Curtiss with his hydro-aëroplane have culminated in the production of a machine capable of running over land and travelling on the water with the same facility with which it rises from either of these elements into the air. His original model was fitted with two floats, a water-shield, and a large pontoon, but in his latest production only a single pontoon is used. This pontoon is rectangular in plan, 12 feet long, 2 feet wide, 1 foot deep, and 50lb. in weight. Its under surface curves up to meet the upper surface 3 feet from the front edge; similarly, its upper surface curves down to meet the under surface 3 feet from its rear edge. The aëroplane itself is of the usual type of Curtiss biplane, and carries under each extremity of the lower plane a skid, 4 feet long, to prevent the plane tips touching the water when turning upon it. Wheels are fitted in front and behind the pontoon. The aëroplane has made many successful flights at San Diego Bay (Cal.), rising easily into the air, and after flights gliding down to water, upon which it alighted without a splash. The diminution of speed caused by the head-resistance of the pontoon, which, as will be understood, does not possess the stream-line form, is said to be about five miles an hour.

DR. PETRIE'S discovery, which is reported in *The Times* of April 15, that the marmot is the host of fleas of very large size, may prove of considerable importance in connection with the study of the epidemiology of plague in Manchuria. Although it appears highly improbable that an epizootic has played any part in the outbreak in Manchuria proper, there is ample confirmation for the hypothesis that, in regions further west, the epidemic is derived from marmots. These animals, locally known as "tarbagans," are hunted for their skins. The occurrence of plague epizootics among them has been recognised for some years, but it is not known what form the disease takes, nor how it may be transmitted to the hunters. This demonstration of the existence of the marmot flea indicates a possible link in the chain of infection, and it is not improbable that future investigations will show that, in Manchuria, the marmot flea may to some extent play the same part as the rat flea in India. In the meantime, it cannot be said that this discovery brings us much nearer

to an explanation of the epidemic in Manchuria. No adequate reason has yet been found for the wide dissemination of the disease, at a season when few fleas of any kind are to be encountered. The appearance of the disease in a pneumonic form of exceptionally high virulence affords also a problem which still requires an answer. Although the Chinese epidemic has attracted so much attention, it becomes almost insignificant when compared with the ravages of the disease in India. Prof. Simpson, in a letter to *The Times* of April 17, directs attention to the enormous plague mortality in the United Provinces of Agra and Oudh, districts of which the joint population is little greater than that of the British Isles. Upwards of 72,000 persons died of plague in these provinces during March, and in the week ending March 25 the number of deaths reached the appalling figure of 22,000.

THE number of Easter vacation workers at the Port Erin Biological Station has this year, for the first time, exceeded fifty. The universities and university colleges of Birmingham, Cambridge, Cork, Liverpool, Manchester, and Reading are represented by members of their biological staff or by senior students; and the researchers include:—Prof. B. Moore and Mr. E. Whitley (bio-chemistry), Mr. Walter Tattersall, and Mr. E. W. Shann from Manchester, Prof. Cole from Reading, Mr. Douglas Laurie from Liverpool, a group of botanists—Prof. Harvey Gibson (Liverpool), Mr. J. C. Johnson (Cork), and Mr. R. H. Compton and Mr. S. Mangham (Cambridge)—working at algæ, a group of planktologists from Liverpool, including Mr. W. Riddell, Dr. W. J. Dakin, Prof. Herdman, and others. The new wing of the Biological Station, which was erected last winter, is now fully occupied by the researchers, and the larger laboratory is crowded with senior students. If numbers continue to increase, a further extension in the near future will certainly be required. The fish hatching is proceeding as usual. The first fertilised eggs of the plaice appeared in the spawning pond this year on February 13, but after that the cold, tempestuous weather seemed to delay the spawning, as the total numbers passed through the hatching-boxes up to date (April 20) are behind those of last year. The number of visitors to the aquarium of the institution is, however, considerably in advance of last year. Periodic observations on the plankton at sea are being taken from Prof. Herdman's yacht *Runa*, and the outstanding fact in this season's work, so far, is that the diatoms are unusually scarce and late. The vernal phytoplankton maximum has not yet arrived.

IN the Australian monthly, *The Lone Hand*, for February, Prof. J. Macmillan Brown discusses the question of the White Gods of Ancient America. He points to the singular fact that among the races of the Isthmus there is a large sprinkling of blonde-haired, blue-eyed, European-like men and women, whose origin is not to be explained by the theory of descent from the white emigrants of later historical times, this more recent European type being rapidly modified by environment and miscegenation, and quickly disappearing. He also refers to legends of the arrival in America of bearded white strangers, like Manco Capac. These stories, like the stone culture, are mainly confined to the Pacific littoral and the neighbouring mountain ranges. To explain these facts Prof. Brown postulates a Polynesian, that is to say, ultimately a Caucasian, immigration which passed northwards from Peru, from which direction he assumes that the culture represented by the Palenque ruins and that of the Astecs had its origin. It can scarcely be said that the facts which he has collected prove his theory; but the problems of the origin of Central American civilisation are so perplexing that this suggestion deserves consideration.

HITHERTO it has been generally believed that the paper read before the Society of Antiquaries in February, 1785, by W. Marsden, entitled "Observations on the Language of the People commonly called Gypsies," in which, from materials collected in 1783–4, he announced the similarity of Romani to some Indian dialects, was the first publication of the fact in this country, though it had been anticipated on the Continent by Rüdiger and Grillman. In *The Gypsy-Lore Journal* for January, Mr. J. Sampson advocates the prior claims to this discovery of Jacob Bryant, the author of that fantastic and now wholly useless treatise on mythology, "The New System, or an Analysis of Ancient Mythology." At the meeting of the Society of Antiquaries in the April following the receipt of Marsden's communication, that of Bryant, "Collections on the Zingara Gypsey Language," was read. The glossary of Bryant has now little value, and abounds in curious mistakes; but Mr. Sampson proves that the material was collected at least as early as 1776; and, if this be so, Bryant has the honour of having anticipated not only Marsden, but also the Continental philologists in this remarkable discovery.

IN the January number of *The Gypsy-Lore Journal*, Mr. D. F. de l'Hoste Ranking begins a useful analysis of the account of the beliefs and sociology of the Gypsies of Central Russia recently collected by Mr. V. N. Dobrovolski. This branch of the Gypsy race strongly insists on its Egyptian origin, and even assigns to Pharaoh the useful invention of the "jemmy," which enables them to tackle modern locks. They are on a much higher plane, as regards intelligence and culture, than the peasantry among whom they live. They possess, for instance, an elaborate system of defining time by the motions of the stars, a survival of their primitive nomadic life. Their most cherished possession is the whip, and the association of it with the marriage customs of the tribe, which Mr. Ranking suggests to be connected with marriage by capture, is more probably intended to expel the evil spirits which beset the bride and bridegroom at this crisis of their lives. The use of the doll in the betrothal rites seems to be based on a mimetic fertility charm. Their polytheism has now widely absorbed the national reverence for the ikons; and another form of magic includes the use by thieves of a candle made of a dead man's fat, the "Hand of Glory" of the "Ingoldsby Legends." Mr. Ranking suggests that the *provenance* of this last superstition may form an important link in the chain of evidence which may solve the problem of Gypsy origins, and he pleads for special inquiries regarding this belief.

MESSRS. E. LEITZ have issued a very useful pamphlet on the microscope and how to use it. The path of the rays, the meaning of aperture, resolving power, illumination, eye-pieces, and focussing are all briefly but fully explained, the text being illustrated with many excellent diagrams.

The Eugenics Review for April (iii., No. 1) contains an interesting and suggestive article, by J. H. Kohlbrugge (translated from the German by J. H. Koeppern), on the influence of a tropical climate on Europeans. It is pointed out that no white race has been able to survive in the tropics unless race-mixture has taken place, and as the white races cannot become really acclimatised, and as it is doubtful whether we can achieve satisfactory results by race blending, it is concluded that we can neither take the place of the native nor do without him.

MISS CHICK and Dr. Martin give an interesting summary, with new experiments, on the readiness with which various rat fleas bite man (*Journ. of Hygiene*, xi., 1911, No. 1). The matter is of importance with reference to the spread of plague. They find that the common rat flea of temperate regions (*Ceratophyllus fasciatus*) readily bites man. Two more specimens of *Xenopsylla cheopis*, the common rat flea of India and other parts of the tropics, have been captured by Dr. Boycott at Guy's Hospital. Only one specimen of this flea has hitherto been recorded in England. The destruction of fleas by exposure to the sun is dealt with by Captain Cunningham, I.M.S., in No. 40 of the Scientific Memoirs of the Government of India. It is found that in the hot sun of India fleas die in about forty-five minutes, the result being chiefly due to the heat rays.

TO Mr. F. L. Dames, of Berlin, we are indebted for a copy of "Bibliotheca Entomologica," a classified catalogue of entomological works and papers for sale at his establishment, containing, in this instance, 7633 items.

WE have to acknowledge the receipt of a copy of the second number of *The Nature Photographer*, the official organ of the Nature Photographic Society. The feature of this issue is a portrait of a grey wagtail, which is a superb example of live-bird photography.

IN our last week's number reference was made to a notice in the *Aarsberetning* of the Bergen Museum, of the recent scientific cruise of the *Michael Sars* in the Atlantic. A fuller and well-illustrated article on the same subject, by Dr. Johan Hjort, appears in *Naturen* for March and April. After an introductory notice of the object and extent of the cruise, attention is directed to the hydrographical results, which include observations on temperature and salinity taken at 110 stations, these being illustrated by maps and diagrams. After a short notice of the plankton, and another of pelagic animals, the deep-sea fishes taken during the cruise receive fuller attention, special interest attaching to the maps illustrating the localities where specimens of Cyclothone, Gonostoma, and Chauliodus were respectively taken.

WRITING in his usual picturesque and attractive style, Sir Harry Johnston, in the April number of *The Quarterly Review*, pleads for the preservation of the fauna and flora, not only of the British Empire, but of the world at large. For he recognises that if effective measures are to be taken with this end in view, they ought to be taken without delay, "lest, before we can put in force regulations to save from destruction the rarer and more wonderful and beautiful of living forms on the earth's surface, they may be swept away for ever to gratify the whim or the taste of the uneducated many." Sir Harry puts the case in a very temperate manner, freely admitting that in many districts, East Africa for example, the claims of agriculture must be paramount, and that the wild fauna should be mainly restricted to reserves. In urging that such reserves should not be opened even to personages of the most exalted rank, the author has our full sympathy. Whether he is justified in his belief that the Lado white rhinoceros is even now in peril of extinction, may perhaps be doubtful; but we are in full accord with him in regarding a recent much-advertised slaughter of the species as altogether unjustifiable. That we ourselves are by no means blameless in such matters, is, however, proved by the evidence quoted as to the recent enormous destruction of sea-elephants in South Georgia.

IN the February number of *The Cairo Scientific Journal*, Mr. F. Hughes discusses the amount of silt carried by the Nile during the floods of 1908 and 1910. Observations were made near Cairo and at points on the Rosetta branch of the river, and results in parts per million of from 1200 to 2000 were obtained. Some examples were collected from canals of various dimensions, and the reduction of coarser suspended matter in some cases in subsidiary canals was very marked after a short distance.

THE Dutch Meteorological Institute publishes a series of observations obtained by means of kites on board ship in tropical latitudes. Forty-one ascents are given, 2360 metres being reached in one case. Naturally the sets of observations at any one place are few, but the material will be of value in connection with such other information as accumulates in these little investigated regions. Pressure, temperature, humidity, and wind force and direction are given.

IN the April number of *The Geographical Journal* the positions of nineteen geodetic positions of stations of the Uganda are given. The War Office intend to publish a full account of the operations and calculations connected with this work, and in a second part to discuss the local attraction, based on a comparison between the above positions, and the astronomical latitudes now being computed by the Belgian astronomer, M. Dehalu. The same number contains a reference to Dr. K. Peucker's proposals for the colouring of relief maps, for which aërial locomotion has produced demand. His method is based on the teachings of physiological optics, and there is certainly room for a more scientific and less empirical study of cartography in this country than has hitherto obtained.

A GEOGRAPHICAL report on the Franz Josef Glacier has been published by the New Zealand Department of Mines. Mr. J. M. Bell, the director, examined the area in 1908 and 1909, a topographical survey of the glacier and its tributaries being made with theodolite and phototheodolite. A number of points were fixed and marked for future reference, for the frontal face of the main glacier is ever changing and it is difficult to determine its general direction of movement; on the whole, it seems to have retreated in recent times, and now stands at a point 692 feet above sea-level. Measurements of a series of points on the glacier surface gave rates of movement of from a foot a day near the side to about double this amount near the centre.

IN "Extracts from Narrative Reports, 1907–8," of the Survey of India, are given more detailed results than can be included in the annual report. The diurnal variation of horizontal magnetic force was determined at Trichinopoly, in southern India; and a comparison of the magnetic instruments at Dehra Dun with those which Mr. D. C. Sowers, of the Carnegie Institute, had used while travelling overland from Pekin to Srinagar, was made. Full details of the secular change values for each month are given at each of the four magnetic observatories of Dehra Dun, Barrackpore, Toungoo, and Kodiakánal, as well as hourly means of declination and horizontal force. The section dealing with tidal and levelling operations gives the values of the tidal constants for the eight stations in operation. Binocular American precise levels were used by one party, and were to be used by all parties in the following season, by which change an appreciable increase in the rate of work was attained. In the work of the pendulum party the changes in the times of vibration of each of the four pendulums from 1904 to 1909 are given and discussed.

