THURSDAY, AUGUST 11, 1898.

THE PALÆONTOLOGY OF VERTEBRATES.

Outlines of Vertebrate Palæontology. By A. Smith Woodward. (Cambridge Natural Science Manuals.) Pp. xvi + 470; illustrated. (Cambridge: University Press, 1898.)

IT is now thirty-eight years since the appearance of the first edition of Owen's "Palæontology," which may be regarded as the first systematic treatise on that subject issued in this country. And if the section of that work devoted to the vertebrates be contrasted with the volume now before us, some idea of the enormous strides made in this branch of biological science during the period will be self-apparent. At the time that Owen wrote, our knowledge of fossil fishes remained much in the state it was left by the labours of Georges Cuvier and Hugh Miller; the restoration of the armour-plated fish-like types appearing as more or less grotesque caricatures of what we now know to be their true form; while the classification was as crude as it was unphilosophical.

The group now termed the Stegosauria was at that time placed among the Reptilia, and was represented chiefly by the true Labyrinthodonts and the *Archegosaurus*; the latter of which still figured as the representative of the so-called "archetype." Although among the true reptiles the Ichthyosaurs, Plesiosaurs, and Pterodactyles were already fairly well known, the Anomodonts were in evidence mainly by a few skulls, and their apparent relationship to mammals was undreamt of. North America and Belgium had not yet opened to our view the marvellous array of Dinosaurs; while among birds *Archæopteryx* was still an unknown quantity. To attempt to point out the deficiencies which then prevailed in our knowledge of the Mammalia would far exceed our space, but it may be mentioned that the Creodont Carnivora, and the Amblypod Ungulates, together with several other American groups of the latter order, had not yet been recognised. And whole mammalian faunas, such as those of Quercy, Samos, Maragha, the "Bad Lands" of North America, and Patagonia, were quite unheard of.

The advance during this period of considerably less than half a century, both in the amount of material available for work and in the work actually accomplished, has, indeed, been so vast that the vertebrate palæontology of 1860 is scarcely comparable with that of 1898. The one hardly merited the name of a science at all, while the other is entitled to rank with modern vertebrate zoology, of which, indeed, it is but the complement and keystone. As we have probably already explored most of the bone-beds of the world the science is unlikely to advance during the next forty years by the leaps and bounds which have marked its progress in the past, but even at a much lower rate of speed our successors at the end of that period will probably be surprised at the imperfection of our own knowledge.

With the advantage of all the labours—and failures—of his predecessors in this field at his disposal, it is not to be wondered at that Mr. Woodward has succeeded in producing a volume that will eclipse or throw into the shade all previous works on the subject. In bringing the classification of fossil fishes up to its present state of comparative perfection the author himself occupies the foremost place among palæontologists; and in regard to this portion of the subject criticism would be almost an impertinence. He has also contributed important original information with regard to the structure and affinities of the extinct crocodiles and certain other groups of reptiles. With regard to the remaining groups of vertebrates, the author's position in the British Museum affords him exceptional opportunities of not only keeping abreast with modern discovery, but also of verifying and criticising the work of his fellow labourers by an examination of many of the actual specimens on which such work is based. And when he has seen reason so to do, he has not hesitated to propose new interpretations.

In his preface Mr. Woodward states that the main object of his work has been to produce a volume suitable to the requirements of "students of vertebrate morphology and zoology who are desirous of examining in detail the palæontological aspect of their subject." And how important it is to bring the workers in the zoology of the present time into closer touch with those who devote themselves to the same study in the past, needs no urging on our part. While, therefore, the work is not to be regarded as one that will satisfy all the needs of the advanced student of vertebrate palæontology, it will be invaluable even to him; and for those for whom it is specially designed it appears, in the main, to be all that can be desired.

One highly important feature in the treatise is the selection of a few of the better-known types of each group to indicate the leading structural peculiarities thereof; and the reader is accordingly spared all mention of the imperfect and unsatisfactory specimens which too frequently render palæontology so unattractive to workers in recent zoology. So far as we are capable of judging, Mr. Woodward appears to have attained remarkable accuracy in regard to the facts connected with the animals he describes. And what makes his descriptions particularly valuable is that the details of structure are arranged in each instance, so far as practicable, in the same order; thus rendering the comparison of one major or minor group with another of the same rank as easy as possible. The admirable illustrations, many of which are original, while others are borrowed from the writings of well-known specialists, serve to explain and accentuate the descriptions; and if the careful reader fails to grasp the leading morphological traits of the groups and genera described, it will certainly not be the fault of the author.

One point that strikes the critic is that the author is somewhat too apt to describe groups or genera with a somewhat over-degree of confidence as to their affinities, and in regard to the remains which have been referred to them.

Take, for example, the genus *Homalodontotherium*, originally described by Sir W. H. Flower, on the evidence of an imperfect skull from the Tertiaries of Patagonia, now in the British Museum. No one reading the description would imagine that there are palæontologists who believe that the reference of this genus to the "Ancylo-

poda" is based on a misconception, and that there are even some who doubt whether the limb-bones assigned to it in this volume are rightly associated. Whenever such doubts exist, either in regard to systematic position or the association of remains, the mention of them is, in our opinion, of prime importance.

Another point to which we take exception is the author's hesitation in adopting the rule of priority in nomenclature, unless strong reasons exist against it in particular cases. The result of this hesitation is that in many cases we have two names given for a genus as if they were of equal value. We find, for instance, *Belodon* or *Phytosaurus*, *Hyopotamus* or *Ancodus*, and *Giraffa* or *Camelopardalis*. In the third case the introduction of the alternative is obviously superfluous, as it is used by no zoologist with any respect for himself; but in the others, the second name is the one that should be employed. Whether he accept priority or no, the author ought to have made up his mind which name he intended to use, and have stuck to that and that alone. The man who hesitates in this respect is lost.

In regard to the classification of the higher vertebrates, the author follows to a great extent the schemes of some of those by whom he has been preceded. But in certain cases innovations are made, some of them doubtfully advantageous. We fail, for instance, to see the advisability of definitely including the problematical Eocene group Tillodontia within the Rodent order, of which it completely destroys the definition. Till their affinities be proved absolutely certain, it seems to us preferable to follow Sir William Flower in regarding such groups as occupying undetermined positions.

In view of recent discoveries with regard to vestiges of a placenta in certain living marsupials, the author's observations in regard to the phylogeny of that group will be read with special interest. Mr. Woodward is of opinion that marsupials have become non-placental by degeneration, and that the loss of nearly all replacement in the dental series is likewise an acquired feature. But he believes that the little *Triconodon* of the Dorsetshire Purbeck had already acquired the modern dental type; and it is consequently to be inferred that marsupials had become differentiated from a primitive placental type by the middle of the Jurassic epoch, and that such marsupials existed in the northern hemisphere. Now in a later passage (p. 431) we read that "the skeleton of these Australian marsupials does not appear to differ in any essential respects from that of the Creodonta and Condylarthra met with in the northern hemisphere at the dawn of the Eocene period. It is quite likely, therefore, that they [the Australian marsupials] are the direct descendants of some unknown families of the latter groups in the southern hemisphere." But he has already admitted the existence of true marsupials in the northern hemisphere during the Jurassic, and it is, therefore, obvious that, allowing time for migration of the evolved marsupials into the northern hemisphere, "some unknown families of Creodonta and Condylarthra" must have existed in the southern hemisphere at least as early as the Lower Jurassic, if not the Triassic! If we read the author's meaning correctly, there is no getting away from this *crux*, and it is certainly a "large order" that the groups in question should be of such vast antiquity. We are prepared to accept the origin of the Monotremes from the Anomodonts or some allied Batrachians, and have indeed urged it ourselves; but, in the absence of tangible evidence, to be asked to believe that the Creodonts originated in the Trias or Lower Jura from the Theriodonts (which is practically what the above amounts to) at present staggers our powers of credulity.

On p. 430 the author revives the old theory as to the complete isolation of Australia "from all other existing continental areas since the remote epoch when Prototheria and Metatheria were the dominant mammals." And in order to support this contention he is compelled to remove the Patagonian Tertiary *Prothylacinus* (p. 388) from the Marsupials, and to place it among the Creodonts. But if an animal with a thylacine-like dentition (perhaps with somewhat fuller replacement) and skull, and an inflected lower jaw is not a Marsupial, it seems to us that we may as well give up our present system of classification altogether. Moreover, the isolation theory involves great difficulties with regard to the origin of the American opossums and selvas and the Australian dasyurids.

There are, however, difficulties into which the author's fondness for the isolation of continental areas leads him in other parts of the world. On p. 419 we are told that "South America must have been quite an isolated region from the close of the Cretaceous to the dawn of the Pliocene." It is true that on p. 429 this isolation is limited, so far as words go, to North America; but the general idea conveyed is the same, and nothing is mentioned with regard to the necessity of connection with other lands to explain the evolution of the fauna. The separation from North America is undoubtedly true, and thus far we are glad to be in agreement with the author. But when he speaks of universal isolation since the Cretaceous, it practically implies that the Ungulates and Rodents of South America have had no connection whatever with those of the rest of the world, since it is more than doubtful if these orders, as such, were evolved in Cretaceous times. And we should like to be informed how the occurrence of Octodonts in both South America and Africa is to be explained; to say nothing of the apparent connection indicated by recent discoveries between the African hyraces and the Patagonian Toxodonts and Typotheres. Moreover, in this connection the author seems deliberately to have walked into a pitfall of his own digging. The aforesaid Patagonian *Homalodontotherium* is referred (p. 307), in opposition to the views of most writers, to a group of Ungulates known as the *Ancylopoda*, and typified by the European, Asiatic, and North American genus *Chalicotherium*. Now *Chalicotherium* is unknown before the Oligocene, and if South America has been shut off from the rest of the world between the Cretaceous and the Pliocene it would involve the supposition that it originated quite independently of *Homalodontotherium*; or, in other words, two members of one and the same group were developed in isolated areas without the possibility of the existence of a common ancestor.

But this is not all the fault we have to find with Mr. Woodward's treatment of the *Ancylopoda*. He mentions and describes *Homalodontotherium* first, so that the unsophisticated student would take that genus (instead

of *Chalicotherium* or *Macrotherium*) to be the type of the group, whereas it is more than doubtful whether it belongs to it at all. And it must be added that, in our opinion, the whole suborder is an unnecessary one. The teeth of the two genera last mentioned are so like those of the *Brontotheriidæ*, that we are persuaded the *Chalicotheriidæ* are merely Perissodactyles that have developed an edentate-like type of foot. A somewhat similar type has originated independently among the Artiodactyla in the *Agriochœridæ*, and there is no reason why it should not occur in the Perissodactyles.

Space prevents allusion to several other points inviting criticism; but, in the main, we are satisfied that Mr. Woodward has succeeded in producing a very valuable work, so far as actual facts are concerned. In regard to theories, it is possible that he may see his way to certain modifications in a later edition. An important feature is the bibliography at the end, which is generally remarkable for its accuracy, although the present reviewer must disclaim the authorship of a work with which he is credited under the title of "Deer and their Horns."