THE Seismological Society of America, which owes its foundation to the interest aroused by the Californian earthquake of 1906, has recently issued the first number of its quarterly Bulletin. Most of the short papers which it contains are devoted to the study of seismology in the United States, to the difficulties under which its prosecution labours, and to suggestions for organised work in the future. Among the papers of permanent interest may be mentioned Mr. H. F. Reid's account of the earthquakes felt in Central New Mexico in 1906 and 1907, and the list of seismographs known to be at work on the American continent, a list which includes no fewer than thirty-five Wiechert pendulums, twenty-nine Bosch-Omori pendulums, and nine Milne seismographs. Prof. Branner, in discussing the relations between earthquakes and the growth of faults, suggests the need for distinguishing between faults which are now active and others which have apparently reached a condition of stability, and he points out the useful work which might be carried out in this direction by the organised study of Californian earthquakes.

THE daily and yearly period of rainfall at Trieste is discussed by Dr. E. A. Kielhauser in an interesting paper laid before the Vienna Academy of Sciences in November last, based on eleven years' readings of the self-recording rain-gauge at the observatory (1896–1906). Among the many points referred to we may mention that the rain-curve of the amounts for separate hours shows that it is made up of a large number of waves of short periods. In addition to the most prominent extremes of the absolute maximum (11h.–12h. p.m.) and the absolute minimum (11h.–12h. a.m.), fifteen relative maxima and minima are exhibited. In spring and winter, the hours of 5 a.m. to 1 p.m. are relatively dry, while in summer and autumn they are relatively wet; for the other hours the reverse naturally obtains. At all seasons of the year the duration of rainfall is greatest at night-time. The annual rainfall is 39·7 inches (mean of sixty years, 42·8 inches). The driest months are February, April, December, and especially January; the wettest months are May, June, November, and especially September and October. The driest month of the eleven-year period was February, 1896 (0·07 inch), the wettest, October of the same year (10·7 inches).

THE April number of the Journal of the Röntgen Society contains a paper by Dr. W. Salomonson, of Amsterdam, on the induction coil, considered mainly from the point of view of the Röntgen-ray photographer. It is well illustrated by reproductions of photographs of the spark and of the primary current taken with a string galvanometer or an oscillograph. These show clearly that, as the capacity of the condenser in the primary is increased from a very small value, the time taken for the primary current to fall to zero at first decreases, then increases, in agreement with the theory of Mizuno. With an interrupter working in hydrogen or coal gas, the time of fall of the primary current may be reduced to 0·0002 second. Experiments with a new coil, by means of which photographs of the heart and lungs can be taken in 0·01 second, show that the spark is shaped like a corkscrew, and that it passes before the magnetic field due to the current in the primary has disappeared.

To those who are so unfortunate as to have to deal with electrical apparatus which has been flooded, the account of the steps taken by the railway and other companies to clean and dry the apparatus submerged during the Paris floods of 1910, published in *The Electrical Review* for April 14, will prove useful. It is compiled from the report of the Société des Electriciens, which relates to more than a thousand pieces of apparatus which were dried satisfactorily. The apparatus was first washed either with water, or, if battery acid had attacked it, with dilute acid, then water, then weak alkali, then water. If oil had got into the apparatus it was first washed with benzoline. Any method of drying, if properly applied, was found effective. Fixed machinery was dried either by an air blast or by fires underneath, in the first instance, and the process completed electrically. Portable machinery was treated in ovens gas or steam-heated to 120° C. at atmospheric, or to 70° C. at reduced pressure. A 60-kilowatt direct-current generator gave up two gallons of water in the drying process. Storage cells appear to have come through the floods with very little deterioration.

MESSRS. CARL ZEISS (LONDON), LTD., have recently introduced the following novelties in optical instruments:— Mayer's new dissecting microscope has a characteristic form of exceptionally large stage, and can be fitted with either monocular or binocular observing systems. It can also take a stereocamera and drawing apparatus. Zeiss's field-glasses are made in a new form, possessing increased light-transmitting power combined with exceptionally large field. Strict alignment of the lenses is secured by casting the hinges and body in one piece. Telescope spectacles are for extreme myopia (10–20 dioptres), and give a field of more than 40°. For astigmatism a special form is provided. A new level is of small dimensions but of extreme sensitiveness. The bubble is observed by a reflecting prisma, which shows images of the semicircular ends of the bubble. In adjusting the instrument, these semicircles are brought into contact along their diameters. All axes are truly cylindrical. The telescope is hermetically sealed up, and by means of a transferable eye-piece can be read from either end. The instrument is packed in a case about 8 inches by 5 inches by 2½ inches, and the accuracy equals that of a 12-inch or 14-inch level of ordinary type. The Cardioid condenser is for dark-ground microscopical illumination, and is chiefly for studying colloidal matters. It gives a narrow extreme annular illumination the rays of which reunite in the plane of the object. Colloidal gold particles of less than 10 $\mu\mu$ can be seen moving rapidly in a field illuminated with this device. The oral illuminator contains a special arc lamp of 5 amperes fitted with a condensing arrangement for dental and mouth illumination. It is also fitted with a special tinted glass for bleaching the teeth. A new illuminating device for operating theatres consists of a powerful automatic-feeding arc lamp of 30 amperes, throwing a strong beam of light upon a large collecting lens. A system of mirrors breaks up and recollects the light so as to concentrate it free from shadows upon the operating table. The arrangement is, naturally, chiefly useful when surgical operations are performed at night.

IN an article on the central buffer-coupling appearing in *Engineering* for April 21, it is stated that there is a distinct tendency towards its adoption in countries where the 5-foot 6-inch gauge is the standard. In India, where there are some 16,300 miles of 5-foot 6-inch gauge line, the standard coupling is causing ever-increasing trouble. On one line, the renewals necessary to replace one year's breakages necessitated the placing of orders recently for 10,000 screw-couplings. As the present standards give a coupling of about the maximum weight which can be handled conveniently by the native staff, it is apparent that relief must be sought either by making use of much more costly material or in making a change in the type of draw-gear. The present trouble arises from the greater hauling capacity of modern locomotives, the extending use of high-

capacity wagons, and the more general application of automatic brakes. It is of interest to note that the central-buffer coupling produces less waste of energy in trains travelling on a curve. Tests carried out in India on a 5-foot 6-inch line showed that the side-buffered stock required an increase of power of 5·82 per cent. on a 40-chain curve as compared with similar stock, but fitted with central-buffer couplings.

OUR ASTRONOMICAL COLUMN.

ASTRONOMICAL OCCURRENCES FOR MAY:—

May 1. 1h. 11m. Venus in conjunction with the Moon (Venus 1° 29′ S.).
4. 11h. Uranus stationary.
5. 6h. Mercury in Inferior conjunction with the Sun.
11. 16h. 53m. Jupiter in conjunction with the Moon (Jupiter 1° 19′ N.).
12. 17h. 57m. Moon eclipsed, partly visible at Greenwich.
18. 9h. 16m. Uranus in conjunction with the Moon (Uranus 4° 43′ N.).
22. 13h. 54m. Mars in conjunction with the Moon (Mars 2° 19′ N.).
26. 7h. 15m. Saturn in conjunction with the Moon (Saturn 2° 38′ S.).
28. 14h. 28m. Mercury in conjunction with Saturn (Mercury 1° 35′ S.).
29. 14h. 51m. Venus in conjunction with Neptune (Venus 2° 59′ N.).
30. 14h. 57m. Neptune in conjunction with the Moon (Neptune 5° 32′ S.).
30. 16h. 50m. Venus in conjunction with the Moon (Venus 2° 35′ S.).

COMETS AS MERELY OPTICAL PHENOMENA.—On a plate accompanying No. 4492 of the *Astronomische Nachrichten* there appear reproductions of fifteen photographs, each of which bears a striking resemblance to one or other of the various cometary forms made familiar to us by photographs of comets. But each of these images was produced by passing luminous rays through various lenses in abnormal positions, and the author, Signor Luigi Armellini, of Tarcento, throws out the suggestion that comets may only be optical phenomena produced by the distortion of solar rays passing through lenticular cosmical masses of meteorites. The author does not discuss the spectroscopic side of the question, and the idea is not novel, but the photographs reproduced are so realistic as to make the note of interest.

THE "ASTRONOMISCHEN JAHRESBERICHTS."—Owing to ill-health, Prof. Berberich has been forced to hand over the editorship of the extremely useful *Astronomischen Jahresberichts*, founded by the late Dr. Wislicenus in 1900, to the Astronomische Rechen-Institut of Berlin. In order that the year-book may not suffer by the change, Dr. Fritz Cohn, director of the Rechen-Institut, asks for the cooperation of astronomers who publish any papers during the year. The section on variable and new stars has been undertaken by Dr. Pračka, Observatorium Nižbo Bohemia, to whom extracts coming under that heading should be sent.

THE INTRINSIC LIGHT AND EFFECTIVE TEMPERATURES OF ALGOL AND ITS SATELLITE.—In a paper recently published in the *Bulletin Astronomique*, Dr. Nordmann discusses the intrinsic brightness and temperatures of Algol and its satellite by a method depending upon a knowledge of these quantities for the sun, and quite independent of his heterochrome photometer method. In the result, he finds that the surface brightness of Algol is about twenty-six times that of the sun per unit area, and that the effective temperature of the star is about 13800°; by the independent photometric method he found 13300° as the temperature.

While the general failure to detect a secondary minimum in the light-curve of Algol suggests that the satellite only emits a negligible quantity of light, Dr. Nordmann's results indicate that the satellite is not the obscure, cool body it is generally supposed to be, but has an effective temperature and a surface brightness of the same order as those of the sun, to which it is about equal in diameter. The temperature found is equal to, or less than, 5730°, and the magnitude is not greater than 5·5. For the sun he obtained a temperature of 5320°, and for γ Cygni, which Lockyer places in the Polarian class, a stage higher than the Arcturian class which includes the sun, he found 5670° by his photometer method, but he concludes that Algol's satellite has a temperature not very superior to that of γ Cygni. Finally, he shows that, alone, the radiation from Algol would probably suffice to maintain the surface of the satellite turned towards the primary in a state of incandescence.

HALLEY'S COMET.—In a letter to *The Observatory* (No. 434, April) Mr. Keeling directs attention to an apparent brightening of Halley's comet early in March. From November, 1910, to February 5, the comet was becoming fainter, from mag. 14½ to mag. 15½, but on March 4 both the visual and the photographic observations at the Helwan Observatory showed it to be much brighter, smaller, and more sharply defined than during the previous four months. Its magnitude, determined from two plates taken on that date, was 14–14½, but it was half a magnitude fainter again on March 8. The Helwan observations show that throughout the long period it has now been observed during this apparition it has been about a magnitude brighter visually than photographically.

At the last meeting of the Royal Astronomical Society Mr. J. H. Reynolds directed attention to the distinct type of tail emanating from the comet on different dates. The Helwan photographs form a very long, connected series, and from them Mr. Reynolds suggests that the type of tail presented depends upon the distance from the sun rather than upon the size of the comet; when near the sun the tail appears as a prolongation of the envelopes around the nucleus, but when distant it takes the form of streamers radiating from a point directly behind the nucleus. Investigations by Mr. Knox Shaw indicate that at distances from 0·4 to 0·7 the tails are of the extended envelope type, from 0·7 to 0·8 they are of an intermediate type, and above 0·8 they are of the radiating type, such as seen in the case of Morehouse's comet.

A continued ephemeris for the comet is published by Dr. Ebell in No. 4492 of the *Astronomische Nachrichten*.

OBSERVATIONS OF JUPITER.—In the April number of *L'Astronomie* M. Antoniadi describes his observations of Jupiter made at the Barbier, the Meudon, and the Juvisy observatories during 1910. Numerous spots, clouds, and disturbances were seen and are described, and it is remarked that the suggestion, made in 1902, that the Red Spot is pushed forward by the great disturbance which overtakes it periodically, was confirmed by the observations made in July; on July 25 the longitude of the Red Spot was 356° instead of 358°. A splendid drawing in colours is reproduced on a plate accompanying the article.

GEOLOGICAL WORK IN BRITISH LANDS.[1]

II.—IN AUSTRALASIA.

THE Geological Survey of Western Australia suffers, like that of India, from the pecuniary attractions offered by mining companies. It thus lost Mr. Brooking at the end of 1909, but hopes to retain other efficient officers. In the Annual Progress Report for that year (issued in 1910), Mr. H. P. Woodward describes an association of albite and tantalite in pegmatite dykes (p. 17) which recalls the famous dyke with rare black minerals at Ytterby. The albite has been removed in one reef and replaced by quartz, furnishing another point of similarity between the Australian example and those of Swedish isles. The Bulletins recently issued rightly devote much attention to mining interests. We are glad to note that Mr. J. Allan Thomson, lately one of the Rhodes scholars from New Zealand, contributes the petrographical matter to No. 33. He provides, among other points, an interesting discussion on uralitic hornblende (p. 132). The mining memoirs, such as this on the Gascoyne and Pilbara Goldfields, and No. 38 (1910), on the Irwin River Coalfield,

[1] The first article appeared in NATURE of February 23, 1911 (vol. lxxxv., p. 553).

are complete in themselves, with colour-printed maps and sections. The responsibility of one officer for each field bulletin probably aids the rapid production of a series in a single year. Mr. Talbot describes in No. 39 (1910) the country traversed on a water-seeking expedition in the interior, between Wiluna, Hall's Creek, and Tanami. We note the occurrence of obsidianites at one point (p. 29). The descriptions and excellent photographs of the country make the bulletin of geographical value (Fig. 1). Four

FIG. 1.—Jellabra Rock-hole, east of Gardiner Range, on the border of West and South Australia, Devonian Sandstone.

contributors furnish Bulletin 36 (1910), on palæontology, two being English specialists. Dr. G. J. Hinde describes sponge-spicules, the silica of which remains uncrystalline, from a post-Cretaceous rock in the Norseman district. Mr. Newell Arber deals with certain plants, which would determine strata at Mt. Hill and near Mingenew as Jurassic; and Mr. R. Etheridge describes a number of Jurassic marine fossils from the Greenough River district. Mr. L. Glauert, of the Western Australian Survey, compares the jaw and teeth of a new diprotodont species, *Sthenurus occidentalis*, found in stalagmite, with the species known to Owen. He then (p. 71) gives a useful systematic list of Western Australian fossils, which must not be overlooked by stratigraphers and students of distribution. He holds (p. 111) that the occurrence of Devonian beds in his State is confirmed by a review of specimens from the Napier Range, submitted to Dr. Henry Woodward.

Mr. H. Y. L. Brown reported to the South Australian Government in 1910 on the country south and east of the Murray River. The observations of geologists have here shown the existence of old river channels in a rock-floor under marine Tertiary beds; the latter receive water inland at their junction with the older rocks, and provide important reservoirs, through which the fresh water percolates gradually to the sea. Bores in the desert region have been successful. Mr. W. Howchin, of the University of Adelaide, describes two very striking moraines of the Permo-Carboniferous Glacial epoch at Rosetta Head and King's Point, South Australia (Trans. Roy. Soc. South Australia, vol. xxiv., 1910). The great boulders of transported granite appear to weather out as if they were of modern origin, just as they do in South Africa, where denudation has attacked the Dwyka beds (Fig. 2).

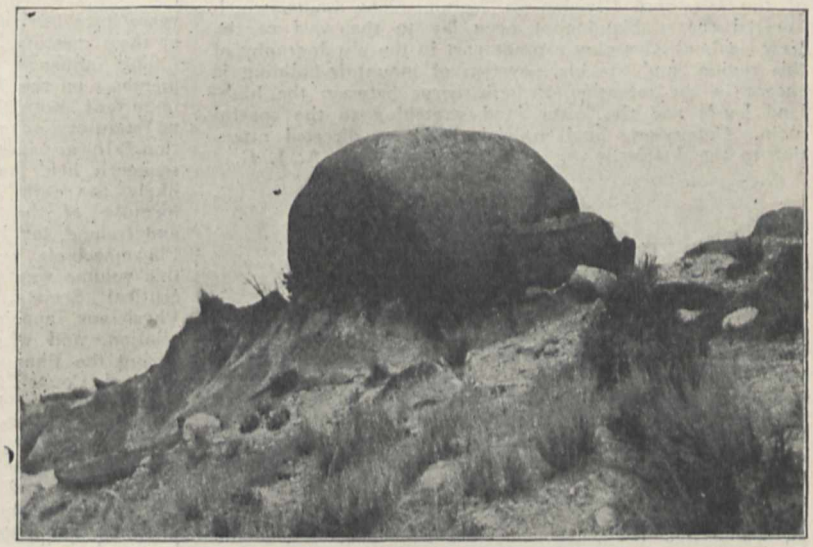


FIG. 2.—Granite erratic resting on Permo-Carboniferous glacial till, Palæozoic moraine of King's Point, South Australia.

The Geological Survey of New South Wales has issued a well-illustrated account of the Murrumbidgee River district, where a storage-reservoir is in progress (Records, 1909, price 7*s.* 6*d.*, with large coloured maps and sections). The author, Mr. L. F. Harper, keeps in view the geological history of the country, and is by no means content with mere description. Messrs. R. Etheridge and W. S. Dun furnish a monograph on Eurydesma in New South Wales (Mem. Geol. Surv. New South Wales, 1910, price 7*s.* 6*d.*). This large Permo-Carboniferous lamellibranch is known only from Australia and from the Indian Salt Range. The authors support Morris, to whom the generic name is due, and differ from Stoliczka, by placing Eurydesma near Avicula. They regard Aucella as its nearest fossil, and Meleagrina, the pearl oyster, as its nearest modern representative. Its stratigraphical and local restriction gives it special interest. Mr. A. R. McCulloch has illustrated the genus by appropriately bold and striking plates.

In Victoria, Prof. Skeats describes the gneisses and dacites of Dandenong, twenty-five miles from Melbourne (Quart. Journ. Geol. Soc. London, 1910, p. 450). The interest lies in the conclusion that the gneissic rocks result from dynamic action on dacites, the product being subsequently altered by contact with a mass of granodiorite. Mr. F. Chapman (Proc. Roy. Soc. Victoria, vol. xxii., 1909, p. 263) has investigated the Batesford Limestone, devoting particular attention to the foraminifera and the ostracods. New species are described, and the rock is regarded as of Middle Cainozoic age. Mr. Chapman, by his continuous and patient work, is carrying out ably for Australia the traditions of Prof. T. Rupert Jones. Mr. R. W. Armitage (*Victorian Naturalist*, vol. xxvii., 1910, p. 21) reviews known cases of the inclusion of plant-remains in lavas, and records the discovery of charred wood in Pliocene basalt near Melbourne. The basalt has intruded minutely into the shrinkage-cracks of the timber, "along the medullary rays and around the annual rings." Mr. Armitage has also guided the Field Naturalists' Club of Victoria to West Essendon (*ibid.*, p. 83), and gives an interesting account of Cainozoic sands converted by percolating waters into quartzite. In discussing the literature of similar cases, he would have been aided by a fuller reference to the modern quartzites formed in arid regions of South Africa.

The Geological Survey of Queensland is naturally concerned principally with mines. Mr. L. C. Ball describes the Starcke Goldfield (Publication No. 223), where the reefs are formed through the replacement of the slaty country-rock by quartz and a triclinic felspar, the alteration spreading inward from fissures due to earth-movement. The occurrence of secondary felspars in similar

veins elsewhere is referred to (p. 14). Mr. Ball also reports on minerals, including tin, mercury, copper, and coal, in North Queensland (No. 222, 1910). The coals of Cooktown are believed to be of early Mesozoic age; but the author refers (p. 37) those of Mount Mulligan to the Palæozoic, on account of the presence of Glossopteris. Mr. Marks describes the coal-measures of Trias-Jura age in south-east Queensland (No. 225), but does not add anything to their palæontology. A large map has been issued 1910), showing the topography of the mineral fields and coal-fields in east central Queensland, on the scale of one inch to four miles.

The Bulletins of the New Zealand Geological Survey continue to maintain their exceptionally high position. Messrs. Bell and Clarke (No. 8, 1909) make us acquainted with the scenery of the Whangaroa district, in the far north of the long promontory of Auckland. The difficulties so often met with in the palæontology of New Zealand appear to crop up here, and, in view of the scarcity of fossils and the uncertainty of those discovered, it is found impossible to divide the Kaeo series into a Mesozoic and a Cainozoic portion, though both are believed to be present. Greensands and "claystones" are its most extensively developed rocks (p. 49). Igneous rocks of Palæozoic (?) to Cainozoic age occur, and are illustrated by thin sections. Mr. J. H. Adams (No. 9, 1910) describes the Whatatutu subdivision in Raukumara, which is also in the North Island. Here satisfactory fossils enable him to place the whole of his beds, the Whatatutu series, in the Upper Miocene, and to reject a previous grouping into Cretaceous and Lower Cainozoic (pp. 12 and 23). Mr. C. Fraser (No. 10) treats of the Thames Goldfield in Hauraki, Auckland, which has suffered from the usual periods of "boom" and consequent depression. The "sensational development," however, of one mine in 1904 shows how irregular vein-mining may prove to be. One of the features of the district is the Table Mountain, formed by the weathering out of a huge dyke of andesite, which penetrated a plateau of easily eroded rhyolite-tuffs. The gold and silver ores began to be imported into the district in early Cainozoic times, and the vein-material partly fills fissures and partly replaces country-rock (p. 41). The "bonanza" deposits are attributed to waters that had acquired different characters meeting at certain points along intersecting veins, and thus promoting deposition. Mr. E. Webb (No. 11) writes on the country in the north of the Westport Division in Nelson. The faults which lowered the highland that once lay to the west of the New Zealand Alps play a great part in the physiography of this region, and the block-system of mountain-building is shown in the retention of fault-scarps between the highland levels and the lower land stretching to the coastal plain. Copper-ores and molybdenite have directed attention to the district. G. A. J. C.

THE PHARMACEUTICAL SOCIETY'S SEVENTIETH ANNIVERSARY.

THE seventieth anniversary of the Pharmaceutical Society of Great Britain, which occurs this month, is an event of some considerable interest, which is not wholly confined to those who practise the art of pharmacy. Since its earliest days the society has devoted its attention to improvements in scientific education, and, indeed, before it was a year old, it had instituted courses of lectures in chemistry, materia medica, pharmacy, and botany. Its foundation dates from April 15, 1841, when at a meeting of chemists and druggists held at the Crown and Anchor Tavern, in the Strand, it was resolved to form an association "for the purpose of protecting the permanent interests and increasing the respectability of chemists and druggists."

At that time there were many men who by their training were well equipped for the work of compounding drugs and dispensing medicines, but owing to their lack of cohesion the science of pharmacy was making very slow progress. The rapid advances which the society made in the commencing years of its existence was in a large measure due to the pervading influence of its first president, William Allen, F.R.S., who, in addition to carrying on the business of a chemist in Plough Court, in the City, was a man with very considerable scientific attainments. In 1796 he had with several other young men formed the Askesian Society for practical scientific research, and three years later he helped to form the British Mineralogical Society, while in 1804 he delivered a course of lectures on natural philosophy at the Royal Institution.

With such a man at the head, there is little wonder that the newly formed Pharmaceutical Society became imbued with his scientific spirit, and turned to education as a means of raising pharmacy from the low level at which it stood as a calling in those days. The Royal Charter of Incorporation was obtained in 1843; therein the purpose of the society is set forth as being for the advancement of chemistry and pharmacy and the promotion of a uniform system of education of those who carry on the business of chemists and druggists. As already stated, the School of Pharmacy was soon established, and in 1845 a laboratory was constructed which compared favourably with the laboratories of Germany, including that of Giessen, and most of those in France. Having instituted a sound system of education and examination, the society was in a position to ask the Government for privileges for its members, but it was not until 1852 that an Act was passed restricting the use of the title of pharmaceutical chemist to examined persons. This Act did not restrict the sale of poisons, and the society had to wait another sixteen years before it obtained from Parliament a measure of legislation by which the retail traffic in poisons was placed in the hands of those who had passed the statutory examinations.

To revert to an earlier period and the efforts made to encourage scientific research, a committee was appointed in 1844, on the recommendation of Dr. Pereira, to investigate the then known materia medica. The committee was composed of several officers and members of the society, together with the professors at the school, and did a considerable amount of useful work, the results of which were communicated to meetings of the society. The evening meetings, held once a month in the autumn and winter, have contributed very largely to the advancement of scientific pharmacy, and the great improvements in the methods of preparation and administration of medicinal compounds which have been effected during the last seventy years have been due in a great measure to the discussions at these meetings.

The influence of the Pharmaceutical Society and its members on the British Pharmacopœia has been extremely important, notwithstanding that the society, as such, has no statutory acknowledgment of its work in this connection. In a paper read in 1845, Peter Squire, who subsequently held the office of president, pointed out the evils likely to result from the discrepancies existing in the formulæ of the Pharmacopœias for England, Scotland, and Ireland, but it was not until 1864 that the first British Pharmacopœia was published. When the preparation of this volume was contemplated, the council of the Pharmaceutical Society, at the request of the College of Physicians, appointed a committee to assist in its compilation, and when a few years later the duty of preparing the Pharmacopœia was transferred to the General Medical Council, the society was requested to keep in touch with that body. In the preparation of subsequent editions the services of pharmacists have been invaluable.

The British Pharmaceutical Conference, although in no way part of the society, largely consists of members of the society, and the parent body has never ceased to encourage the conference in the useful work it has accomplished. *The Pharmaceutical Journal* was founded in 1841 by Jacob Bell, and has been the means of recording and distributing the results of work done in connection with pharmacy and allied sciences. The British Pharmaceutical Codex is another of the society's publications which has contributed to the progress of pharmacy. More recently the society has directed its attention to improving its educational system, which seems to justify the belief that the scientific spirit which imbued its founders has been inherited by those who govern its affairs to-day.