R. L.

THE SCIENCE OF PREVENTIVE MEDICINE.

Transactions of the British Institute of Preventive Medicine. (First Series). Pp. xi + 163. (London: Macmillan and Co., Ltd. New York: The Macmillan Company, 1897.)

IN an editorial note to this volume Dr. Allen Macfadyen writes that "the papers included in this volume have been contributed by members of the staff of the Institute, and were completed early in the present year" (1897), so that more than a year ago the British Institute of Preventive Medicine was able to point to this series of completed but unpublished papers, which, however, only saw the light at the end of 1897, as evidence of the activity of its staff.

As considerable interest is naturally being evinced in the Institute, which has just taken up its abode in a new home at Chelsea, it is perhaps desirable to give more than a mere review of the work that has so quietly and steadily, but unostentatiously, been going on in the old habitation.

As Lord Lister points out in a short introductory notice, "The British Institute of Preventive Medicine was incorporated on July 25, 1891, with the view of founding in the United Kingdom an institute similar in character and purpose to the 'Institut Pasteur' in Paris, the 'Hygienisches Institut' in Berlin, and other establishments of a like nature existing abroad." The main objects of the Institute, as set forth in the memorandum of Association, are as follows:—

"(1) To investigate the means of preventing and curing the various infective diseases of men and animals, and to provide a place where researches may be carried on for this purpose.

"(2) To provide instruction in preventive medicine to medical officers of health, medical practitioners, veterinary surgeons, and advanced students.

"(3) To prepare, and to supply to those requiring them, such special protective and curative materials as have already been found, or shall in future be found of value.

"Further, to provide the means for carrying out investigations in all branches of bacteriology, including those of practical importance to chemists, agriculturists, and manufacturers."

It had evidently also been anticipated that it would be necessary to carry out the examination of water and sewage as regards their bacteriological and chemical contents, and with this in view a chemist has been appointed on the staff to take charge of such work. How far the objects of the Institute have been gained is evident from even a superficial glance at the papers contained in this first series of *Transactions*; while on a more careful study of the contents of this volume it is evident that much work of permanent value has been done under the direction of Dr. Macfadyen, Dr. Hewlett, and Mr. Lunt.

The first paper, which is evidently based on work carried out in connection with the production of anti-streptococcic serum, deals especially with the exaltation of the virulence of the streptococcus pyogenes and the streptococcus erysipelas by passing them through the rabbit. In the course of twenty-six such passages, Dr. Bulloch found that he was able to increase the virulence from a strength such that one-quarter of a c.c. was necessary to kill one kilogramme of rabbit to a strength such that one-millionth c.c. was sufficient to bring about the same result; but Dr. Bulloch comes to the conclusion that (1) the degree to which the streptococcus can be exalted by passage through a susceptible animal varies; (2) that an animal immunised against a streptococcus from a case of erysipelas is also immune against a streptococcus from a case of abscess, which indicates that so far, at any rate, as a horse is concerned, these organisms have a very similar action, and that, therefore, they are closely allied from a biological point of view.

The second paper, "On the so-called 'pseudo' Diphtheria Bacillus, and its Relation to the Klebs-Löffler Bacillus," by Dr. Richard T. Hewlett and Miss Edith Knight, has a practical bearing on the diagnosis of diphtheria by microscopic and cultural examination. Drs. Hewlett and Knight arrive at the conclusion that at least two forms have been described as "pseudo" diphtheria bacilli: "(*a*) one in morphology, a Klebs-Löffler bacillus, but non-virulent (Roux and Yersin, &c.), and (*b*) another shorter, plumper, and more regular in form, and staining more uniformly than the Klebs-Löffler bacillus ("Löffler, Von Hoffmann, Park, Beebe, Peters, &c.)," but that "the term should be reserved for the latter form." They also maintain that by gradual heating it is apparently possible to convert a typical Klebs-Löffler virulent bacillus into a typical non-virulent "pseudo" bacillus, and by cultivation and incubation and passage through an animal to convert a "pseudo" into a Klebs-Löffler bacillus. From what we know of the history of epidemics of diphtheria, and of the cultural characteristics of organisms that are carried through a long series of generations, there is no doubt that the virulence of the diphtheria bacillus varies enormously; but whether we have simply a non-virulent form and a virulent form of the same organism, or whether two organisms—of the same group, no doubt, but having permanently different

degrees of virulence—growing side by side in different proportions and at different periods of the disease, it is very difficult to determine. At the same time it must be acknowledged that Dr. Hewlett and Miss Knight bring forward considerable evidence in support of their thesis.

Other papers of equal importance, but of less general interest, are those by Messrs. W. St. C. Symmers and Alex. G. R. Foulerton. Drs. Macfadyen and Hewlett describe a method for the sterilisation of milk by a coil-heating apparatus, by means of which successful Pasteurisation may be carried out (at a temperature of from 68° to 72° C.), such temperature having little, if any, injurious effect on the milk, but increasing its keeping quality enormously. They also show that the diphtheria bacillus, the typhoid bacillus, the tubercle bacillus and streptococcus pyogenes are rendered incapable of doing any harm by being treated in this apparatus, along with milk.

Mr. Lunt contributes an interesting article on the sterilisation of water by filtration through the Berkefeld filter. The methods he uses are exceedingly ingenious, and the results obtained apparently very trustworthy. He comes to the conclusion that the Berkefeld filter keeps back all organisms for at least twenty-four to forty-eight hours, and that only water bacteria can pass through this filter at any time, except in those cases where there is a rapid oscillation in the pressure under which the water is passed through the filter. Under these circumstances organisms of all kinds appear to be "percussed" through the fine pores of the filtering candle.

A paper "On the bacillus of bubonic plague—Pesstis," by Dr. R T. Hewlett, gives some interesting information concerning this organism. In "Bacteria and dust in air," Dr. Macfadyen and Mr. Lunt give the results of a repetition of some of Dr. Aiken's experiments on dust particles in the air; they give in addition, however, an enumeration of the number of micro-organisms that were present in duplicate samples of air; they find that the number of dust particles is enormously greater than the number of bacteria. In one case in the open air there was just one organism to every 38,300,000 dust particles present; whilst in the air in a room, amongst 18,000,000 particles of dust only one organism could be detected. Mr. Lunt furnishes the final paper in the volume: on a convenient method of preserving living pure cultivations of water bacteria, and on their multiplication in sterilised water. Mr. Lunt falls in with the theory that has been put so strongly forward during the last year or two, that although water organisms grow well in water, those organisms which do not belong to this group gradually die out. He obtains results of considerable interest as regards the classification of certain species of bacteria in a group called water bacteria, having the following characters: (*a*) to be found in natural water; (*b*) capable of living for very long periods in sterilised water; (*c*) capable of very rapid multiplication in sterilised water; (*d*) showing no signs of degeneration when kept for long periods in sterilised water. This article is of considerable practical value, and forms a fitting conclusion to a series of papers which will have a far more than ephemeral interest. We congratulate the British Institute of Preventive Medicine on the manifestation of useful activity afforded by the present volume

A NEW TEXT-BOOK ON ELEMENTARY ALGEBRA.

Introduction to Algebra, for the Use of Secondary Schools and Technical Colleges. By G. Chrystal, M.A., LL.D. Pp. xviii + 412 + xxvi. (London: Adam and Charles Black, 1898.)

THE appearance of this book marks another stage in the improvement which is at last being effected in English treatises on elementary algebra. How different it is from the old-fashioned text-book will be partly realised by observing that the first sixty-two pages are assigned to the discussion of the fundamental laws of algebra; that upwards of fifty pages are devoted to elementary curve-tracing; and that the elementary theory of rational functions is presented in a correct and fairly methodical shape. The notions of degree, homogeneity, and symmetry are introduced, as they ought to be, at an early opportunity, and their importance duly emphasised, and illustrated; in this and other ways the student's attention is directed to the all-important subject of algebraic form. The chapter on the resolution of integral functions into factors is both clear and scientific; this fact alone distinguishes Prof. Chrystal's work from the great majority of its predecessors. The binomial theorem, for a positive integral exponent, instead of having a special chapter devoted to it, and being treated as a sort of mathematical Rubicon, is deduced, in passing, as a particular case of distributing a product. Finally we may remark (*à propos* of a recent correspondence in this journal) that the solution of a quadratic equation is made to depend on the factorising of its characteristic, and the ordinary method by "completing the square" is ignored, except, oddly enough, in one example, where it is quite unnecessary, and the factorisation is otherwise obvious.

In the matter of notation, also, and in methods of work, the author has shown himself independent of tradition: thus the method of detached coefficients is employed whenever it is convenient, and the symbols Σ and Π are freely used from the outset. With this we entirely agree; on the other hand, the use of the solidus appears to us excessive; for instance, we find the worked examples in Chapter xv. difficult to follow. But, of course, a person in the habit of constantly using this notation might be of a different opinion.

All competent and honest teachers who wish to make their pupils think, and not merely to acquire that shallow unreasoning dexterity which scores in examinations, but is otherwise of little use and even, by itself, pernicious, will welcome this work as the best intermediate class-book that has yet appeared. In some respects it compares favourably with the author's larger treatise: less encyclopædic, it has the advantage of greater unity; and, what is more important, it is written after a wider experience of teaching and examining. The effect of this appears in various ways; in remarks on common errors of beginners, in leading up to general laws by particular examples, in occasional anticipation of theorems to be presently proved, and in the statement of results not within the scope of the treatise, but intelligible and stimulating to the student, who thus gets some glimpses of the regions he may some day hope to explore.

In order to secure for a work of this kind the fair trial which it so thoroughly deserves, we venture to make an appeal to the great body of examiners, in whose hands lies so much power for influencing, either for good or ill, the character of mathematical teaching in schools. A paper on elementary algebra is too often a medley of questions, generally of a stock type, which do, indeed, test the candidate's familiarity with certain set rules, and to some extent his ingenuity in applying them, but are very far from gauging his powers of mathematical reasoning. So long as this is the case, a premium is offered to radically bad methods of teaching. A boy can be taught the rule for algebraic long division in a very short time, without any attempt to make him understand its object or principle; and what is the use of wasting time upon such superfluities, when we can take him on to the practice of G.C.M., and thus enable him to make sure of answering two questions in his examination? Now it is quite possible to combine questions on set rules (and it would be absurd to propose the entire omission of them) with fair and simple questions on matters of principle: if this were done, it would be a great encouragement to a good teacher, and tend to raise the average standard of instruction.

The book being so good, it is worth while to call attention to the points in which it appears capable of improvement. First of all, sufficient emphasis is not laid on the fact that in *applications* of algebra the signs + and − are used both as symbols of operation and also as indications of quality, or "sense": that this is possible, without causing confusion, is not obvious *a priori*. Thus, in the case of steps, let πa mean a step of a units to the right, νb a step of b units to the left, and let + and − refer, in the usual way, to the composition of steps: then we have formulæ such as $\pi a + \pi b = \pi(a + b)$, $\pi a - \nu b = \pi(a + b)$, $\pi a + \nu b = \pi(a - b)$ or $\nu(b - a)$ according as $a >$ or $< b$, and so on. If we write + and − for π and ν throughout, apply the formal rules $+(+a) = a$, $+(-a) = -a$, &c., and then interpret the sign of any result qualitatively, *i.e.* as π or ν according as it is + or −, the conclusion is correct, and the same as if the complete notation had been used throughout. This remark is due to De Morgan, and has been strangely ignored by subsequent writers.