AMERICAN HYDROLOGY.[1]

THE investigations of the hydrographical department of the United States Geological Survey have already received notice in these columns, and of the reports under consideration, two belong to a group which has been described at some length. These are papers Nos. 262 and 264, dealing with the conditions of stream and river flow on the South Atlantic coast and the eastern Gulf of Mexico (M. R. Hall and R. H. Bolster), and on the St. Lawrence basin (C. C. Covert, A. H. Horton, and R. H. Bolster).

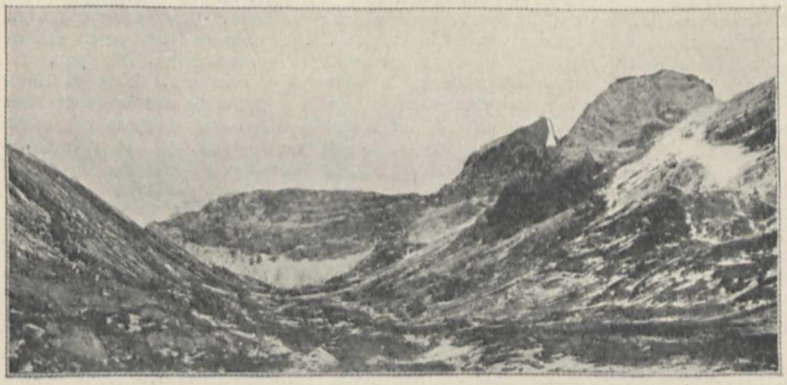


FIG. 1.—Synclinal Valley of Upper Willow Creek, Colorado.

The other five reports are of more distinctive character, and call for individual notice.

Paper No. 260 is a preliminary report on the ground waters of the Estancia Valley, New Mexico (Oscar E. Meinger). It is an investigation of the conditions affecting the irrigation of a valley in the centre of New Mexico, which is a depression 2000 square miles in area, without any drainage outlet. Insufficient rainfalls have been the cause of several crop failures. The proposal is to utilise wells for the supply of water, and, except perhaps in the central portion, where the presence of alkali threatens to impair seriously their quality, the prospect, on the whole, is favourable to a development of these subterranean supplies.

Paper No. 240 deals with the geology and water resources of the San Luis Valley, Colorado (C. E. Siebenthal). This valley lies in the south central part of the State of California, and has a length from north to south of 150 miles, and a maximum breadth of 50 miles. The area is drained by the Rio Grande, with a number of tributary streams, notably the Conejos River and La Jara, Alamosa, and Saguache Creeks. The geology of the district is summed up as a "Miocene deposition, unconformable below, of a series of sands, gravels, and interbedded lavas and tuffs, followed by orographic movements and additional volcanic activity, succeeded by quiet deposition of sands and clays in fresh-water lakes, passing without stratigraphic break into Pleistocene and Recent deposits." As regards its water resources, the San Luis Valley is an "almost ideal example of the artesian basin." Water occurs in beds of fine blue to grey sand, varying from 1 to 20 feet or more in thickness, separated from one another by beds of blue clay ranging from a foot to several hundred feet in thickness. The source of supply is the mountain streams which flow down from the higher levels and disappear as soon as they reach the alluvial slope. The Rio Grande itself in one section of 15 miles loses no fewer than 75 cubic feet per second by seepage. The report records the existence, by actual count, of 3234 wells capable of irrigating from 20,000 to 25,000 acres.

Paper No. 254 is of a similar character, treating of the underground waters of north central Indiana (S. R. Capps and R. B. Dole). The area covered is one of 7611 square miles, comprising nineteen counties. About two-thirds of it is covered with drift to a depth of more than 100 feet. This drift furnishes the water to by far the greater number of wells within its region, and there are few places where sufficient water for domestic needs cannot be obtained at moderate depths. For public supplies and manufacturing purposes, however, the source is inadequate. The report gives detailed particulars relating to the wells of the different localities, together with a comprehensive survey of the geological conditions. There is also included a section on the chemical character of the water and the means to be adopted to render it suitable for domestic and industrial uses.

Paper No. 253 is on the water powers of the Cascade Range; part i., southern Washington (Jno. C. Stevens). The Cascade Range runs through the States of Washington and Oregon with a general summit elevation of 6000 to 8000 feet. The higher peaks include Mount Shasta (14,380 feet), Mount Ranier (14,363 feet), and five or six others above 10,000 feet. The range is characterised by steep slopes and its streams by rapid flow. Add to this that there is an abundant and fairly uniform supply of water, fed during the summer by the snow banks and glaciers of the upper regions, and it will be seen that the district presents many interesting features from a hydrographical point of view, and is a very favourable locality for the development of water power. The area dealt with in the report comprises the drainage basins of the Klickitat, White Salmon, Little White Salmon, Lewis, and South Rivers flowing through the southern portion of the district and situated in Washington. Of these streams, the Klickitat is the most important, having a range of elevation of 3255 feet through the course of 73 miles surveyed, and being capable of developing some 150,000 horse-power under conditions of average minimum discharge. Altogether the potential horse-power of the district aggregates some 425,000.

The last report to be noticed is that, perhaps, which presents most features of interest to the general reader, as apart from the specialist. The paper on underground waters for farm use (Myron L. Fuller) is a particularly valuable little manual affording a considerable fund of information within small compass on matters of vital importance to the community at large, and especially to the pioneer agriculturist—information which is very often regrettably outside the range of his ken. To commence with, there is a brief, general, and lucid account of the manner in which water occurs in the various geological strata, illustrated by some excellent photographs, with a statement of the relative safety of the different materials. The common sources of water supply are then discussed,

FIG. 2.—Artesian Well on the Navin Ranch, San Luis Valley, Colorado.

[1] Surface Water Supply of the United States, Papers 240, 253, 254, 255 260, 262 and 264. (Washington: Government Printing Office, 1910).

including lakes and ponds, streams, springs, wells, and cisterns, and the opinion is expressed that, of all these sources of supply, ground water is the most satisfactory for farm use, because it is least liable to pollution, and that streams and ponds are least trustworthy, because of the ease and frequency with which they are contaminated. Next follows a general description of underground waters and of the means to be adopted for their protection. The information on the subject of wells is detailed and complete, and includes some useful statistics of the cost of the various types, and a tabular statement of their advantages and disadvantages. The "safety distance" from possible sources of pollution is discussed, and that recommended ranges from 100 feet in clay and shale to 200 feet and more in sand and gravel. Boring tools and appliances and the methods of sinking wells are illustrated by diagrams and photographs. Altogether, the manual is one to be cordially commended for careful perusal and study by those dependent for water supply on local and adventitious sources.

It is interesting to note the author's remarks on the use of the "divining rod" for detecting the presence of underground water. He is of opinion that the alleged automatic deflection of the rod can only be attributable to unconscious muscular action, and that, however honestly the operator may believe in the reality of his powers, the irregularity of the results obtained and the numerous instances of failure recorded indicate that the system is crude, merely experimental, and quite untrustworthy.

B. C.

SCHOOL MEDICAL SERVICE.[1]

ONLY to those familiar with the origins of the medical inspection movement is it credible that, in little more than four years, a system should have developed that needs a Blue-book of upwards of 200 pages even for a brief summary of the work. The second report of Sir George Newman, chief medical officer to the Board of Education, shows that the system of medical inspection is now a fully organised service, producing its multitudes of new facts and propounding innumerable problems of detail.

Section I. deals with administration. The statement of policy is unambiguous. "From the outset the Board took the view that the Medical Inspection of School Children was but one of a number of activities comprised in School Hygiene, and the science and art of School Hygiene itself could not be regarded as an independent science and art which could be pursued in detachment from other studies, but was, in fact, an integral and vital part of that science which, under the name of Public Health, deals with all questions affecting the health and physical condition of the nation" (p. 3). Time alone can fully justify this statement; but, from the beginning, it appealed to the administrative mind. The creation of rival services for inseparable departments of health would have meant that one service would ultimately be superseded. The return of the public health officers into touch with the individual children has undoubtedly restored to that service a unity of purpose that it should never have lost. Preventive medicine includes personal as well as environmental hygiene.

This report contains much material to justify the Board's policy. Of the schedule used, it is important to record that "it is not, and never was, intended to be merely a means of collecting statistics. . . . The intention of Parliament was clearly that Medical Inspection should be of a practical character, and have practical rather than academic results" (p. 8). This is a timely warning against the danger of statistics heaped up without any synthetic idea. Nothing more disconcerts the man of practice, who, in this question, is more important as yet than the man of theory. On the whole, this year's reports come well out of the test. The medical men engaged in the medical school service number approximately 986; there are 73 women doctors and 289 nurses.

Section II. deals with the physical condition of the children as revealed by medical inspection. There are many interesting percentages as to cleanliness. Pediculosis is all too common, but the systematic schemes of cleansing have effected immense improvements. Incidentally, such schemes will help in the control of less easily perceptible parasites. There is abundant evidence that lavatory accommodation and spray baths are on the increase. But it is certainly disappointing to have to read that here 26 per cent., there 15 per cent., elsewhere 21 per cent., should suffer from vermin. It is, on the other hand, gratifying to find that, in one case, the 26 per cent. of one examination fell to 9 per cent. on the second examination, and this over a total of more than 3000 children. Obviously the activity of the parents has been stimulated by the concentration of attention on the parasitic state. Ring-worm is extremely common. This troublesome and wearisome ailment ought to be extinguished, but its extinction will be difficult. In some counties the cases amount to 1 in 73, in others to 1 in 45. In one town the cases were 1 in 67, in another 1 in 1000. Adenoids and enlarged tonsils and glands have contributed largely to the recorded ailments. So have defective hearing and defective vision. It is impossible to summarise the masses of facts and methods here detailed, but the special attention directed to the respiratory passages may be expected, in the long run, to reduce malnutrition and early tuberculosis. Heart disease should also profit by the inspection. One school medical officer reports "1·7 per cent. of heart disease among all children examined at five and thirteen years," but he adds that "three times as many suffer from hypertrophy or dilatation" (p. 61). Another found 2·3 per cent. among five-year-old children and 1·2 per cent. among twelve-year-old children. The association of heart disease with rheumatism has been carefully studied by some medical officers. Factors in the production of "dilated heart are anæmia, over-strain, work out of school hours, and cigarette smoking" (p. 62). Of seventy-six boys examined for "heart strain due to double digging undertaken in connection with the garden classes," nine showed signs of rheumatic heart disease, and "in eighteen other cases signs of heart strain were discovered" (p. 61). These facts are of fundamental importance in physical education. The whole question of the "rheumatism of children and adolescents" demands careful investigation.

The section on tuberculosis contains many facts of great importance. "It is interesting to observe that the percentage of tuberculosis among the routine cases is found to be 0·75 in 1909 as against 1·02 in 1908, and among the routine and special cases 1·22 in 1909 as against 1·31 in 1908. Among the special cases, the percentage shows a slight rise—2·02 in 1909 as compared with 1·97 in 1908" (p. 63). These figures refer to 683,715 children examined in 1909, as compared with 245,000 in 1908. It is not indicated whether any special reaction methods have been used in diagnosis. The amount of tuberculosis discovered in different localities varies enormously; but the results, if based simply on ordinary clinical inspection, cannot be accepted as indicating the full extent of tubercular prevalence. "The prevalence of phthisis among school children is still a matter upon which great differences exist among school medical officers, and this will continue to be the case until definite standards of diagnosis are introduced" (p. 66). The results recorded abroad from von Pirquet's reaction are in entire discord with the facts recorded here. It is obvious that the whole question of the prevalence of tuberculosis needs investigation *de novo*. It is a question of primary importance, not merely for practice, but for correct inferences as to heredity. If, as one observer (Dr. Herford, of Altona) finds, that, in an examination of 2594 school children, "63 per cent. reacted, 50 per cent. of the five-year-old groups, and 94 per cent. of those about to leave school" (p. 66), and if these results be verified, we must suspend judgment on the whole question of prevalence. If those results are correct, masses of statements about "tubercular diathesis" and "intensity of inheritance" fall to the ground. The increase of open-air schools is a gratifying practical result.

Section III., on "following up," contains a good deal of important practice. Section IV. indicates the range of "medical treatment," including the improvement of school arrangements, sanitation, physical exercises, open-air classes, powers under special Acts for blind, deaf, defec-

[1] Annual Report for 1909 of the Chief Medical Officer of the Board of Education Pp. 213. (London: H.M. Stationery Office, 1910.) Price 11*d*.

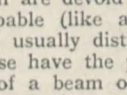
tive, epileptic, cooperation with the sanitary authorities as to infectious disease, directions to the parents, school nursing, contributions to hospitals, and establishment of school clinics (p. 94).

Section V. deals with dental disease and dental treatment. Section VI. discusses the problem of special schools for physically defective and epileptic children. Section VII. deals with feeble-minded children; Section VIII. with physical training. There are important appendices on practical questions.

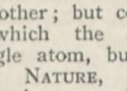
Altogether, the Board of Education and its chief medical officer are to be congratulated on this conspectus of the school medical service, which is rapidly becoming the most important medical service in the country.

OPTICALLY ACTIVE PHOSPHORUS-COMPOUNDS.