The expression "latent sign" occurs without explanation, and apparently for the first time on p. 64. This is a point which often puzzles beginners, and might well receive a little attention.

Chapters xvi. and xvii., on irrational functions and surds, are a miserable compromise, as Prof. Chrystal is evidently aware. Arts. 169–74, 181–84, should have been omitted altogether; this would leave room for other illustrations, especially of Art. 172. Most of the examples, too, are of a thoroughly unpractical type; they might, perhaps, be put in an appendix as samples of the curious trifling of examiners.

Arithmetical Progression is without value in itself, but affords capital exercise in what may be called algebraical counting [99·9 per cent. of ordinary students say that the nth term is $a + nd$], in the derivation and use of a general formula, and many things besides. For these reasons it might be discussed at an earlier stage; the formula $s = \frac{1}{2}n(a + l)$, which, by the by, is not given, may be illustrated by two pieces of paper cut in the shape of the side elevation of a staircase.

In treating Geometrical Progression, it might be well to prove, without using the binomial theorem, that as n increases indefinitely r^n becomes infinite or infinitesimal according as $|r|$ exceeds or falls short of unity. This would enable the teacher to take it earlier, if he wished.

Two additions might very well be made in the interest of technical or scientific students. The principle used in calculating the slope of a graph from its equation might be explained and illustrated; and it might be stated, without proof, that the binomial theorem is true for all rational values of n if x is a proper fraction, and hence deduced, or proved separately, that $(1 + x)^n = 1 + nx$ approximately, whenever x and nx are both small.

Another thing that might easily be done would be to introduce examples involving complex quantities in the later chapters, for instance those on partial fractions, on proportion, and on series. Purely algebraic work with complex quantities is too much neglected, and the sooner a student becomes familiar with it the better.

As might be expected, there are very few definite inaccuracies; there is, however, a rather striking one at the top of p. 68. It is, of course, untrue that "the larger n the more slowly does x_n increase between $x = 0$ and $x = +1$"; and this slip is the more remarkable because it is contradicted by the figure on p. 67. The tyro may amuse himself by finding the value of x for which x^m and x^n are increasing at the same rate. G. B. M.

THE CUNEIFORM INSCRIPTIONS OF WESTERN ASIA.

First Steps in Assyrian. By L. W. King. Pp. cxxxix + 399. 8vo. (London: Kegan Paul and Co., Ltd., 1898.)

THE appearance of Mr. King's volume, with its modestly worded title, is opportune, and we think it likely that it will be welcomed by every student of the literatures of the East. The author's avowed object is to help the student of the cuneiform inscriptions who has, as yet, made but little progress in his difficult work, but there is little doubt that Mr. King's stout volume will be of considerable use to others besides him.

The readers of NATURE will remember that attention has been called in these pages to the series of important texts which the Trustees of the British Museum have recently issued, and those who have taken the trouble to examine the various parts as they appeared will have found that, with the exception of short prefaces which roughly classify the texts, no detailed information of their contents has been given. Any translations, or even good summaries of the contents of most of the texts, are, in the present state of Assyriological knowledge, impossible; and if we consider for a moment that not only is the language in which a large section of the documents is written imperfectly known, but also that the readings of several of the signs are doubtful, this fact will not appear wonderful. It must not, however, be imagined that Assyriologists are beaten, far from it; but they ask for time, and time must be given to them. Their chief necessity is, of course, the texts, and the sooner these are put into

their hands the better for the progress of Assyriology. Another want is students to work at the Accadian, Sumerian, and Semitic inscriptions which are now available in abundance, and it is much to be hoped that Mr. King's book will induce young men of means and leisure to devote themselves to these most important subjects.

About thirty years ago, when the late Sir Henry Rawlinson and Mr. George Smith were working through the masses of inscribed clay fragments from the Royal Library at Nineveh, it was commonly thought that the originals of the early portions of Genesis would be found among them, and the identification of the Story of the Deluge which Mr. G. Smith published in 1870, greatly stimulated the hopes of the theologian and historian. As a result the most absurd expectations were formed, and for some years after this date, the study of cuneiform was cultivated by many solely with the view of discovering parallelisms and "proofs" of the Bible narrative. Attempts were made by Oppert, Schrader, Sayce, and others to formulate a grammar of the cuneiform inscriptions, and their works were instrumental in setting the subject on a firm base. Semitic scholars in general were somewhat sceptical, but that is hardly to be wondered at when we consider the colossal ignorance of general Semitic grammar which some of the early Assyrian "scholars" displayed in their publications. Since that time, however, the knowledge of the cuneiform inscriptions has increased greatly, and Mr. King's book is a proof of this fact; to some who have gone on crying persistently that Assyriology is "uncertain" and "nebulous" it will come as an unpleasant surprise. Roughly speaking, it may be divided into three parts: (1) Grammar; (2) cuneiform texts; and (3) vocabulary. In the first part Mr. King describes briefly the origin and rise of our cuneiform knowledge, and gives a tolerably full sketch of Assyrian grammar, with sign lists, lists of ideographs, &c. In the second part we have a series of forty-two complete extracts from cuneiform compositions of all periods from B.C. 2200 to B.C. 600; these comprise historical, mythological, religious, magical, epistolary and other texts, including the Tell el-Amarna tablets. In the third part are a number of cuneiform texts, specially arranged to enable the beginner to test his own knowledge and to gain experience and confidence in deciphering new compositions, and a complete vocabulary to the whole book. From beginning to end cuneiform type is used, and as the fount is of the same size as that employed by the late Sir Henry Rawlinson, it will not be found troublesome to the eyes. The full transliterations and translations will materially help the beginner, and even the more advanced student will, at times, be glad of them; and, as far as we can see, Mr. King is abreast of all the modern readings and renderings adopted by American and German scholars. We notice that he follows those who read the name of the plague-god Ura, and has no doubt good reason for so doing; it seems, however, that Father Scheil has found the name spelt Dibbara, syllabically, which reading agrees with that suggested by Harper, Delitzsch and others.

It is to be hoped that Mr. King's book will attract new workers to the field of Assyriology, and that it will lead them eventually to the unravelling of the meanings of the difficult texts, which were written in the most complex of characters by Semitic and non-Semitic peoples alike at the dawn of civilisation.

THE NEBULAR HYPOTHESIS.

Essai synthétique sur la formation du Système Solaire; première partie: formation du système. Par M. le Général Lafouge. Pp. ix + 226. (Chalons sur Marne: Martin Frères, 1898.)

THE nebular hypothesis of the origin of the planetary system, presented by Laplace "avec la défiance que doit inspirer tout ce qui n'est point un résultat de l'observation ou du calcul," is now just over a century old. At the time of its conception weak points must have been apparent, probably to none more clearly than to Laplace himself, although the main points of his theory are displayed with a concise lucidity, which is unfortunately rarely to be found in the works of later writers on the same subject. And now, after years of criticism and counter suggestions prompted by speculations both rational and irrational, the hypothesis stands very much in its original position. Its inadequacy in some special directions has, it is true, become more fully realised as fresh facts have arisen to be explained. We are not concerned here in mentioning the particular directions in which the original hypothesis stands in need of support, further than to point out that the author has not given particular attention to these difficulties. Without entering into objections, which Lord Kelvin and others have raised from purely theoretical considerations, it will be sufficient to mention that the symmetry which is found to exist in the arrangement of the planetary system offers a difficulty to which no adequate answer has been found. No mathematical proof has yet been given, nor is it given in this book, to show that a ring of vapour surrounding the sun or central mass could condense into a single planet of considerable mass. The conditions supposed by Laplace seem more favourable to the formation of a swarm of small bodies more resembling the asteroids, or bodies of even lesser bulk, than that of a system of planets, encircled by satellites. Nor does the simple observation of nebulæ in the sky contribute any material support to the original theory. Those nebulæ whose construction can best be studied in the telescope do not present that regularity of outline or condensation, which would seem to be demanded by the construction of such regular mechanism as the solar system possesses. But the fundamental principle contained in Laplace is that the formation of the planetary system is the result of a process rather than of an act, and this suggestion remains practically undisputed. If the details and facts by which Laplace sought to maintain his hypothesis have received little confirmation since his time, it is still safe to say that his generic thought has not been refuted after a century of research. Indeed research has had little direct bearing on the subject, with the exception of two most remarkable investigations: the one, that of M. Poincaré on the possible forms of equilibrium of a rotating fluid mass; the other, the great work of Prof. G. H. Darwin on the effects of tidal action.

Nevertheless, in spite of the really small increase of our knowledge in comparison with the great difficulty of the problem involved, there has been no lack of speculations, more or less scientific, on a subject which has evidently exercised a not unnatural fascination on many minds. The authors of these elaborations of the original theory, of whom M. Faye is perhaps the best known example, have all borrowed at least the central idea of Laplace, deriving the whole solar system from a single aggregation by some process of successive annulation. This is the course adopted by General Lafouge, who, however, is not content to start with a nebula endowed with sensible heat and angular momentum. He imagines the nebula to exist in its initial stage of an indefinite and irregular shape at a temperature of 0° on the absolute scale, and in this mass the attenuated constituents, dissociated by the cold, are perfectly intermixed. Such a process of dissociation is not in agreement with what is known of the properties of matter, and little can be said in favour of the assumption. The homogeneous material of the nebula is, in the author's hypothesis, subject to molecular cohesion, but not to internal attracting forces. Yet the nebula is under the attracting influence of external bodies from which are derived motions of translation and rotation, together with the formation of a central nucleus of increased relative density, while the whole body takes a spheroidal shape as it loses its homogeneity. The action of tides, which is here made use of, though rather vaguely described, is beyond all doubt an influence of the highest importance in the early history of the nascent system. But to attribute great dynamical effects to external attraction, while denying the evident result of mutual attractions of the several parts of the nebula itself, is, if we have correctly apprehended the author, an absurd inconsistency which makes us distrust the whole theory as here presented. And yet, while denying that internal gravitation is operative, General Lafouge supposes a molecular cohesion sufficient to cause the nebula to finally "tourner tout d'une pièce."