ONE of the most fascinating problems of organic chemistry consists in the attempt to prepare compounds the molecules of which are devoid of planes of symmetry, and are therefore capable (like a screw or a glove) of existing in two forms, usually distinguished as left-handed and right-handed; these have the property of rotating the plane of polarisation of a beam of light to equal extents in opposite directions. Such compounds usually contain an "asymmetric" atom linked to four or five radicles all differing from one another; but compounds have recently been prepared in which the asymmetry cannot be attributed to any single atom, but is a property of the whole molecule (see NATURE, vol. lxxxii., p. 266, December, 1909; this vol., p. 93, March 16). In addition to carbon (linked to four different radicles), asymmetry has been traced by Pope and his colleagues to atoms of pentavalent nitrogen and of tetravalent tin, sulphur, and selenium, whilst Kipping has added tetravalent silicon to the list. The latest addition, that of pentavalent phosphorus, forms the subject of a recent paper by Prof. Meisenheimer in the Berlin *Berichte*. Two or three years ago this author described a new type of isomerism in the case of nitrogen, the chief characteristic of which was the presence of only four different radicles attached to the pentavalent atom instead of the five that had usually been thought necessary to give rise to optical activity. The conclusions then arrived at have been confirmed by the recent preparation of methylethylaniline oxide,



in pure crystals, which displayed a large optical activity when dissolved in dry benzene, both the dextro and the lævo forms of the oxide having been separated and examined. The new phosphorus compound is of precisely similar composition, having the formula

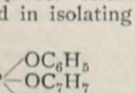


It was prepared by combining diphenylethylphosphine, $(C_6H_5)_2P(C_2H_5)$, with methyl iodide, liberating the base by means of silver oxide, and decomposing it by boiling with water, as indicated by the equation

$$(C_6H_5)_2(C_2H_5)(CH_3)POH = C_6H_6 + (C_6H_5)(C_2H_5)(CH_3)PO.$$

The inactive base was resolved by combining it with bromocamphorsulphonic acid—the same agent that was employed twelve years ago by Pope and Peachey in preparing the first active derivatives of asymmetric nitrogen—and was separated again from this acid by passing ammonia gas into a solution of the salt in benzene. The ammonium salt was filtered off, and the base separated in needle-shaped crystals of undoubted purity. When redissolved in benzene, the base showed the highly satisfactory rotatory power $[\alpha]_D + 33{\cdot}8°$ $[M]_D + 57°$.

The experiments now described provide a completed solution of a problem which had already been solved partially by Kipping and Luff (Proc. Chem. Soc., 1909, p. 203). These authors succeeded in isolating two isomeric hydrindamides of the formula



which differed from one another in optical rotatory power, and almost certainly contained the dextro- and lævo-rotatory forms of the phosphoric radicle; unfortunately, it was not found possible to separate this radicle from the active hydrindamine which had been used in resolving it, and the final proof of the activity of the phosphoric radicle could not be given.

METEOROLOGICAL REPORTS AND SUMMARIES.

MANILA WEATHER BUREAU (1906).—The meteorological observations at the secondary stations have now been published, and form part ii. of the annual report (part i., referring to the central observatory, appeared some time ago). It extends to 404 quarto pages, and includes daily observations and monthly means at the stations which at that time constituted the meteorological service of the Philippines. The observations are carefully collated and examined at the central observatory; some of the stations extend to the Ladrone and Western Caroline Islands, and are of the utmost importance in connection with the origin and premonition of the destructive typhoons that frequently advance from that part of the Pacific Ocean. They are also used in the preparation of the valuable monthly weather bulletins of the bureau, to which we have often had occasion to refer.

Toronto Observatory (1908).—During the year covered by this report, the building used since 1855 was replaced by a new Canadian Meteorological Office and Observatory. The following values are taken from the useful summary of results given for each month and the year, with differences from the average of the past sixty-nine years. The extremes of temperature are taken from the maximum and minimum thermometers in the Stevenson screen. Highest temperature (July 30), 91·5°; lowest (February 4), −17·4°; highest on record, 99·2°; lowest, −26·5°. Mean of highest readings in 1908, 55·8°; of lowest, 37·7°. Mean from max. and min., 46·7°, being 2·7° above the average. Highest solar radiation (August 4), 128·3°; lowest night radiation (February 4), −21·6°. Rainfall, 21·72 inches; depth of snowfall, 77·8 inches. Percentage of possible sunshine, 47, the average for the past twenty-seven years being 42 per cent. The mean W. declination was 5° 54·1′; dip, 74° 36·9′.

Korea Meteorological Observations (1908–9).—These valuable observations and results are in continuation of those referred to in our issue of May 19 last. The following statistics refer to Chemulpo Observatory (lat. 37° 29′ N., long. 126° 32′ E.) for 1909. Temperature:—mean maximum, 58·5°; absolute, 93·2° (in August); mean minimum, 44·1°; absolute, 8·1° (in December); annual mean, 50·7° (normal, 51·1°); rainfall, 25 inches (normal, 37·7 inches), days, 96; sunshine, 2746 hours (62 per cent. of possible amount). The instruments and methods are the same as those at Japanese stations.

Odessa Observatory (1909).—We are glad to see that Prof. Stankevitsch proposes to cooperate regularly in the international researches of the upper air. Two kite ascents were made in December, but only moderate altitudes were reached. At present this important work can only be carried out under difficulties, as the director and his principal observers are engaged at the University. The annual summary shows that the mean temperature was 50·7°; January, 21·2°; July, 74·3°; absolute maximum, 94·8° (in July), minimum, −7·2° (in January). Rainfall, 14½ inches, on 98 days; fog, 58 days; frost, 95 days. Appendices give the normal values for a number of years (see NATURE, February 16), also rainfall and thunderstorms, at stations in south-west Russia.

India Weather Review, Annual Summary (1909).—The greater part of this work is taken up by the calculation of the monthly and annual departures of each element from the normal values, and a useful discussion of the results under four seasons: cold-weather period (January and February), hot-weather period (March–May), south-west monsoon period (June–September), period of the retreating south-west monsoon (October–December). These are followed by abstracts of the observations made in India and a few extra stations, and by maps relating to rainfall, and the tracks of cyclonic storms formed in the

Indian seas. The temperature in 1909, as in the two preceding years, was slightly colder than usual. The lowness occurred almost entirely in northern and central India, owing chiefly to a defect of day temperature; the largest deficiency occurred in April and June. The total rainfall, on the average of the whole of the plains, was 2·1 inches (5 per cent.) above the normal, which is the largest excess since 1894. In the Indian Ocean it was very irregularly distributed, being 25 per cent. below the normal at Seychelles, nearly normal at Mauritius, and 43 per cent. above the average at Zanzibar.

Deutsche Seewarte, Hamburg (1909–10).—The observations and results for stations under the control of the Seewarte are published in its *Jahrbuch* for 1909 in the usual form (NATURE, May 19, 1910). The present volume, the thirty-second of this valuable series, includes ten stations of the second order (for four of which hourly readings are also given) and extracts relating to storms from registers kept at fifty-seven signal stations. The following values are quoted from the annual summary for Hamburg:—temperature: mean maximum, 52·2°; mean minimum, 41·4°; mean, 46·4°; absolute maximum, 81·7° (May); minimum, 9·3° (January and February); rainfall, 27·8 inches, 164 days. Fog, 64 days; the only months free from it were April–June.

Like its predecessors, the thirty-third annual report of the work of the Deutsche Seewarte, for 1910, contains full details of the staff, observers, and of the duties performed in various departments. In the branch of ocean meteorology, one is struck by the increasing number of observers, now numbering about 1075, and at the amount of data relating to the sea, about 4228 months' observations during the year in question. This branch is actively promoted by agencies at twenty-three ports, which, in addition to other duties, undertake the verification of instruments. The observations are utilised in monthly meteorological charts and daily synoptic weather charts of the North Atlantic Ocean, and many other useful publications. The department dealing with weather telegraphy and storm warnings also shows great activity. An exchange of telegraphic observations is kept up with foreign services, and is supplemented by daily kite observations and reports from mountain stations. We have before mentioned the useful experiments of issuing storm warnings to the North Sea and Baltic deep-sea fisheries, &c., by wireless telegraphy. Several other departments are engaged in valuable work, including the issue of handbooks and other publications, to some of which we have frequently had occasion to refer.

Stonyhurst College Observatory (1910).—The results of the meteorological observations show that the mean temperature of the year, 47·2°, was 0·4° in excess of the average. The warmest month was August, 57·2°, and the coldest January, 37·0°; June had the greatest number of high readings: above 70° on nine days. The absolute maximum was 78·0°, in June and July; minimum, 13·5°, in January. The annual rainfall was 53·29 inches, being 6·26 inches above the normal. The amount of bright sunshine was only 28·3 per cent. of the possible quantity. Terrestrial magnetism forms an important part of the work of the observatory; the yearly mean values were:—declination, 17° 20′ W.; inclination, 68° 42·2′; horizontal force, 0·17407 C.G.S. units. Data relating to magnetic storms are supplied to the International Committee on Terrestrial Magnetism and to Potsdam Observatory. The solar surface was observed on 166 days; on 40 days the surface was found quite free from spots. The principal meteorological means, &c., are compared with the averages of 63 years; this long period greatly enhances the value of the data.

MUSEUM CONFERENCE AT HALIFAX.

A CONFERENCE of members of the Museums Association and other persons interested in museum work was held at Halifax on April 8. Halifax is peculiar in the organisation of its two public museums, which are directed by honorary curators, under the control of the Education Committee of the borough, and it was by these authorities that the conference was summoned. About sixty persons attended, including representatives from Liverpool, Manchester, Sheffield, Salford, Hull, Bolton, Warrington, and other museums in Lancashire and Yorkshire. After the Natural History Museum (Belle Vue) and the Museum of Anthropology and Arts (Bankfield) had been inspected, and tea taken on the invitation of the Mayor of Halifax, the chair was taken by Mr. Howard Clay, chairman of the Education Committee.

Mr. W. B. Crump, Halifax Museums, read a paper "On a New Method of illustrating British Vegetation in Museums," in which he described the exhibition of common British trees at the Halifax (Belle Vue) Museum, where it is carried out from the nature-study point of view, so as to direct attention to the features in the life-history which are readily observable in the woods, and proceeded to advocate the arrangement of botanical specimens in popular museums on a geographical basis instead of the usual systematic plan. A Pennine moor, an oak wood, a salt-marsh, the vegetation of a pond, may, by careful selection of material and the free use of photographs, be effectively illustrated in a museum.

Mr. H. Ling Roth, Halifax Museums, in a paper "On the Use and Display of Anthropological Collections in Museums," compared the two methods, the geographical or ethnographical and the Pitt-Rivers or topical method, in which latter the evolution of articles for some definite use is exhibited. By the study of unrisen peoples we may learn a great deal about our own gradual progress. Specimens should be accompanied by illustrations of the people who make and use them, and collections should be formed to show how things are made. All the points were demonstrated by reference to the exhibits in the Bankfield Museum. Mr. T. Sheppard, Hull Museum, spoke of the advantages following the publication of guides to the museum, and gave particulars of ways and means. Mr. H. P. Kendall made an appeal for the more systematic collection in museums of prints and other illustrations of local antiquarian interest.

SOME RECENT FISH LITERATURE.

TO the Philippine Journal of Science for October, 1910, Mr. Alveri Seale contributes an account of a collection of Bornean fishes; this includes 117 species, of which ninety-one are common to the Philippines. Among the five species described as new, mention may be made of a shark, *Carcharias borneensis*, allied to *C. dussumieri*, but differing in the position of the fins and the form of the teeth.

The Japanese representatives of the families Sciænidæ, Lobotidæ, and Lutianidæ form the subject of two papers by Messrs. D. S. Jordan and W. F. Thompson in the Proceedings of the U.S. National Museum, Nos. 1787 and 1792. Of the first family Japan possesses few species, all referable to the typical subfamily, and allied to Chinese and Indian types; there is but one representative of the second family, and the species of the third are not numerous, although two are sufficiently common to be of commercial value. It may be noted that in the second paper a new generic name is proposed for a Hawaiian fish. In No. 1782 of the same publication Mr. T. Gill discusses the structure, affinity, and habits of the wolf-fishes. From peculiarities in the structure of the scapular arch and the actinosts of the fins, coupled with the absence of ventral fins, the author supports the views that these fishes should be separated from the Blenniidæ to form a family by themselves—the Anarrhichadidæ. Examination of the skeleton demonstrates that the current classification of the genera requires radical amendment.

The generic and, in some degree, the specific name of the typical wolf-fish (*Anarrhichas lupus*) is based on a misconception, the former term signifying a climber, from a legend that these fishes occasionally leave the water and clamber on to the rocks, while the latter seems to have been given from an idea that they prey on other fishes. It has, however, long been known that they feed almost exclusively on molluscs, crabs, and sea-urchins, for seizing and crushing which their powerful dentition is specially adapted. Most of the species are normally inhabitants of depths where perpetual darkness reigns; and when the typical wolf-fish visits shallow water for spawning, it is active only at night. In spite of the prejudice against the wolf-fish on account of its hideous head and formidable teeth, the flesh is stated to be excellent for the table.

To the Proceedings of the Academy of Sciences of Philadelphia for October, 1910, Dr. H. W. Fowler contributes notes on little-known New Jersey fishes, and likewise notes on various chimæroids and ganoids. In the latter a new chimæra is described from New Zealand, and two new species of Cylindrosteus are likewise named.