A dense central nucleus is now formed, as the author is careful to explain, by the attraction of exterior masses. No thermal effect arises from this operation, because no internal work is done; but the nucleus acts as a centre of attraction to which the outer parts are drawn. In this way heat is developed, and the angular velocity is increased by the contraction in volume, just as in the theory of Laplace. Dilation of the nucleus takes place as a consequence of the rise of temperature, and, assisted by the centrifugal force, a stratum of the nucleus rises until equilibrium is attained under the pressure of the materials descending from the outer regions. In this way a ring is formed, which is later to give birth to the first planet. Meanwhile more rings are formed in the same way, towards the outside of the nebula, the outside ring, and consequently the outside planet, being formed last, as in M. Faye's system. The nucleus, however, continues to be enlarged by additions from the outer material, and by the dilation caused by the heat disengaged, until finally it absorbs the rings to which it has given rise. Under new conditions of pressure the ring splits up into vortices, which gather up the scattered fragments of the ring and form an agglomeration, which remains as a planet, while the central mass, after absorbing all the residual matter of the original nebula, finally contracts as it loses heat by radiation. For the explanatory details of the actual conditions of the solar system, and for a theory of the origin of comets, space cannot be found here, and on these points the essay itself must be consulted.

Although the sources from which General Lafouge has gathered his ideas are not very frequently acknowledged, there seems to be reason to suppose that many of them are not original. Doubtless the plan of the author was to advance a theory which should commend itself as a reasoned whole, and therefore the origin of an idea seemed to him of little importance compared with its intrinsic merit. Thus the division of rings into multiple branches by means of currents from the polar regions seems suggested by an idea of M. Roche; little or no use is made of these multiple branches, however. On the subject of solar heat again, a view is advanced which seems a mere modification, without improvement, of the discredited theory of Sir W. Siemens. Originality and sound argument have not entered in large proportion into the composition of this essay, which, however, is probably not much worse and certainly not much better than many of its predecessors, elaborated with the same object in view. New facts acquired by the use of special apparatus may warrant or necessitate enlarged discussion of the theory of the origin of the cosmos; but to us it appears that science is not edified by these attempts to explain cosmogony by simply supplementing our very meagre knowledge of the operation of natural laws by a mass of conjectural hypotheses. Surely Laplace is right in saying: "Ces phénomènes et quelques autres semblablement expliqués, nous autorisent à penser que tous dépendent de ces loix, par des rapports plus ou moins cachés, qui doivent être le principal objet de nos recherches; mais dont il est plus sage d'avouer l'ignorance, que d'y substituer des causes imaginaires."

OUR BOOK SHELF.

Photographische Bibliothek, Nos. 9 and 10. *Das Fernobjektiv*. By Hans Schmidt. Pp. vi + 120. *Der Gummidruck*. By J. Gaedicke. Pp. vi + 79. (Berlin: Gustav Schmidt, 1898.)

IN the first of these two books Herr Hans Schmidt has brought together a good account of the manipulations necessary for the effective and successful working of the tele-photographic lens—the lens of the future, as he terms it in his preface. He divides his subject into four parts, the first two dealing with lenses generally, and the tele-photographic lenses, namely Steinheil's, Voigtländer's, and Zeiss's, in particular. In Part iii. he discusses their employment for obtaining pictures of different styles, such as architecture, portraits, landscapes, concluding in the fourth and last part with the practical work of setting up the apparatus, and the other manipulations previous to obtaining the finished picture.

Those who work with or intend to use lenses of this kind, cannot do better than consult this book, which is written by one who is familiar with their intricacies. Numerous reproductions from negatives, taken by the author himself, illustrate the several types of pictures which can be successfully obtained with these lenses.

In the second of these books the author, Herr J. Gaedicke, treats of the process, a form of direct pigment printing, that has proved so successful. Although the

author uses the term "Gummidruck" (printing by means of india-rubber), he is careful enough to point out that other means besides india-rubber are now employed. The process, which is here very clearly described, is accompanied by many wrinkles which will be useful to those who have never previously employed it.

Perhaps few amateurs would attempt this method of printing, considering the numerous other more simple means in use, but professionals will find that a great latitude can be obtained in development, so that the appearance of the picture can be made to suit various tastes.

A short and interesting historical notice is given showing how the process has gradually been evolved, and this is followed by an account of the advantages of the method, the materials employed, and the whole manipulation.

Chapter vii. describes briefly the three-colour and combination pigment printing, while Chapter viii. contains a summary of the process. Two plates, which accompany the text, illustrate the difference between the simple- and combination-gummidruck.

Text-Book of Physical Chemistry. By Clarence L. Speyers. Pp. vii + 224. (New York: D. van Nostrand Company. London: E. and F. N. Spon, Ltd., 1898.)

BEGINNING with a chapter on energetics, in which Ostwald is followed, the author treats in order the properties of gases, thermodynamics, physical change including the properties of solutions, chemical equilibrium and chemical change, Gibbs' phase rule, the effect of temperature on chemical change, and electrochemistry. A satisfactory feature is the free use of the calculus. The book is intended for students; under these circumstances the omission of all reference to original papers is, we think, a serious mistake. The method adopted is to give the theory of a phenomenon in mathematical form, following this up by a number of exercises illustrating the equation obtained. The exercises appear to be taken, as a rule, from the original memoirs dealing with the subject under consideration, and are doubtless useful; but in many cases the deduction of the equation is too much abbreviated to be easily followed, and the experimental basis of the theory is nowhere sufficiently fully considered. This tendency to put theory before experiment is especially objectionable in teaching.

The treatment from the standpoint of energetics, adopted in the opening chapters, is not strikingly successful. The following statement occurs, for example, on p. 18: "When we attempt to get work from the volume energy of a gas, we find that the work we get comes from heat energy, or some other energy, and that *so long as the gas remains a perfect gas and its mass does not change so long the volume energy of the gas remains constant, whether T changes or not.*" The volume energy of a perfect gas is, however, given by the product of its volume and pressure, and is therefore proportional to the absolute temperature.

The author's view (p. 20), that "The kinetic theory is a troublesome thing and is becoming an object of ridicule," will hardly meet with universal acceptance.

Notwithstanding the faults above mentioned, it is only fair to add that the book is up to date, and that the range of subjects considered is wider than usual.

Recueil de Données Numériques Optique. By H. Dufet. Premier Fascicule. Pp. ix + 415. (Paris: Gauthier-Villars et Fils, 1898.)

BOTH chemists and physicists will be much indebted to the French Physical Society for the valuable and useful volumes which they are now publishing. The one before us, which is devoted to wave-lengths, and indices of gases and liquids, contains a mass of data, which have been collected from far and near, and brought together in a compact and serviceable form.

Great value must be attached to the volume, as references are given in every case; and even though the work is not quite complete, it is a most desirable addition to every chemical and physical library.

The preparation of the data here collected must have entailed a great amount of work, and M. Dufet deserves the thanks of scientific men for completing the present volume.

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.*]

Solar Halos.

THERE is a coloured halo at a considerable angular distance from the sun that is a very usual phenomenon in (*e.g.*) the Engadine in winter. Its angular diameter appears to be the same as that of the distant white halo sometimes seen round the moon.

On July 2 we were ascending the Furgen Pass from the Breuil side, and such a coloured halo was visible. The snow slope and ridge in the front of us cut off the lower part of this halo; but it was completed both in colour and form by reflection off the snow. Thus the coloured circle was complete; but the upper part (more than half, of course) appeared "in the air," the lower part "on the snow."

The surface of the snow was unusually sparkling in appearance.

It may be of interest to record that, when I have been at a considerable height (over 6000 feet above the sea at the least), and there have been very fine cirrus clouds close to the sun, I have seen exceedingly pure colours *not* arranged in rings. Thus I have seen, in a cloud, a very delicate rose-crimson entirely surrounded by a very pure green. With more continuous mist or cloud between me and the sun, I have seen a succession of coloured rings round the sun; and I have seen these vanish and give place to the single coloured halo of large diameter referred to earlier.

In the Engadine in winter I once saw a very complicated arrangement of circles and parhelia; but it would be impossible to describe these without a figure. I have such a figure, and could lend it to any one specially interested in the subject.

5 Keppel Place, Devonport. W. LARDEN.

A Living Toad in a Snake.

I SHOULD be obliged by your inserting the following experience if you think it remarkable.

Yesterday we killed an adder (?) here, about 38 inches long; and seeing that he had made a meal evidently some little time before, out of curiosity we opened him, and extracted a large toad, which was about half-way down the snake's interior, or about 18 inches.

The toad, whose head was much wider than the snake's, and whose body was many times as large as his enemy's head, we of course all thought must be dead; and we laid him on a flower-bed, wondering how he could have got inside the snake at all, for it certainly seemed a case of the greater being contained in the less. Of course we knew the marvellous stretching powers of a snake's jaws, but this seemed to eclipse them all.

As we watched the toad he seemed to move, so we bethought ourselves of trying to revive him, and, after pouring water freely over him, and whisky and water down his throat, we were intensely astonished to see him revive; so much so that he stood up on all-fours, blown out like a balloon, and made a kind of a dart at a stick in the most comical way.

Eventually "Jonah," as we promptly christened him, disappeared amongst the flowers. Can any of your readers quote a like case of resuscitation? Perhaps some of them might be able to afford information as to the probable duration of the toad's entombment. F. W. MAJOR.

Woodlands, Bettws-y-coed, N. Wales, August 2.

PHOSPHORUS IN LUCIFER MATCHES.

THE recent omission by a well-known firm of match manufacturers to comply with the regulations relative to notification to the Home Office of cases of phosphorus-necrosis among their employés, and the consequent strictures in the House of Commons on the adequacy of the present methods of factory inspection in the case of dangerous trades, have once more drawn attention to the evils which arise from the employment of "ordinary," or, as it is frequently called, "yellow" phosphorus in the manufacture of lucifer matches. As was recently pointed out in the course of the debate upon the Home Office vote, the story is really a very old one. "Phossy jaw" has been on more than one occasion the subject of Parliamentary inquiry. Practically nothing in the way of remedy has followed from these inquiries. The public has been shocked, for a time, with the tales of what the "lucifer disease" may mean to the unfortunate wretch who may be smitten with it, and then the matter is forgotten, until such a startling episode as that which occurred the other day once more rouses attention to it. The temper of the House on the occasion of the debate referred to was, however, unmistakable, and faithfully reflected the state of opinion outside. The country has at length made up its mind that some solution must be found. The old excuses that nothing is possible will no longer suffice. There is a growing conviction that a remedy is at hand, and if the manufacturers will not voluntarily adopt it, the Legislature must arm the Home Office with the necessary powers to compel the adoption.

The word *phosphorus* was originally applied to any substance, solid or liquid, which had the property of shining in the dark, and the characters of the various *phosphori* up to that time known were made the subject of inquiry by Robert Boyle, about the middle of the seventeenth century. The term has, however, practically lost its generic sense, and has become restricted to the wax-like substance discovered by Brand, of Hamburg, in 1674, and which was originally known as the *noctiluca* or the *phosphorus mirabilis*. There is some evidence that phosphorus was known to the Arabs: to judge from the mode of its preparation it was probably identical with the "carbuncle" of Alchild Bechil. It was first brought to this country in 1677 by Krafft, who purchased the secret of its preparation from the Hamburg alchemist, and it naturally made a great sensation when exhibited to the "experimentarian philosophers" of Gresham College, as Hobbes sneeringly called the progenitors of the Royal Society. Boyle seems to have obtained some hint of its origin, or the mode of its manufacture, and in one of the last of his scientific papers he describes in detail a method by which it may be obtained.

Phosphorus was first commercially made in this country by Godfrey Hankewitz, who appears to have acted as a laboratory assistant to Boyle, and who probably made it by Boyle's method. "This phosphorus," wrote Hankewitz, "is a subject that occupies much the thoughts and fancies of some alchemists who work on microcosmical substances, and out of it they promise themselves golden mountains." Nobody of his time made more in the way of gold out of phosphorus than did Mr. Hankewitz at his little shop in the Strand, for he seems to have had the monopoly of its sale for many years. Owing to the difficulty of its preparation, and the comparatively small yield, its price was relatively very high, and even down to about the middle of the eighteenth century it brought from 10 to 12 ducats an ounce. The discovery by Gahn, in 1769, that calcium phosphate was the main constituent of bone-ash gave a great impetus to the manufacture of phosphorus, and it is from one or other of the many forms of calcium phosphate, but principally from bone-ash, that the greater portion of the phosphorus now manufactured is obtained.

The ease with which phosphorus is inflamed must have led to many attempts to employ it as a ready source of fire, in spite of its high price. One of the earliest of these methods consisted in rubbing a fragment of the element between folds of coarse paper and igniting a sulphur-tipped splint—such as the brimstone matches which accompanied the tinder-box—by its flame. Such a method, it need hardly be said, was highly dangerous, and as the burns produced by phosphorus are extremely painful and peculiarly difficult to heal, it quickly fell into disfavour. Indeed, the substance itself acquired so evil a reputation that its employment in any form was absolutely prohibited in several Continental States. The phosphorus bottle of Cagniard de la Tour was practically the last attempt to effect the ignition of a sulphur splint by the direct action of phosphorus, *i.e.* without the intermediate action of an oxidising composition.

Friction matches were first made in the beginning of this century. Chancel, in 1805, had devised the "oxymuriate match," in which potassium chlorate, then newly discovered by Berthollet, was mixed with sugar and gum water, and the mixture affixed to the end of a slip of wood, which was caused to ignite by immersion in oil of vitriol. By adding a small quantity of phosphorus to the mixture it was found that the match could be ignited by simple friction, but such matches were highly dangerous both to prepare and to use; and, although various attempts were made to minimise their danger by the addition of such substances as magnesia and plaster of Paris, the friction matches failed for a time to supersede the "chemical matches" of Chancel, which continued to be made and sold in increasing numbers down to about 1845.

The credit of having made the first phosphorus friction match is usually attributed to Derosne; but, according to Nicklés, Derosne's match was merely an improvement of that made by Derepas in 1812, which in its turn was only a development of a phosphorus match produced in 1805-6. The late Sir Isaac Holden was wont to claim the credit of having been the first to make a phosphorus friction match in this country.

It is worthy of note, however, that the first friction matches made in England were free from phosphorus. These were the "lucifers" or "Congreves" of John Walker, of Stockton-on-Tees, first manufactured in 1827. They consisted of strips of stout cardboard, or thin wooden splints, about 2½ inches long, coated to about one-third of their length with sulphur, and tipped with a mixture of antimony sulphide, potassium chlorate, and starch and gum. From the London *Atlas* of January 10, 1830, we learn that they were sold in tin boxes, each containing about fifty matches, for half-a-crown a box. With each box was supplied a folded piece of glass-paper; on drawing the match between the folds the composition inflamed and ignited the sulphur on the splint. Matches tipped with a similar composition were made at about the same period in France by Sasaresse and Merckel, and in Austria by Siegel.

In Germany the invention of the phosphorus match is ascribed to Kämmerer; but the most prominent name in connection with its manufacture is Preschel, of Vienna, who, with Moldenhauer, of Darmstadt, made Austria and South Germany the chief sources of the supply of matches in Europe. It was Moldenhauer who first introduced magnesia and chalk into the composition in order to neutralise the effect of the deliquescent oxidation products of phosphorus. To-day the chief producing match country of the world is Scandinavia, where there are upwards of fourscore factories, the foremost of which is at Jönköping, employing about 6000 workpeople.

No sooner had the manufacture of the lucifer match become a well-established industry than the attention of various Governments was called to the effect of

phosphorus upon the health of the operatives, and especially to its action in inducing necrosis of the upper and lower jaw-bones. The workpeople who suffered most were naturally those who came most in contact with the fumes—such as the men engaged in mixing the composition, those employed in dipping the splints, or the females who "boxed" the finished matches.

Nowadays the mixing is done under such conditions that the workmen are not much exposed to the fumes; but the dippers, who, when at work, stand over a heated "stone" or plate coated with the composition, are especially liable to be attacked. It does not seem to be certainly established how the necrosis is actually brought about. There is no doubt, however, that workers with carious teeth are soonest affected. Phosphorus as such would appear to have little action; indeed, it is highly improbable that the so-called "fume" can contain any sensible quantity of the free element, and it has been surmised with good reason that it consists of the lower oxides of phosphorus, and in particular of phosphorus oxide, which, as shown by Thorpe and Tutton, is actually more volatile than phosphorus itself. In "boxing" it frequently happens that numbers of the matches ignite, and the air of the boxing-factory is occasionally charged with a considerable amount of these oxides of phosphorus, mixed with phosphoric oxide. The evil effect of these fumes may be minimised by efficient ventilation, and by cleanliness on the part of the operatives, combined with strict attention to the condition of the teeth. Whether, however, it can be altogether obviated by such measures remains to be seen.

The discovery of red phosphorus, in 1845, by Schrötter, of Vienna, led to many attempts to employ it in place of the more volatile and more inflammable variety. Red, or, as it sometimes is erroneously called, amorphous phosphorus, is a micro-crystalline powder of properties very dissimilar to those of ordinary or yellow phosphorus. It can be handled with impunity, is practically non-volatile, does not oxidise at ordinary temperatures, and therefore emits no "fume." It is, moreover, non-poisonous, and no cases of necrosis have been known to attend its use. Inasmuch as it confers ready inflammability upon the igniting compositions with which splints may be tipped, its general employment might, it was thought, obviate all risk of the "lucifer disease." Igniting compositions containing red phosphorus were first tried in Germany in 1850, and about the same time in this country by Dixon and Co., of Manchester, and by Bell and Black in London, but they were not altogether successful. The matches were difficult to strike, and the ignition was almost explosive in character.

These disadvantages are not by any means insuperable; excellent matches of the kind were seen in the Paris Exhibition of 1867, and again in the Vienna Exhibition of 1873. Hochstetter, of Frankfort, manufactures matches containing red phosphorus, which are said to be cheaper than ordinary matches; they burn quietly, and may be ignited even on a cloth surface.

The "safety" matches which, in this country, are usually associated with the names of Bryant and May, were originally suggested by the late Prof. Böttger, and were first made by Lundstrom, of Jönköping, in 1855. In this match the splint, according to Lundstrom's original patent, was dipped in a composition consisting of antimony sulphide, potassium chlorate and glue, and was ignited by rubbing against a specially prepared surface consisting of a mixture of red phosphorus, antimony sulphide and glue. Other varieties of the same kind of match contain in addition potassium bichromate, ferric oxide, minium, or manganese oxide. The amonnt of the red phosphorus needed to ignite these matches is extremely small, less than one five-thousandth of a grain being, it is said, sufficient. In fact it is possible to inflame many of them without any phosphorus at all, especially when they are rubbed against a smooth surface such as that of glass or paper.

These facts make it hopeful that before very long the dreaded lucifer disease may be a thing of the past. There is, indeed, no longer any valid reason why it should be allowed to exist. Yellow phosphorus is not essential to the manufacture of a lucifer match. If phosphorus in any form is required, it need only be in the form of the innocuous red variety—even for a "strike anywhere" match. Red phosphorus matches are rapidly gaining ground all over the Continent, and the day will probably come when this country will range itself with Denmark and Switzerland, and prohibit the use of all matches containing ordinary phosphorus.

GERMAN DEEP-SEA EXPEDITION IN THE STEAMSHIP "VALDIVIA."

THIS expedition was planned by Prof. Chun, of Leipzig, and was originally intended to be exclusively zoological, but, on the representation of Prof. Ratzel, physical and chemical researches were included in the programme. During last winter the German Parliament voted a sum of 300,000 marks to cover the expenses of the expedition, and further sums will probably be voted for the same purpose, and for the publication of the results.

The steamship *Valdivia* was some time ago chartered from the Hamburg-American Line, and has been fitted up with bacteriological, chemical, and biological laboratories, as well as with instruments for sounding, taking temperatures and samples of deep-sea waters, and for dredging, trawling, and the working of plankton nets at various depths. The *Valdivia* is a ship of 2600 tons gross, has a length of 320 feet, a width of 43 feet, and an indicated power of 1250 horses. She is thus as large as, if not larger than, H.M.S. *Challenger*. Captain Krech, a well-known commander of the Hamburg-American Line, has been selected to take command of the expedition, with eight officers and engineers and thirty-five of a crew; most of the officers have previously served under Captain Krech. The *Valdivia* steams from ten to eleven knots, and at the outset of the expedition had on board 2400 tons of coal, consisting chiefly of briquettes.

The laboratories and workrooms on board the *Valdivia* are more commodious and better fitted up with apparatus for scientific investigation than in any previous expedition of the kind, and the same may be said with respect to the various deck appliances for carrying on the deep-sea observations. Besides there is almost a superabundance of room for the storage of all the specimens that may be collected either at sea or on land. The cabins of the scientific staff are handsome and roomy, and the large cabin is supplied with a most magnificent scientific library, including a complete set of the Reports on the Scientific Results of the *Challenger* Expedition. According to arrangement, the ship is to be provisioned, and all the other expenses of the expedition are to be defrayed by the Company for the sum of 340,000 marks. The table of the scientific staff and officers is to be supplied with wine at cost price. The members of the scientific staff receive eight marks each per day from Government, and their lives are insured for 30,000 marks each in case of death.

The scientific staff of the expedition is as follows:—

Official Members.

(1) Prof. Carl Chun (Leipzig), Leader.
(2) Prof. Schimper (Bonn a/Rh.), Botanist.
(3) Dr. Apstein (Kiel), Zoologist.
(4) Dr. Vanhöffen (Kiel), Zoologist.
(5) Dr. Braem (Breslau), Zoologist.
(6) Dr. G. Schott (Hamburg Seewarte), Oceanographer.
(7) Dr. P. Schmidt (Leipzig), Chemist.
(8) Officer Sachse (Hamb.-Amer. Line), Navigator.
(9) Dr. Bachmann (Breslau), Physician and Bacteriologist.

Non-official Members.

(10) Dr. Brauer (Marburg a/L.), Zoologist.
(11) Dr. zur Strassen (Leipzig), Zoologist.
(12) Herr F. Winter (Frankfurt a/M.), Scientific Draughtsman and Photographer.

It is proposed to divide the voyage into three periods :—

I. From Hamburg round the north of Scotland, passing the Cape de Verdes to Cape Town, for which 100 days is estimated, Cape Town being reached in the second half of November.