In the same serial for December, 1910, Mr. Burnett Smith describes certain fish-remains from the Devonian of New York. Most of these are species pertaining to the European genus, Machæracanthus; but the author was fortunate enough to obtain part of the armour of a small arthrodire, which is provisionally regarded as referable to the plastron of a species of Dinichthys. Assuming this to be the case, he points out that the generally received determination of the bony elements of this part of the exoskeleton is incorrect.

In *Science Progress* for January, Dr. H. H. Swinnerton gives reasons to show that the ordinary view as to the respective functions of the median and paired fins of fishes require revision. These views are based, at any rate to a considerable extent, on the movements of fishes which have been deprived of one or more of their fins; but the author points out that operations of such severity must have caused very serious shock to the patients, and thus induced "wobbling" and other eccentric movements. As regards the hind dorsal and the ventral fin, the author is of opinion that their function is connected with the tail-fin, which is the sole propelling organ of the fish. The anterior dorsal fin, on the other hand, appears to serve as the chief agent in the rapid turning movements which are essential to the safety of a fish living in swiftly flowing waters. As regards the functions of the paired fins, these appear to have changed *pari passu* with the modification in the structure and orientation of these appendages which has taken place as we pass from ancient generalised to modern specialised types. To follow the author in tracing these out would, however, occupy too much space on the present occasion, and it must suffice to state that whereas in the primitive fossil shark Cladoselache the paired fins were little more than broad-based lobes on the sides of the body, with their expanded surfaces in the plane of the latter, in modern teleost fishes they are narrow-based fan-like structures, with their broad surfaces capable of being extended at right angles to the axis of the body. And the author has found that "it is possible to recognise a complete sequence from the broad-based fin acting as a keel, through the narrow-based fin with limited freedom acting as a lateral rudder, to the narrow-based fin with great freedom of movement which enables it to be used either as a keel, a lateral rudder, or a break."

In the April number of *The Zoologist* Colonel C. E. Shepherd continues his account of the pharyngeal teeth of fishes, dealing in this instance with the members of the cod family (Gadidæ) and the Carangidæ. R. L.

TECHNICAL TRAINING AND THE OPTICAL INDUSTRY.

THE scheme for the establishment of an Institute of Technical Optics in London was described in a short article in the issue of NATURE for March 16. In that article reference was made to two elaborate reports, covering nearly forty pages of foolscap print, and signed, respectively, by the education officer of the London County Council, Mr. R. Blair, and the Council's educational adviser, Dr. Garnett. The contents of Mr. Blair's report provide much information as to the provision made in this and other countries for higher work in technical optics, and we here reprint extracts from this report as showing the need for the action of the London County Council.

Introduction.—Although the United Kingdom is no longer in the forefront of the optical industry, the science of optics stood on a high level in this country for about 140 years after the publication of Newton's "Treatise on Optics" in 1704. Since 1850, however, the study of geometrical optics has progressed rapidly in Germany, but has been practically at a standstill in England. The trade conditions in both countries have kept pace with the state of optical knowledge. At one time the United Kingdom made most of the best optical instruments in the world and produced a large proportion of optical inventions. But latterly, inventions, presumably owing to more improved facilities for study and practical training, have been more numerous in Germany than in the United Kingdom. The great increase in the German production and export has also been assisted by many other factors, amongst which may be mentioned the help afforded by the Imperial Physical-Technical Institute at Charlottenburg (which should not be confused with the Technical University at the same town), the efforts of the Association of Instrument Makers, and the perfection to which the production of the special glass required has been brought at Jena. During the last fifteen years it has been gradually recognised in England that if the lost ground is to be regained, either wholly or partially, adequate provision must be made for optical instruction in all its branches.

A large amount of valuable information had been gradually gathered together, but, in view of the considerable expenditure suggested in aid of technical training for the optical industry, the presentation of this report was postponed until all available sources of information could be consulted. The inquiries include information regarding the extent of the trade in London and the provinces; the amount of capital invested and the number of workmen employed; the amount of imports and exports; any pecuniary support likely to be forthcoming from the trade or other sources, and the extent to which the trade would cooperate both in giving facilities to employees to attend the proposed institute, and in other ways; the question as to what branches of the optical industry should be included in the scheme, and the nature and extent of the institute as regards accommodation, equipment, and staff. It has also been necessary to study carefully the conditions of optical instruction and trade in Germany, and to investigate the statements and representations on behalf of their interests made by persons and bodies interested in the science of optics and the manufacture of optical instruments in England.

The final results of the investigations made and the conclusions which may reasonably be drawn from them, taken as a whole, point to the necessity for the establishment of the proposed institute for industrial, scientific, and national reasons—industrial because of the lack of progress in the British optical industry compared with the rapid progress made in Germany, and the fact that the value of an optical instrument lies almost wholly in the scientific knowledge and skilled labour applied to its making; scientific because of the necessity to the scientific worker of the production on the spot of the best and most suitable instruments for the purposes of pure and applied science; national because of the necessity of the home production of instruments for various branches of the public service.

Comparison between the Provision of Optical Instruction in England and Germany.

It appears beyond doubt that instruction in pure and applied optics and in fine instrument making is much more developed in Germany than in England. At most German universities, especially the technical universities, the importance of optics and its practical applications are recognised to a greater extent than in England; in some cases attention is even devoted to the practice of instrument making. At English universities optics are either practically neglected or are taught as a branch of physics together with sound, heat, and electricity. When attention is devoted to optics, the practical application of optical principles to the designing of instruments is almost entirely disregarded.

With regard to special technical schools for instrument making, Germany possesses four, England only a department of an institute. Moreover, the German schools are generally housed in proper buildings and well equipped for theoretical and practical work, whilst the building and equipment of the Northampton Department of Optics are quite inadequate.

The attention devoted to the German schools is reflected in the attendance of full-time day pupils:—Schwenningen, for example, has seventy-two, Göttingen eighty-eight, of whom a large number are engaged in technical optics. The department at the Northampton Institute has twenty

students, most of whom are engaged in sight testing and spectacle making and not in optical instrument making. The liberal funds available for the German schools enable them to charge only about 30*s.* per annum for full-time instruction. The Northampton Institute is compelled to charge 15*l.* per annum, a fee which many students must find it impossible to pay.

It is of some importance to observe that the four German schools, as their names imply, are organised for the teaching of fine instrument making generally, whereas the Northampton department is principally concerned with optical instruments.

Finally, it may be noted that the German schools have been established by the municipalities concerned, generally as a result of action taken by the local trades. They receive, however, maintenance grants from the States concerned and appear to be in close touch with the authorities.

The single courses given in fine instrument making at various German trade schools are at least equal in organisation and quality to the one or two courses at technical colleges in England and are greater in number. The work of the Munich course has been developed to that of a department of technical optics; 201 pupils receive eight to nine hours' instruction per week.

The more numerous and superior opportunities for optical instruction in Germany have made themselves felt in all directions. Formerly a large number of optical inventions were made in England. Latterly, they have been more frequent in Germany, and the resulting trade has gone to that country. The records of the Patent Office are conclusive in this respect; such names as Zeiss, Goerz, Anschütz, Steinheil, Busch, &c., are household words in British optical circles. Some British firms are compelled to employ foreign mathematicians.

No practical text-book of optics exists in English, and the principal technical literature on the subject of optical progress and inventions is in German. The Northampton Institute is the sole place in England where the Gauss system of computing simple lenses and lens systems is properly taught. English optical instrument makers who wish to keep abreast of their science and industry are compelled to learn German and teach themselves.

In spite of these drawbacks, many important recent inventions have been made in England; in fact, as regards the quality, the English optical inventions are probably unrivalled, although in quantity they are less. As British enterprise and manual skill are not inferior to German, it is reasonable to suppose that this country would easily hold its own if the necessary opportunities for full instruction were provided. In former times optical problems were simpler and technical methods less complex. This has entirely changed, and to-day Germany, the country with the best optical literature and instruction, produces most inventions and has the biggest output and export.

In spite of the advances made in optical instruction in Germany, it does not appear that the optical trade is by any means content with what has been done. The instrument-making schools are being improved and expanded, and trade classes for instrument-making at other technical schools are being increased and developed. To give two recent examples—the Göttingen school has just moved into a new building, and the Munich course has been converted into an independent department. Technical optical lectures are increasing at technical and older universities. There is a strong feeling that much more could be done by the State and municipalities for the further advancement of technical optics. This is very significant in view of the fact that the British industry at present is pressing for only a part of the educational facilities already at the disposition of the German industry.

Comparison between the Extent of the British and German Optical Industries.—Germany, the country with the most numerous and best-equipped schools, departments, and courses for teaching instrument making, and with the best technical universities, has captured the largest amount of the world's optical trade. Starting well behind France and England, she has thoroughly beaten both countries in the amount of her production and export. In both countries there is considerable difficulty in obtaining trustworthy figures as to capital and the number of workmen employed. Fairly definite figures, however, can be obtained from the export and import results and the British census of production figures.

The net British exports of scientific instruments, &c., have only increased from 395,009*l.* in 1900 to 509,185*l.* in 1909. But at the same time there has been a heavy import, commencing at 595,305*l.* in 1900 and rising to 666,563*l.* in 1909.

The German export of scientific instruments, &c., was valued at 1,200,000*l.* in 1898, and for 1909 it was valued at 2,276,550*l.* Since 1904 alone it has increased by 776,550*l.* Imports into Germany appear to be very low, whilst in England the imports are so heavy as to be larger than the exports. At the present moment the German export of optical instruments is almost as great as the whole of the British production. Apparently the British trade has no true exports in the sense of excess of exports over imports, and is dependent upon foreign imports for a part of the home consumption. In spite of all these disadvantages, however, the British industry continues to exist and do excellent work. The Germans state that at the Brussels Exhibition, 1910, both the British and French industries were well represented, and they direct special attention to the large English catalogue with its good illustrations.

Germany and France appear to possess almost a monopoly in the production of the special glass required for optical instruments; the French glass is made from German formulæ. Large quantities of raw optical glass and of partially and fully finished glasses and lenses are annually exported to England. If this export were interfered with by any cause, a large section of the British industry might possibly find itself in a very grave position.

It is not technical education alone which has assisted the German industry. There has evidently been a keen demand for the finest instruments of precision made in the country itself on the part of men of science, professors, professional men, the army, the navy, and manufacturers. Great help has also been afforded by the following factors:—

German Association of Instrument Makers.—The association was founded in 1881. It looks after the interest of the trade in every respect with regard to general education, technical training, commercial education, international and other exhibitions, and finally by representations to the Imperial Government. This last point seems of some importance, and some details may therefore be given. It appears that, as far back as 1890, the association was agitating for the proper differentiation, in official documents, between optical and other fine instruments. The difficulties caused by the lack of a suitable scheme of classification have already been mentioned. At the same time the association was making representations against a protective tariff for instruments manufactured in Germany, as their second market lay in foreign countries, and reprisals were feared. Other negotiations have been carried on with the Government with regard to avoiding the duties paid on the re-import of instruments for purposes of repair. This is most significant, as it shows that instruments sold abroad cannot be repaired abroad, but have to be returned to Germany for this purpose. The association deals very fully with all questions regarding the participation of German firms in international exhibitions and with representations concerning the imposition of foreign tariffs on German goods. In one case it approached the Danish Government with reference to obtaining a larger amount of Iceland spar for optical purposes.

Jena and the Optical Industry.—Much of the success of the German industry comes from the town of Jena, where the firm of Zeiss is situated. Three men combined together in order to produce what was required for the optical industry. These were Dr. Schott, a glass manufacturer; Prof. Abbe, an oculist; and Carl Zeiss, a microscope maker. Prof. Abbe's efforts have had great influence upon the German industry. He introduced many improvements, and endeavoured not only to benefit his own firm but the whole industry. Dr. Schott obtained a grant from the Prussian Government for the purpose of investigating the best kinds of glass for optical purposes, especially with regard to the relation between the optical properties of glass and the chemical composition of solid amorphous fluxes. The result is that Schott has almost a world's monopoly for the best kind of special glass for optical purposes. Where one of the very few English glass manu-

facturers will quote at most about twenty-five different meltings, Schott of Jena, and Parra-Mantois of Paris will quote anything between 100 and 150. It may be mentioned that the University of Jena has benefited to the extent of about 100,000*l.* by the success of the firm of Zeiss. At the present time the firm of Zeiss employs about fourteen graduates who are either mathematicians or medical men.

Imperial Physical-Technical Institute.—Very great assistance has been rendered by the Imperial Physical-Technical Institute in Charlottenburg, which, as above mentioned, should not be confused with the Technical University in the same town. It was founded in 1887, and is concerned partly with physical research and partly with the development, standardising, and testing of fine instruments of almost every description. Its relations to the optical industry are numerous and intimate, and the manufacture of optical instruments has benefited accordingly.

The British Optical Society.—Some account may be given of the Optical Society on account of its relations to the optical department at the Northampton Institute and the trade generally.

The society was founded in 1899, and has over 400 members in London and the provinces at the present time. It has kept alive the interest of the different branches of the trade in the technical optics classes at the institute, and has for a series of years contributed about 110*l.* per annum towards the expenditure for the same.

It has also been instrumental in placing the trade in communication with the institute with regard to the details of optical work. In 1901 it appointed an educational committee for the purpose of inquiring into the question of optical education generally. In 1902 Prof. Silvanus Thompson read an important paper on "Technical Optics" before the Society of Arts, in which he strongly urged the establishment of a real optico-technical institute either at the Northampton Institute or elsewhere. The same conclusion was arrived at by the Education Committee of the Optical Society. The committee pointed out that it was only by the provision of such educational facilities that the optical trade of this country could be expected to compete with its foreign rivals, and that the Northampton Institute, with its teaching staff and equipment, would be the suitable place for the new optico-technical institute.

The German industry has received much more benefit from its association than the British industry from the corresponding association in England. Finally, as the German research and standardising institute at Charlottenburg came into existence long before the corresponding English institute, it has consequently been enabled to get into closer and more fruitful touch with the optical industry.

The Optical Convention in 1905.—The convention dealt not only with scientific and trade subjects, but devoted considerable attention to the problem of optical education. On this last point it adopted the following resolution:—

"That the Optical Convention hereby expresses the cordial approval of the project of founding an optical technical institute for the training of opticians in the scientific principles of optics and their technical applications which it regards as a matter of industrial importance to the nation; and in view of the backward state of optical teaching in this country it urges the London County Council to push forward, as a matter of pressing need, the foundation of such an institution on the lines of the scheme which was under the consideration of the late Technical Education Board."

The Paramount Importance of the Optical Industry for Industrial, Scientific, and National Purposes.

It may be urged that the expenditure contemplated (amounting to 35,000*l.*, together with an annual maintenance grant rising eventually to 5000*l.*) is comparatively large in proportion to the extent of the optical industry, its capital, number of employees, and production. But this objection can scarcely be maintained when the problem is studied in all its far-reaching aspects.

In the first place, there are very few industries where the ultimate value of the goods produced represents so much in wages for the skilled designers and workmen and so little in the actual scrap-value of the materials employed. It is difficult to find an exact parallel in other branches of manufacture. For example, the production of valuable chemical products from certain raw materials as the result of intricate investigation and a long series of reactions. Or, perhaps the case of artistic products in which the actual value of the materials is very little compared with the value conferred by the insight of the artist and the cunning of his hand.

The overwhelming importance of the optical industry on the larger scientific and national issues involved was very clearly stated by Mr. Conrad Beck on the occasion of the deputation of the optical industry to the Technical Education Board in 1902. He pointed out that the number of instruments, for the manufacture of which optical knowledge is required, was very great indeed, ranging from ordinary spectacles, opera glasses, field glasses, telescopes, nautical instruments, microscopes, photographic lenses, photographic apparatus, and so forth, to surveying instruments, astronomical instruments, lanterns, range finders, gun sights, lighthouse prisms and reflectors, heliographs, periscopes, and almost every kind of optical instrument.

These instruments are widely used in the prosecution of science, in industrial processes, in the exercise of many important professions, in our shipping trade, the greatest in the world, and in the nation's naval and military lines of defence.

It cannot be too clearly understood that the success of the manufacture of all the instruments mentioned depends upon a thorough knowledge of practical optics on the part of designers and managers, and upon a constant supply of skilled foremen and workmen.

In times of peace the War Office and the Admiralty probably require something like 25,000 field glasses and telescopes per annum, and much larger number in times of war; the numbers sold to private individuals are, of course, much greater. Both the War Office and the Admiralty have been approached with regard to the influence which the proposed optical institute will have upon the production of the finest kinds of optical instruments used in the army and navy.

Spectacles, sooner or later, are worn by large numbers of persons. Field glasses and telescopes alone constitute a large business. All medical, biological, and many other students require microscopes; every ship's officer requires a sextant. Engineers require large numbers of levels and theodolites. The number of photographic lenses sold annually is extremely large. The illustrations of magazines, newspapers, and the majority of books are produced by photographic printing processes, largely depending for success on optical principles.

The advent of long range guns has been responsible for a special section of the optical industry concerned with the manufacture of elaborate optical gun sights and special telescopes of peculiar construction; new methods for range finding by optical instruments are being constantly sought.

In various industries a microscope is becoming each year of greater importance. It is used in the testing of steel and iron and for brewing, butter making, silk and textile manufacture, sugar making, and in numerous other industries. The photographic industry alone, which has assumed such great dimensions during recent years, is entirely dependent upon optical principles. Although large amounts of chemicals are used in photography and various materials for the construction of cameras, all the work employed would be entirely useless without the proper designing of the lenses employed.

Finally—although it cannot be definitely stated in concrete terms—there would appear to be some relation between the general efficiency of a nation and its manufacture of the finest instruments of precision for purposes of observation, research, measurement, and control. The material development of a nation is largely concerned with the utmost utilisation of the natural forces and materials at its disposal, and both pure and applied science are becoming increasingly dependent upon the help afforded by the finest instruments. A nation should have for this purpose an ample supply of the finest instruments. It should manufacture these itself for its own special purposes, and keep itself in a condition to repair and improve existing instruments and invent and construct new ones. It is significant to observe that both England and France have fallen behind Germany in this respect.

FINAL REMARKS AND RECOMMENDATIONS.

I have no hesitation in stating that a case has been made out for the establishment of the institute on broad and comprehensive lines, an institute which shall not only serve the needs of London, but also be of use to everyone connected with optical matters in the United Kingdom. The state of the industry, scientific opinion, and the other considerations involved, point to the need of the establishment of an institute without further delay. At the present moment an opportunity is afforded for utilising to the full the experience gained in foreign countries, the optical instruments of which have, to a large extent, supplanted our own. The Optical Institute, if founded, might become, under proper management, the first of its kind in the world. The material for doing this is at hand; it should be remembered that even in its present incomplete condition the optical department of the Northampton Institute has been visited by foreign technical experts, and many of its leading features copied.

The investigation has shown that the widest cooperation may reasonably be expected from eminent men of science, from the leading manufacturers, and from the University of London, other universities, and the Imperial College. The institute is thus assured of the best scientific advice possible and of actual practical help from interested manufacturers, and it will benefit by being linked up with institutions of university rank for the purposes of the finest research directly applicable to practical and industrial purposes.

The principal decision to be arrived at by the subcommittee at the present stage is whether capital expenditure, amounting to 35,000*l.*, and an annual maintenance grant rising eventually to 5000*l.*, for the benefit of the optical industry is justifiable, bearing in mind the great national and industrial issues involved. Most of the further details must be considered later and must form the subjects of special reports. Such details will include the proportion of instruction to be devoted to optical instruments in particular and to other fine instruments of precision, the final arrangement of the rooms, details of staffing, the nature of the equipment, the prosecution of research in optical instruments and in optical glass, and so forth. A sum of 5000*l.* in respect of the contemplated expenditure has been included in the capital estimates for 1911–12, and I recommend:—

(1) That a grant of 35,000*l.*, including 5000*l.* for equipment, be allowed to the governors of the Northampton Polytechnic Institute (*Finsbury, C.*), in respect of an institute for technical optics as set forth in the foregoing report.

(2) That the institute be built upon the site already purchased by the governors of the Northampton Polytechnic Institute.

(3) That the institute be governed by the governing body of the Northampton Polytechnic Institute.

(4) That a consultative committee be formed for advisory purposes, on which the optical trade shall be adequately represented.

(5) That, for research and other purposes, steps be taken to affiliate the institute to the Imperial College of Science and Technology, and to associate it closely with the National Physical Laboratory at Teddington and institutions of university rank.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

ANNOUNCEMENT of generous bequests to Aberdeen University is made in *The Times*. From this source we learn that the late Miss Anne Hamilton Cruickshank, daughter of the late Prof. John Cruickshank, who held the chair of mathematics in Aberdeen University, has provided by her will for a professorship or lectureship in astronomy, including navigation and meteorology, in the University, and for a science library at Marischal College. Miss Cruickshank bequeaths 10,000*l.*, from which the trustees are to apply such amounts as, with the funds already in their hands for the same purpose, will make up a total of 10,000*l.* for the institution and endowment of a lectureship or chair of astronomy, including navigation and meteorology. Any balance of the 10,000*l.*, after deduction of the sum required for the institution of a chair of astronomy and the cost of the windows, is to be set aside and applied in such manner as the special trustees may think proper for the library at Marischal College. Miss Cruickshank also leaves 10,000*l.* to the special trustees for the founding and supporting in Marischal College of a science library, to be called the Cruickshank Science Library.

LADY KELVIN has made a gift of 500*l.* to the University of Glasgow for the purpose of founding therein a prize for original research in physics, in memory of the late Chancellor. The prize, which will be accompanied by a gold medal, will be awarded once in three years to a doctor of science who has graduated in the interval, and whose dissertation contains evidence of original experimental work deserving of this special distinction. A similar prize was recently founded by the pupils and friends of Prof. William Jack, to be awarded for the most distinguished mathematical thesis offered for the degree of D.Sc.

AT a meeting of members and officials of local education committees, held at Aberystwyth on April 18 in connection with the Conference of the National Union of Teachers, a discussion upon the necessity for further financial aid for education from the central exchequer was opened by a paper read by Mr. G. S. Baxter, secretary of the Sheffield Education Committee. The following facts from Mr. Baxter's paper are of interest. For the year 1904–5, the expenditure of local education authorities on current account for all purposes pertaining to elementary education only was 18¼ millions, towards which Government grants of 9⅛ millions were received, whilst for the year 1908–9 (the latest available official returns) the expenditure of local authorities had increased to 23 millions and the Government grant to 11½ millions. Therefore, although local charges increased by 4⅞ millions in four years, the State contribution only advanced by about 1½ millions. In addition to the added responsibilities in respect of elementary education, the cost of supplying and aiding secondary, technical, and higher education for the year ended March 31, 1909, amounted to 4½ millions, towards which Government grants were received amounting to less than 2 millions. Taking elementary, secondary, technical, and higher education together, therefore, local authorities in England and Wales expended in 1908–9 a total sum of 27½ millions, of which the Government contributed just over 13 millions, or 48 per cent., leaving about 14½ millions, or 52 per cent., of the amount to be provided locally.

AT the Aberystwyth Conference of the National Union of Teachers, the following resolution, proposed on behalf of the executive, was adopted:—"This conference is of opinion that (*a*) no exemption (either partial or whole time) from school attendance should be granted until the age of fourteen years is attained; (*b*) all wage-earning child labour out of school hours under the age of fourteen should be forbidden by law; (*c*) a system of compulsory attendance at continuation schools from the age of fourteen to eighteen, accompanied by provisions which should safeguard the young people against undue physical or mental overstrain, should be an integral part of a national system of education; (*d*) it should be the statutory duty of the local education authority of each county and county borough to make suitable provision for such further education; (*e*) it should be the statutory duty of every employer of any young person under eighteen years of age (1) to enable him or her to attend continuation classes for such periods of time and at such hours as may be required by the Act, and (2) to supply the names of all such young persons to the local authority on demand; (*f*) all employers should be forbidden under penalty to employ or continue to employ any young person under eighteen years of age who failed periodically to produce a card attesting his or her attendance and good conduct at continuation classes or other educational institutions in conformity with the Act; (*g*) it shall be the duty of the State to make provision for the maintenance of any young person who may be deprived of the means of living as a result of the operation of any national system of education such as is outlined in the foregoing resolutions."

SOCIETIES AND ACADEMIES.

LONDON.

Royal Meteorological Society, April 19.—Dr. H. N. Dickson, president, in the chair.—W. **Marriott**: Variations in the English climate during the thirty years 1881–1910. The Royal Meteorological Society in 1874 commenced the organisation of a series of "second-order stations" at which observations of pressure, temperature, humidity, rainfall, and wind are made twice a day, viz. at 9 a.m. and 9 p.m. In addition to these, another class of stations, termed "climatological," at which observations are made once a day, viz. at 9 a.m., was organised in 1880. The monthly results from all these stations have been published in the "Meteorological Record." The author has taken the general monthly means of all these results as representing the means for England and Wales, and these general means were exhibited to the meeting in the form of an interesting series of diagrams, in which the variations of the various elements for each month were shown in red when above the average, and in blue when below the average, for the thirty years 1881–1910. The warmest months were August, 1899, July, 1900, and July, 1901, while the coldest months were February, 1895, January, 1881, and December, 1890. During the last fourteen years the temperature in October was above the average, with only one exception, viz. 1905. The years with the highest mean temperature were 1898, 1893, and 1899, and the years with the lowest temperature were 1892, 1888, and 1887. The month with the highest mean pressure was February, 1891, and that with the lowest pressure was March, 1909. On the average, April is the month with the least rainfall, and October the month with the heaviest rainfall, while June has the least number of days of rain. The wettest months during the thirty years were October, 1903, and October, 1891, and the driest months were February, 1891, and April, 1893. The years with the heaviest rainfall were 1903 and 1891, and the years with the least rainfall were 1887 and 1893. The wind diagrams showed that the prevailing winds were from the south-west and west, but that in April, May, and June north-easterly winds were more pronounced than in the other months of the year.—Captain C. H. **Ley**: (1) The value of the two-theodolite method for determining vertical air motion; (2) an automatic valve for pilot balloons.

MANCHESTER.