II. From Cape Town, including an examination of the Agulhas Bank and the deep waters to the south, then southwards to the edge of Antarctic ice, returning northwards through the centre of the Indian Ocean to Coccos and Christmas Island and to Padang.

III. From Padang to Ceylon, Chagos, Seychelle, and Amirante Islands, to Zanzibar. Then home by Socotra, the Red Sea and the Mediterranean, Hamburg being reached early in June next year.

On August 1 the *Valdivia* left Hamburg, and was accompanied as far as Cuxhaven by Staats-Secretär von Posadowsky (the Burgomaster of Hamburg), the Directors of the Hamburg-American Line, Prof. Neumayer (Director of the Deutsche Seewarte), and many scientific men. In wishing success to the expedition, the German Minister dwelt upon the importance of a great State like Germany undertaking work of purely scientific character, such as that in which the members of the expedition were to be engaged; although no practical outcome was at present visible from researches of the kind, still the acquisition of new knowledge was, he held, one of the first duties of the State. The Chairman of the Directors of the Hamburg-American Line mentioned in his speech that the Directors considered it a privilege to be able to encourage scientific work; the Company had spared no pains in fitting up the ship and providing it with capable officers, and they expected to lose rather than to make money by the contract that had been entered into.

The ship left Cuxhaven at 8 p.m. on August 1, and during the 2nd and 3rd the dredging and some of the other apparatus were tried for the first time with great success. On the evening of the 3rd she anchored in the Firth of Forth, off Granton, for the purpose of taking on board some additional apparatus, and to permit the members of the expedition to examine the *Challenger* specimens of deep-sea deposits, as well as to land Dr. von Drygalski (who has been nominated as the scientific leader of the German South Polar Expedition of 1900), Dr. Pfeffer (of the Hamburg Museum), and Sir John Murray, who had accompanied the *Valdivia* from Hamburg. The members of the expedition were entertained at dinner in Edinburgh on the afternoon of the 4th, and in the evening the ship sailed again for the Faroe Channel. Geheimrath Dr. Mikulicz, professor of surgery in Breslau, joined the expedition at Edinburgh, and will accompany it as far as the Canaries.

THROUGH UNKNOWN TIBET.[1]

UNTIL a little more than thirty years ago our knowledge of the Tibetan plateau—one of the most remarkable areas on the earth's surface—was exceedingly small, and was very much the same as it had remained since the journeys of Manning and Bogle in the last century. About 1865, natives of India trained by the officers of the Great Trigonometrical Survey were employed in the exploration of portions of Central Asia inaccessible to Europeans; and in the course of the next ten to fifteen years great additions to our knowledge of Southern Tibet and of the trade routes leading to Lhasa from various directions were made by several intelligent and enterprising men, especially those known as Nain Singh, A.K., and the Mirza. A series of Russian explorations begun by Przevalski in 1870, continued by him for many years, and further prosecuted after his death by Pevtsof and others, added to our maps the main features of the Northern Tibetan escarpment, whilst considerable additions were made from time to time by Carey, Bonvalot and Prince Henry of Orleans, Rockhill, and other travellers; but still an immense area in the north-western part of the plateau was completely unexplored until 1891. This, the highest part of Tibet, extends at least 600 miles from east to west, and 250 to 300 from north to south; and very little, if any, of its surface is less than 16,000 feet above the sea-level. It is intersected by snow-bearing ranges of mountains, and dotted over with numerous lakes, many of which are salt.

This bleak and barren region is known as the Chang or Chang-tung, and is a wilderness inhabited solely by

Surveying.

wild animals. A few nomads drive their flocks and herds to the lower and more grassy tracts on the border of the high plateau for pasture during the summer, but they appear never to visit the greater part of the area. Here is the especial home of the Tibetan antelope and the wild yak, at all events in the summer.

In 1874-75 a traverse of the plateau from Ladak to Tengri Nor and Lhasa was mapped by Nain Singh; but the region then examined lies at a somewhat lower elevation than the area to the northward, and the latter was first crossed from west to east by Bower and Thorold in 1891. Their route across the Chang, except in the neighbourhood of the Ladak frontier, lay south of the 34th parallel, still leaving a broad area, marked as "unexplored" on the Royal Geographical Society's Map of Tibet, published in 1894, between the 34th parallel and the Kuenlun. Part of this country was crossed from north to south by Littledale in 1895, in his attempt to reach Lhasa from the northward, his route

[1] By M. S. Wellby, Captain 18th Hussars. Pp. xiv + 440. (London: T. Fisher Unwin, 1898.)

lying rather further west than the traverse of M. Bonvalot and Prince Henry of Orleans; but Littledale's return journey from Tengri Nor westward to Ladak was south of the high Chang throughout. At last, as related in the work now under notice, Captain Wellby and his companion, Lieut. Malcolm, have succeeded in crossing Tibet from west to east by a route that ran for a long distance in the neighbourhood of the 35th parallel, and that admirably intersects the tract hitherto unexplored.

The two travellers started on May 4, 1896, from Leh, in Ladak, with one trained Indian surveyor, Shahzad Mir, duffadar (serjeant) of the 11th Bengal Lancers, who had a considerable experience of Central Asiatic travelling, and ten other men, Ladakis and Yarkandis, as muleteers and servants. The first attempt to penetrate into Tibet by a route across the middle contracted portion of the Pangong lake was frustrated by Tibetan opposition; and after Captain Wellby's party had gone round the north-western extremity of the lake, and then travelled for some ten marches to the eastward, they were again stopped by the people of Rudok, compelled to recross a formidable pass, the Napu-la, and to go north as far as the Lanak-la before they could resume their journey to the eastward. After this their course lay first to the north-east for about 100 miles, and then in an eastwardly direction, no human beings being met with from the Lanak pass, close to the Ladak frontier in longitude 80° on May 29, until more than three months afterwards, when a travelling camp of Tibetan merchants on their way from Lhasa to Kansu in China was accidentally overtaken on September 6, close to the 93rd meridian. From these merchants, whose great caravan of 1500 tame yak is well described, the travellers met, on the whole, with hospitable treatment, and shortly after leaving the caravan they found some friendly Mongolian nomads, by whose aid Captain Wellby and his party, now greatly reduced in numbers, were enabled to pass through part of Tsaidam, and, after skirting Koko-nor, to reach on October 14 the frontier town of Tankar (the Donkir or Donkyr of maps) in the Chinese province of Kansu. Here a friendly missionary—Mr. Rijnhart—was found, who, having occasion to go eastward, accompanied the travellers down the Great Yellow River of China and as far as Peking. In company with Mr. Rijnhart a visit was paid to the great Kumbum Monastery near Tankar, and at Sining Mr. Ridley, of the Inland China Mission, gave an account of the Kansu Mahommedan rebellion of 1895-6, which had just been suppressed. The remainder of the journey through China, though of interest, contains descriptions of countries already comparatively well known.

Bridge in China, five miles from Tankar.

The "Unknown Tibet" of the title is of course the region traversed between the Ladak frontier and Tsaidam, and the journey, of which a good route map has been made, has added greatly to our knowledge of the region. The country is very similar to that a little to the southward, described by Captain Bower, and appears to differ in no great degree, except in its almost arctic climate, from the usual type of Central Asiatic scenery. Wild yak, Tibetan antelopes and kyang abounded in those parts of the area in which grass and fresh water were obtainable, the chief other animals mentioned being the Tibetan gazelle or goa, a large wild cat (probably a lynx), hares and marmots. Some of the latter appear to have been very large, and if they attain the dimensions attributed to them by Captain Wellby, who says they were "of enormous size, as large as men," it is probable that some unknown form was seen by him. Bears were only met with to the eastward. It is impossible to help regretting that neither of the travellers appears to have had any knowledge of zoology or geology, and it is difficult to avoid contrasting them in these respects with most of the Russian explorers. On two occasions (pp. 76, 110) fossils appear to have been observed, but we remain in ignorance of what they were. The only specimens brought back consisted of plants, of which a list is given. It is, however, only right to say that these specimens were brought back despite most serious difficulties through deficiency of carriage, and that, in addition to the geographical observations, careful records were kept of barometrical and thermometrical readings.

On the whole the journey would have been a great success but for the loss of the muleteers, and the sad fate of at least two of them. These two men, one of whom was sick and the other dangerously injured by a gun accident, were left behind with a supply of food and a pony in the middle of the wilderness. No more was heard of them. Three weeks later the remaining muleteers struck work, and left in a body, and, although one subsequently was taken on again, the travellers refused to take back the others, who had behaved badly throughout. As the

men, five in number, were, when last seen, fully 300 miles from Lhasa, to which place they had declared their intention of proceeding, as they had little or no food, and the country all around was uninhabited, it is very probable that they all perished from starvation. Out of the ten muleteers and servants who had left Leh, only three reached the Chinese frontier with the two European travellers and the Indian surveyor.

Of thirty-nine mules and ponies, but three mules survived the hardships of travel, and during the latter part of their journey in Tibet, before meeting the merchants' caravan, the travellers appear to have lived chiefly on game—not always easily procurable—and wild onions.

The account of the journey is well written and fairly illustrated, although, as is so frequently the case, some of the "process blocks" used for cuts illustrate very little except the imperfections of the photographs from which they are copied. It is questionable whether any useful information is afforded by figures like those on pp. 180, 200 and 238. Unfortunately, too, the best views are from the accessible regions of Kashmir and China, not from "Unknown Tibet"; but this is easily understood. The scenery in the Tibetan wilderness is difficult to photograph, and the time of the travellers must have been fully occupied with more urgent matters. The two examples herewith given will serve as specimens of the illustrations.

MEETING OF THE BRITISH MEDICAL ASSOCIATION.

THE meeting of the British Medical Association, which has just terminated at Edinburgh, must be regarded as a great success, both with regard to business and pleasure. At the end of July there is a strong predisposing cause towards holiday; and an excitant which draws the medical man towards so favourite an area for holiday-making as Scotland at this time of the year is naturally welcome to all. A congress is a very good beginning to a holiday, as the recollection of it tends to alleviate what is often the boredom of idleness; and doubtless thoughts born of discussion in Edinburgh are now being developed and bearing fruit a hundredfold in the remoter holiday-taking places of Scotland.

In giving in these columns a short account of the business accomplished at the meeting, it will be best, perhaps, to limit one's attention to those regions of medicine and the allied sciences which are of interest to the general scientific reader.

An interesting address in medicine was delivered by Dr. Fraser. He reviewed succinctly the importance with regard to diagnosis of modern bacteriological method, and then proceeded to give some account of the toxic origin of infectious diseases, emphasising the great activity of some toxins killing as they do—at least, in the case of the tetanus toxin—six hundred million times their own weight of living tissue. He then passed on to consider the production of artificial resistance to disease, and the origin of the protection-producing substances, concluding his lecture with a brief review of the present state of serum therapeutics.

Dr. George Balfour gave an interesting address upon a personal experience of an almost forgotten episode in medical history, the episode in question being the treatment of pneumonia by blood-letting. The lecturer gave an amusing account of how he was treated at the hands of the local medical autocrats of the time when he advocated the abandonment of blood-letting in this disease.