Literary and Philosophical Society, March 21.—Mr. Francis Jones, president, in the chair.—W. **Thomson**: The influence of atmospheric pressure and humidity on animal metabolism. In a previous paper the author stated he had found that the percentage of carbonic acid gas contained in the exhaled air from the lungs was greater when breathing dry than when breathing damp air, also when breathing in mountainous districts where the atmospheric pressure was low than when breathing in the valley, and, again, was greater when breathing in the valley than when breathing at the bottom of a deep coal-pit, where the pressure is still greater. The experiments recorded in the present paper were made upon the exhaled air from three men and one boy, and upon guinea-pigs and mice, and the results from all show that, as a rule, when the barometer fell the percentage of carbonic acid in the exhaled air rose, and when the barometer rose the percentage of carbonic acid fell. As the air became more moist the percentage of carbonic acid fell, and it rose when the air became drier. There was a lower percentage of carbonic acid in the exhaled air when the weather was warm than when it was cold.—Miss Margaret C. **March**: The ornament of *Trigonia clavellata* and some of its derivatives.

April 4.—Mr. Francis Jones, president, in the chair.—Prof. W. W. Haldane **Gee** and A. **Adamson**: Dioptriemeters. The methods of measuring the focal power of thin lenses directly in *dioptries* have been investigated. In the case of converging lenses, the method of obtaining this value directly from observations on the optical bench is to determine the reciprocal of the focal length in metres by calculation, by scale or table of reciprocals, or by a graphical construction which will enable the value in dioptries to be read off from a uniform scale placed at right angles to the line along which the focal length has been measured. In the case of concave lenses (as well as converging lenses) the authors have adopted a method originally suggested by Guilloz, but practically unknown in physical laboratories. They have designed an instrument called a "dioptriemeter," which is of great simplicity and convenience. It consists essentially of a scale of concentric circles 1 mm. apart, which is viewed through a pin-hole at a distance of 200 mm. Midway between the pin-holes and scale is a disc with a circular opening of 10 mm. radius, so that twenty circles are seen. If a concave lens be placed against the disc more circles are seen, the excess above twenty giving the power in dioptries. The circles are so numbered that the value is directly read off. The same method is applied to a convex lens. The instrument is especially useful for investigating the properties of cylindrical lenses and the combinations of lenses. It can further be employed for finding the deviation of light by thin prisms and estimating their power in *prism-dioptries*. The method employed in the instrument has been found to be quite as accurate in principle as the usual optical-bench methods for thin lenses.—Prof. E. **Knecht**: The action of hydrogen peroxide on quinone. It was shown that when hydrogen peroxide is allowed to act on quinone in presence of ammonia, the solution becomes heated, and a brisk evolution of oxygen takes place. On acidulating the solution and extracting with ether, hydroquinone was found to have been formed in considerable amount. Toluquinone behaves in a similar way to ordinary quinone.—Dr. A. N. **Meldrum**: The development of the atomic theory: (vi.) the reception accorded to the theory as advocated by Dalton. At first Dalton's physical atomic theory met with keen opposition, and his chemical theory with neglect. To make the chemical theory known required, in addition to Dalton's own efforts, the zeal of Thomas Thomson and the support of William Hyde Wollaston. For years it came to almost nothing, except in Sweden and Italy. In Sweden, J. J. Berzelius, learning of it in the year 1808 from a memoir by Wollaston, received it with enthusiasm, and set himself, with immense success, to test it on the grand scale. In Italy it was the knowledge of Dalton's theory which stimulated Amadeo Avogadro to enunciate and maintain, exactly a hundred years ago, the hypothesis that equal volumes of different gases contain under the same conditions the same number of molecules. This hypothesis, after the lapse of fifty years, became the fundamental dogma of molecular science.

PARIS.

Academy of Sciences, April 10.—M. Armand Gautier in the chair.—M. **Gouy**: Intercathodic action in a uniform magnetic field. It has been shown by experiment that intercathodic action is produced when the negative charges are connected by the lines of magnetic force. It is now shown that this condition may be replaced by another which is equivalent to it, that there is a maximum of electric potential on the path of the electrons.—M. **Salet**: The absorption and diffusion of light by meteorites of the intersideral space. The number of meteorites received by the earth in a year has been estimated at over 10^{11}, and their mass to be of the order of 1 gram. If these meteorites do not form a stream displaced with the sun, the number per unit volume in space is of the order of 10^{-6}. Some consequences of the diffusion of light by these meteorites are developed, and also of the bearing on the calculations of Pearson on the standard deviation.—Ch. **Fabry** and H. **Buisson**: Some applications of the phenomena of interference to the study of nebulæ. The method of applying the Fabry interferometer to a telescope is described: interference rings have been obtained with this apparatus from the nebula in Orion without difficulty.—A. **Buhl**: Development of a method due to M. Darboux on the theory of moments of inertia.—M. **Darboux**: Remarks on the preceding note.—André **Broca**: The measurement of geodesic angles by the method of repetition. Construction of a suitable apparatus and results of the measurements. The maximum error found was 1 in 300,000.—J. **Le Roux**: The fundamental covariants of the second order in the finite deformation of a continuous medium.—L. **Hartmann**: The mechanism of the permanent deformation in metals submitted to extension. A study of the manner in which the layer of oxide formed on tempered steel comes off when the elastic limit is passed.—G. A. **Hemsalech**: The line spectrum of air given

by the electric spark. The existence of a second line spectrum of air has been established, emitted exclusively by the oscillations of the electric spark.—P. **Pascal**: Researches on the magnetic properties of fluorine. A detailed study of the magnetic susceptibility of fluorbenzene and parafluorphenetol.—A. **Tian**: The decomposition of water by ultraviolet light. Under the action of the radiations from a quartz mercury vapour lamp, water is decomposed into hydrogen and hydrogen peroxide, the latter, decomposing in its turn, giving rise to oxygen. After a sufficient lapse of time for the equilibrium to be established, the effect of the ultraviolet light is identical, so far as the gases evolved are concerned, with electrolysis.—E. **Fleurent** and Lucien **Lévi**: The estimation of phosphorus in milk. Remarks on a recent paper of Bordas and Touplain.—H. **Jumelle** and H. **Perrier de la Bathie**: The leafless Asclepiads of the west of Madagascar.—Lucien **Daniel**: Biometrical study of the descent of grafted and non-grafted beans.—J. **Granier** and L. **Boule**: The heterogamic character of the *gemini* in *Impatiens glanduligera*.—M. **Truschel**: Contribution to the study of the sense of direction in the blind. A study of what has been termed the "sixth sense" in the blind leads to the conclusion that this is really of an auditive nature.—Armand **Juillet**: Relations between the air sacs and the bronchia in birds.—Jules **Courmont** and A. **Rochaix**: The antitoxic immunisation by intestinal antityphoid vaccination. Intestinal vaccination produces immunity against typhoid toxins and the serum of the vaccinated subjects is antitoxic.—M. **Schaller**: A new arrangement for photographing lesions of the skin or mucous membranes, giving configuration and the value of the morbid colorations.—M. **Weinberg** and A. **Julien**: An example of an acquired immunity towards a verminous toxin.—P. A. **Dangeard**. The conjugation of the ciliated Infusoria.—Ph. **Négris**. The distinctive characters of the breccia arising from the erosion of transported breccia in the Peloponnesus.—J. **Thoulet**: A bathy-lithologic chart of the gulf between Têt and Gruissan.

DIARY OF SOCIETIES.

THURSDAY, APRIL 27.

ROYAL SOCIETY OF ARTS, at 4.30.—The Trend of Mineral Development in India: Sir Thomas Henry Holland, K.C.I.E., F.R.S.

ROYAL INSTITUTION, at 3.—The Optical Properties of Metallic Vapours: Prof. R. W. Wood.

MATHEMATICAL SOCIETY, at 5.30.—A Symmetrical Method of Apolarly Generating Cubic Curves: W. P. Milne.—The Solution of the Homogeneous Linear Difference Equation of the Second Order (Second Paper): G. N. Watson.—A Cartesian Theory of Complex Geometrical Elements of Space: G. B. Mathews.—The Number of Primes of given Linear Form: Lieut.-Col. A. Cunningham.—On the Proofs of the Properties of Riemann's Surfaces discovered by Lüroth and Clebsch: Prof. M. J. M. Hill.—On Properties of certain Linear Homogeneous Substitutions: H. Hilton.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—Battery Economics and Battery Discharge Arrangements: A. M. Taylor.

ROYAL GEOGRAPHICAL SOCIETY (Research Meeting), at 5.—Recent Progress in Geodesy: A. R. Hinks.

FRIDAY, APRIL 28.

ROYAL INSTITUTION, at 9.—The Revolutions of Civilisation: Prof. W. M. Flinders Petrie, F.R.S.

PHYSICAL SOCIETY, at 5.—High-tension Electrostatic Wattmeters: Prof. Ernest Wilson.—Previous Magnetic History as Affected by Temperature: Prof. Ernest Wilson and L. C. Budd.—Note on the Behaviour of Incandescent Lime Kathodes: Dr. R. S. Willows and T. Picton.—On the Formation of Dust Striations by an Electric Spark: Dr. S. Marsh and W. H. Nottage.

INSTITUTION OF MECHANICAL ENGINEERS, at 8.—Gas-producers: J. Emerson Dowson.—The Effect of Varying Proportions of Air and Steam on a Gas-producer: E. A. Allcut.

INSTITUTION OF CIVIL ENGINEERS, at 8.—The Commercial and Technical Relations of Engineering Design and Work: T. Frame Thomson.

MONDAY, MAY 1.

ROYAL SOCIETY OF ARTS, at 8.—Rock Crystal: its Structure and Uses: Dr. A. E. H. Tutton, F.R.S.

SOCIETY OF ENGINEERS, at 7.30.—The Protection of Water Supplies: H. C. H. Shenton.

ARISTOTELIAN SOCIETY, at 8.—A New Law of Identity: Miss Constance Jones.

SOCIETY OF CHEMICAL INDUSTRY, at 8.—The Testing of Creosote: C. Edward Sage.—A Modification of Raschig's Theory of the Lead Chamber Process: E. Divers, F.R.S.

INSTITUTE OF ACTUARIES, at 5.—Notes on the Insurance Act 1910, Dominion of Canada: T. Bradshaw.

TUESDAY, MAY 2.

ROYAL INSTITUTION at 3.—The Decay of Idealism in France and of Tradition in England: J. E. C. Bodley.

FARADAY SOCIETY, at 8.—Hydro-electric Plants in Norway and their Application to Electrochemical Industry: A. Scott-Hansen (Christiania).—Electro-metallurgy in the Steel Foundry: Verdon Cutts.—Two Simple Forms of Gas-pressure Regulators: Edgar Stansfield.

WEDNESDAY, MAY 3.

ROYAL SOCIETY OF ARTS, at 8.—Improvements in the Transport and Distribution of Goods in London: A. W. Gattie.

ENTOMOLOGICAL SOCIETY, at 8.—South African and a few Australian Aculeate Hymenoptera in the Oxford Museum: the late Col. C. T. Bingham.

SOCIETY OF PUBLIC ANALYSTS, at 8.—The Evaluation of certain Spices used in Medicine: J. C. Umney and C. T. Bennett.—Absorption of Dissolved Oxygen by Sewage Effluents and the Royal Commission's Provisional Standard: E. Halliwell.—The Detection of Traces of Hydrogen Cyanide: Dr. G. D. Lander and A. E. Walden.—(1) Note on the Composition of "Blaud's Pills"; (2) Note on the "Pearl Coating" of Pills.—A. E. Parkes and J. D. Roberts.—A Reaction for "Caulophyllin."—J. F. H. Gilbard.

THURSDAY, MAY 4.

ROYAL SOCIETY, at 4.30.—*Probable Papers*: Some Phenomena of Regeneration in Sycon, with a Note on the Structure of its Collar-cells: J. S. Huxley.—Cancerous Ancestry and the Incidence of Cancer in Mice: Dr. J. A. Murray.—Motor Localisation in the Brain of the Gibbon correlated with a Histological Examination: Dr. F. W. Mott, F.R.S., Dr. E. Schuster, and Prof. C. S. Sherrington, F.R.S.—Immunisation by means of Bacterial Endotoxins: Dr. R. T. Hewlett.

ROYAL INSTITUTION, at 3.—The Optical Properties of Metallic Vapours: Prof. R. W. Wood.

LINNEAN SOCIETY, at 8.—On John Vaughan Thompson and his Polyzoa, and on Vaunthompsonia, a Genus of Sympoda: Rev. T. R. R. Stebbing, F.R.S.—On Polytrema and some Allied Genera: Prof. Sidney J. Hickson, F.R.S.—Observations on some New and Little-known British Rhizopods: J. M. Brown.—The British Museum Collection of Blattidæ enclosed in Amber: R. Shelford.—Freshwater Algæ collected in the South Orkneys by Mr. R. N. R. Brown: Dr. F. E. Fritsch.

RÖNTGEN SOCIETY, at 8.15.—The Use of Radium in Malignant Growths: C. W. Mansell Moullin.—Rapid Radiography: Ed. S. Worrall.

FRIDAY, MAY 5.

ROYAL INSTITUTION, at 9.—New Organic Compounds of Nitrogen: Prof. M. O. Forster, F.R.S.

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