Sir William Broadbent opened a discussion on the significance and consequences of different states of vascular tension with their general management. He discussed the different clinical conditions giving rise to increased and diminished vascular tension respectively, and indicated the lines of treatment appropriate to each. He did not enter into the vexed question of the accurate measurement of blood pressure in man, and practically limited his remarks to arterial tension.

Prof. Bradbury, of Cambridge, read a paper upon the management of general vascular conditions with special reference to the use of erythrol tetra-nitrate. This drug, it will be remembered, was introduced by Prof. Bradbury as a result of experiments made by him and Mr. Marshall at Cambridge some few years ago. Its vaso-dilating action is less transient than that of the vaso-dilators hitherto at the command of the physician. Prof. Bradbury's later experience seems in every way to have confirmed the earlier results he obtained with this drug. Dr. Haig emphasised the significance of uric acid in the production of high arterial tension.

A discussion was opened by Dr. Alexander James on the clinical varieties of hepatic cirrhosis. An interesting paper was communicated in this connection by Prof. Adami, of Montreal. The author pointed out that the experimental injection of alcohol, although resulting in fatty degeneration of the liver, only gives rise to a very slight amount of cirrhosis, the typical hobnailed liver having never been produced experimentally. He also referred to the views of Hanot, who regards the enlarged cirrhotic liver associated with jaundice as being of an infectious origin. The author then described his own researches, which were made in connection with a very remarkable disease affecting cattle in a limited area of Nova Scotia, the main lesion of this disease being extensive cirrhosis of the liver. From all the animals he obtained a characteristic micro-organism, which apparently presented considerable resistance to staining reagents. Time has not yet permitted the author to make cultures of this organism, but he is about to do so. His results in this connection will be awaited with considerable interest.

Prof. MacCall Anderson pleaded for the more general use of tuberculin. He thinks much might yet be done with tuberculin in cases of consumption if it were combined with suitable hygienic and dietetic measures. The open-air treatment of consumption received much consideration, many of its votaries giving their results.

The meetings of the Section of Psychology were especially interesting. In the presidential address given by Dr. T. S. Clouston upon "The Neuroses and Psychoses of Decadence," the lecturer contrasted these with the neuroses of development. He pointed out that man's normal average life may be divided into three periods of twenty-five years each; he then proceeded to give statistics which tended to show that the neuroses prevail largely in the period of brain growth and development of function, the very best years of life being very free from them. They come on during decadence with a rush and to a far more deadly degree than even during development, senility being the most deadly period of all.

Dr. John Sibbald opened the discussion upon Suicide, its Social and Psychiatrical Aspects. The author contributed a paper giving the statistics of suicide for England, Wales and Scotland. He showed that the rate of suicide per annum per million of population had risen during the past thirty years from sixty-seven to eighty-six in England and from forty to fifty-four in Scotland. He then proceeded to give statistics with regard to the methods of suicide. Dr. Haigh read a paper on the cause of suicide, the all toxic uric acid according to this author playing here a most important *rôle*. Dr. Morselli, of Genoa, contributed an interesting paper on the characteristics of suicide by the insane as compared with those of suicide by the sane. On Friday, the 29th, this Section proceeded to consider the subject

of Hypnotism, its phenomena and theories. An interesting feature in this discussion was a speech by Mr. Myers, of Cambridge, on the psychological side of hypnotism. Mr. Myers contrasted hypnotism with hysteria, sleep, and somnabulism. The author concluded his remarks with discussing the probable nature of "suggestion." Did the hypnotiser by suggestion merely infuse power or evoke it? Mr. Myers held the view that in some cases there was an actual transmission of power from operator to subject, a kind of telepathy. In other cases the hypnotiser merely taught the subject to start self-suggestion of his own, and he cited the miracles performed at Lourdes as an instance of the latter method. Prof. Benedikt, of Vienna, made some interesting remarks on this subject.

In the Section of Neurology Dr. Ferrier opened a discussion on the treatment, curative and palliative, of intracranial tumours. The discussion was continued by Drs. Dercum, Collins, Sir William Broadbent, and others. Dr. Buzzard introduced a discussion on the influence of micro-organisms and toxins on the production of disease of the cerebral and peripheral nervous system. According to the author micro-organisms in this connection acted in two ways: directly by their actual effect on the nervous tissue, and indirectly through the agency of chemical substances produced by their action on the blood or other tissues of the body. The author mentioned in this connection the so-called infective diseases of the central nervous system. The paper provoked a lively discussion.

The Section of Pharmacology and Therapeutics commenced its business with an address from Dr. Affleck. The lecturer sketched the progress of therapeutics, including under this term balneo-therapeutics. Concerning actual pharmacology not much was said. Dr. Herschell introduced a discussion on the treatment of diseases of the stomach; the Section had the advantage of the presence and opinions of Prof. Ewald, of Berlin, and Dr. Lauder Brunton. Prof. Turck, of Chicago, gave a demonstration of the various methods he employed in the diagnosis and treatment of gastric disorders.

A new feature of this year's meeting was the inclusion of a Section dealing with Medicine in relation to Life Insurance, with Dr. Claud Muirhead as President. The points discussed in their relation to life assurance were cardiac disease, middle-ear disease, and pregnancy.

The Section of Pathology, under the presidency of Prof. Greenfield, proceeded to discuss the nature and treatment of Leucocytosis. The subject was introduced by Dr. Robert Muir. Papers were also read by Dr. Lazarus Barlow on Irritation of Pleura and Pleurisy, and by Dr. Durham on the Agglutinating and Sedimenting Properties of Serum, and their relation to Immunity. Prof. Stockman contributed a paper on the Pathological Effects of Dead Tubercle Bacilli. Many other papers followed, giving rise to considerable discussion.

The Section of Physiology was opened by a lecture by Prof. Rutherford on Tone Sensation. Dr. Waller read a paper on the Action of Anæsthetics on Vegetable and Animal Protoplasm. Dr. Waller seems to have turned his attention from nerve fibres to nerve cells. His paper included the description of some interesting experiments upon the action of alcohol and ether vapour upon the spinal cord of the frog. He further showed that anæsthetics exerted the same paralysing influence upon vegetable as upon animal cells. The paper was illustrated by lantern slides and diagrams. Dr. Weymouth Reid joined in the subsequent discussion. Dr. A. C. Sturrock read a paper on the Selective Affinity of the Tissues, especially as regards the Mammary Gland.

In the Section of Anatomy, Prof. Cunningham opened a discussion on Anatomic Variations, dividing them into two great classes, prospective and retrospective. The former were indicative of changes that might yet become normal in the history of the species, while the latter were of two kinds: first, simple arrest; and, secondly, development along lines which had once been normal for the species. The address was illustrated by lantern slides of the brains of apes and microcephalic idiots. The President closed the meeting with some remarks on the teaching of anatomy. F. W. TUNNICLIFFE.

PROFESSOR GEORG BAUR.

BORN on January 4, 1859, at Weisswasser (Bohemia), where for a time his father was Professor of Mathematics, Georg Baur passed his youth in Hessen and Württemberg. He went through the Gymnasium at Stuttgart, and in 1878 entered the University at Munich, taking up especially the study of palæontology, geology, zoology, and mineralogy. In 1880 he went to Leipzig, where he studied under Credner and Leukhart. Two years later he returned to Munich, and there obtained the degree of Doctor of Philosophy. He remained in Munich from 1882 to 1884 as assistant to Prof. von Kupffer, to whom he was much attached, and who in turn honoured him with his friendship. In 1884 Dr. Baur accepted a call to New Haven, Conn., as assistant to Prof. O. C. Marsh. He relinquished this position in 1890 to accept the post of docent at the Clark University of Worcester, Mass. A year later he succeeded, after great difficulties, in getting up an expedition to the Galapagos Islands, leaving in May and returning in October with a valuable collection of the flora and fauna of these interesting islands. In 1892 he went to Chicago University as Assistant Professor of Comparative Osteology and Palæontology, and was made Associate Professor in 1895.

It was in September 1897 that a serious break-down of his health gave the first indication of mental overwork. From the beginning of his career Dr. Baur had been so intensely devoted to his studies and researches, that almost no leisure remained to him for recreation; no fewer than 143 separate papers testify to his industry. A vacation of a few months, mostly spent at one of the Wisconsin lakes, seemed to benefit him. Returning to Chicago in December, the physicians recommended either a sojourn in California or in Germany. The wish to be near his relatives made him decide for his old home, and together with his family he left for Europe, the University generously granting a further leave of absence. The gravity of his illness (paralysis), already suspected in America, was at once recognised at Munich. The disease made such rapid progress, that not many weeks after his return from a short stay in Southern Tyrol his transfer to an asylum was found to be necessary. The end came on June 25.

The family have received many touching expressions of sympathy. At the grave Prof. von Kupffer spoke feelingly, referring to the great talents, the keen perception, the untiring industry of the deceased by which he had created himself an honoured place in anatomy and palæontology. "Though young in years," he said, "Prof. Baur was an authority in many a field. In remembrance of the time we worked together, of the friendship which united us, I lay down in deep sorrow this laurel wreath."

THE BEN NEVIS OBSERVATORIES.

WITH reference to the announcement in NATURE of July 28, intimating that, unless means were provided, the Observatories at Ben Nevis would be closed in October next, we are glad to be able to state that it will not be necessary to take that step this year. The subjoined letter explains how this threatened mis-

fortune to meteorological science has for the present been averted.

Scottish Meteorological Society, 122 George Street, Edinburgh, July 27, 1898.

It was announced last week in your columns that the Ben Nevis Observatories were to be closed in October next for want of funds. It gives me much pleasure to announce now that this will not be the case. I have received a letter from Mr. J. Mackay Bernard, Kippenross, in which he promises to give 500*l.* "in order that the Observatories may be carried on for another year." The record of observations for one whole year will thus be the result of Mr. Bernard's great generosity.

He expresses a hope in his letter that before the end of that year arrangements may have been made for the permanent carrying on of the work by State aid, and his very liberal and prompt action makes the Directors more hopeful than they were that this desirable end may yet be reached. But if the State does not charge itself with the maintenance of these Observatories, then Mr. Bernard's example may perhaps be followed by others, so that the Directors may at least be able to obtain continuous and complete observations for the eleven years of a sun spot period. This would mean the making of an important addition to knowledge by Scotland, and in that aspect Mr. Bernard is patriotic as well as liberal.

In conclusion, allow me to thank you, and the press generally, in the name of the Directors, for the sympathetic attitude which has been taken by the newspapers towards the work carried on by the Scottish Meteorological Society.

ARTHUR MITCHELL, *Hon. Sec.*

The question of the position of the Ben Nevis Observatories came up in the House of Commons on Friday last in connection with the annual vote of 15,300*l.* to the Meteorological Council for meteorological observations. As this sum (nearly 3000*l.* of which is annually expended upon telegraphic reports and storm warnings) is for observations throughout the United Kingdom, Scotland at present receives a proportional part of it, and a grant of 350*l.* is made annually for the two Ben Nevis Observatories—the high level observatory receiving 100*l.* and the low level observatory 250*l.* Mr. Hanbury, Financial Secretary to the Treasury, has undertaken to ascertain whether a larger amount could not be granted to Scotland out of the Parliamentary vote in respect of the observatory on the summit of Ben Nevis, the suggestion being that a grant of 500*l.* a year should be made for five years. In a leading article in Monday's *Times*, the valuable work carried on at the observatory is pointed out, and the hope is expressed that Mr. Hanbury will succeed in effecting such a redistribution of the grant to the Meteorological Council as will provide for its further prosecution and development. The value of the observatory as a meteorological station is beyond question, and something should certainly be done to place its work upon a permanent footing.

NOTES.

THE *Standard* of Friday last contained the following telegram from its Vienna correspondent:—"On the closing day of the International Congress for Applied Chemistry, an interesting paper was read by Dr. Leo Lilienfeld on the synthesis of albuminous substances. By means of the condensation of phenol and amido-acetic acid with phosphoric oxychloride, the lecturer has succeeded in producing pepton, a substance which, it had hitherto been believed, could be obtained only from organic substances. In order to dispel any doubt as to the possibility of thus making artificial albumen, the lecturer carried out the entire process in the presence of the assembled chemists, and then demonstrated the identity of artificial and natural albumen by means of reactions." This announcement is of great interest to chemists, and we shall give an account of the synthesis next week, when further details will probably be available.

NEWS has just been received of the death of Prof. James Hall, the veteran State Geologist of Albany, New York.

UPON the recent retirement from the Indian Medical Service of Brigade-Surgeon Lieutenant-Colonel D. D. Cunningham, F.R.S., Professor of Physiology, Medical College, Calcutta, the Government of India have placed on record their high appreciation of the eminent services rendered by him to the State. Dr. Cunningham was appointed to the chair of Physiology in the Medical College at Calcutta in 1879—a post which he continued to occupy till he was compelled to take sick leave last year. By his zeal and devotion to his work he introduced a high standard of efficiency in the teaching of physiology in the College. He was the first professor to demonstrate histological preparations to the students in a systematic way, and also the first to teach them the practical use of the microscope. He twice received the thanks of the Government of India for reports submitted by him in collaboration with the late Dr. Lewis. Dr. Cunningham's most recent investigations have been connected with snake-bite and the discovery of a remedy. In a letter to the Director-General of the Indian Medical Service, the Governor-General writes:—"By the retirement of Dr. Cunningham the Government of India lose the services of one of the most distinguished of the scientific men who have served them, the Indian Medical service one of its most eminent members, and yourself an invaluable adviser. He carries with him on his retirement the warmest thanks of the Government of India for his long and distingushed services."

SOME of the objections to the system of granting indulgences to anti-vaccinationists were pointed out in last week's NATURE. Since then the Vaccination Bill has had an eventful history. It came before the House of Lords in Committee on Thursday last, and the second clause—the conscience clause—providing parents with a means of exemption from penalties for the non-vaccination of their children, was rejected. The amended Bill had therefore to go back to the House of Commons, where it was considered on Friday, and a motion to disagree with the Lords' decision to leave out the conscience clause was carried. In consequence of this vote, the Bill again came before the Upper House on Monday, with the result that the conscience clause was reinstated—the Lords reversing on Monday their decision of Thursday last. It may be expedient to pass the Bill in its complete form, but the principle of permitting conscientious anti-vaccinationists to put themselves beyond penalties other than those which their neglect will bring upon them, is unsound and dangerous.

IN view of the proposed alterations in the laws relating to vaccination now contemplated in the Bill before Parliament, the Council of the Royal College of Surgeons of England have reaffirmed the following resolution adopted by them in 1893 and forwarded to the Royal Commission on Vaccination, viz.:—"We, the Council of the Royal College of Surgeons of England, desire to put on record at the present time our opinion of the value of vaccination as a protection against small-pox. We consider the evidence in favour of its life-saving power to be overwhelming, and we believe, from evidence equally strong, that the dangers incidental to the operation, when properly performed, are infinitesimal. Experience has satisfied us that, even when vaccination fails to afford complete exemption from small-pox, it so modifies the severity of the disease as not only to greatly reduce its mortality but to lessen the frequency of blindness, disfigurement, and other grave injuries. We should therefore regard as a national calamity any alteration in the law which now makes vaccination compulsory. We are, moreover, firmly convinced that re-vaccination is an additional safeguard and should be universally practised."

HERR ALBIN BELAR, director of the seismological station in the k.k. Oberrealschule at Laibach, Austria, is making an endeavour to collect information with reference to the earthquake which occurred in Dalmatia on July 2, and caused great destruction in the town of Sinj. The disturbance was recorded at Laibach by four instruments, and a number of observations and pictures referring to the earthquake have been collected there. It is proposed to publish these records, together with any other papers which may be obtained, either on the recent earthquake, or on the nature of earthquakes generally, and recent seismology, in a work by the sale of which it is hoped to obtain funds for the relief of the people who have suffered losses by the shock. Contributions intended for this work may be in German, French, Italian, or English, and should be sent to Herr Belar before the middle of December.

MANY Polish men of science have signed a protest against the action of the Prussian authorities at Posen (Poznań) in prohibiting them from attending the meeting of the Polish Association for the Promotion of Medical and Natural Knowledge, which it was proposed to hold in that town at the beginning of the present month. Early in July the organising committee of the meeting was informed by the Director of Police that persons of Polish nationality would not be permitted to take part in the proceedings, and that if they went to Posen they would be expelled from the country immediately. For thirty years the Association has held its meetings without any difficulties, and in the year 1884 a meeting was held in the town of Posen itself. The recent action, directed as it was against men whose only object was calm and friendly intercourse, violates the legitimate claims of science, and discourages scientific investigation in Poland. It is unfortunate that intellectual enterprise should be made to suffer on account of strained relations between certain members of German and Polish nationalities. The protest against the measures taken by the Prussian police authorities has been signed by most men of science in Cracow and Lemberg, and forwarded to the Polish members of the Austrian Parliament.

THE death is announced of Prof. George Ebers, author of numerous works on Egyptology. Prof. Ebers was born in Berlin in 1837. He studied first at Göttingen, and then in Berlin, where he came under the influence of the egyptologists Brugsch, Lepsius, and Böckh. After taking his degree at Jena, he undertook a journey of a year's duration in Egypt and Nubia, and on his return in 1870 he was appointed to a professorship at Leipzig. In 1872 he visited Egypt for a second time, and on this occasion made his discovery at Thebes of the celebrated papyrus which is known by his name.

PARTICULARS of the career of the late Dr. Johan Eliza de Vry, the eminent Dutch pharmacist and quinologist, who died at The Hague on July 30, in his eighty-sixth year, are given in the *Chemist and Druggist*. Dr. de Vry was born on January 31, 1813, at Rotterdam. His first appearance in the literary world was with a Dutch translation of Heinrich Rose's "Handbook of Analytical Chemistry," which was at that time a famous text-book. This work brought him into direct correspondence with many of the leading chemists of the day, among these being Pelletier, for whom Dr. de Vry always entertained the utmost reverence. It was through Pelletier's influence that his attention was especially directed to quinine and the cinchona alkaloids generally, concerning which he was to become one of the chief living authorities. De Vry took the degree of Ph.D. at Leyden University in 1838, and was subsequently appointed teacher of chemistry and pharmacy in the Medico-Pharmaceutical College of his native city. In 1850 he sold his pharmacy, which he had carried on for eighteen years, and devoted himself to scientific work exclusively. At that period he published an immense number of papers on pharmaceutical subjects—nitroglycerin, morphia, red phosphorus, cherry-laurel water, and cinchona, occupying his attention. In 1856 he was elected an honorary member of the Pharmaceutical Society of Great Britain, and in 1857 he went to Java on a commission by the Dutch Government as Inspector of Chemical Investigation. He stayed in Java six years, and it is universally admitted that his labours materially assisted in the development of the cinchona industry there. After finishing his labours in the island, Dr. de Vry visited India, and gave much assistance to the Indian Government in regard to the cultivation of cinchona and the extraction of the alkaloids there. For his services in this direction he was rewarded by the Queen of England with the C.I.E. in 1880. In 1895 he was awarded the Hanbury gold medal given by the Pharmaceutical Society of Great Britain, and only a few weeks before his death the University of Utrecht bestowed upon him the honorary degree of M.D.

THE British Mycological Society's second annual week's fungus foray will be held in Dublin from September 19 to 24.

A SEVERE shock of earthquake, lasting five seconds, occurred in Messina at 2.33 a.m. on Saturday, August 6, and was followed by three weaker shocks.

THIS year's meeting of the French Association for the Advancement of Science opened at Nantes on August 4. M. E. Grimaux, the president, delivered an address on the chemistry of the infinitely small, referring more particularly to Pasteur's researches. About 30,000 francs were voted as grants in aid of scientific work, 13,126 francs being from the funds of the Association, and 18,800 from the Girard legacy fund.

THE Government of British Guiana has lately taken steps of great practical utility in arranging for geological surveys in the gold districts. From a report on the gold and forest industries of British Guiana we learn that a survey has already been conducted by Prof. J. B. Harrison in the north-west district, and the results embodied in a report, while an additional report on the petrology of the district is awaiting publication. A further expedition to examine the formations of the Potaro-Conowarook district is now being organised. The great importance of this work will be recognised in view of the fact that there are no trustworthy official reports on the geology of British Guiana in existence. The experience of the past ten years has proved that British Guiana is rich in gold; and what is now needed is the importation into the Colony, and the adoption of, mechanical washing appliances for alluvial gold. By such means deposits of alluvial gold, vast areas of which are known to exist, but would not pay to work by the means now employed, could be made to produce large quantities of gold. During the year ending on June 30, the amount of gold exported from the Colony was 117,265 ounces, or a decrease of 10,326 ounces upon the output of 1896–97. This serious decrease is partly ascribed to exceptionally bad weather, and partly to the exhaustion of alluvial workings in the Barima district.

PROF. KARPINSKY contributes to the latest issue of the *Bulletin* of the St. Petersburg Academy of Sciences an interesting note on hail observed on April 30, 1897, by M. Czernik, near Ivangorod, in Russian Poland. The hail was falling that day from two nearly quite opposite directions, and was of two entirely different kinds. One variety consisted of large grains of a pear-like shape, and of a peculiar structure; while the other consisted of smaller, transparent grains, which had the shape of flattened ellipsoids. These latter contained nothing, but the former had in their central opaque portions black granules which proved, on chemical analysis, to consist of iron, with traces of nickel and cobalt, and silicon. These granules were sent to the Academy, and Prof. Karpinsky analysed them. The powder

obtained from these granules consisted chiefly of magnetic iron oxide, which had been formed through the oxidation of magnetic iron; the latter could be seen very well. Moreover, the granules contained augite and, probably, sulphuretted iron, and some other substances not yet determined. Besides iron, they also showed traces of nickel and sulphur. "Such a composition," the Russian professor concludes, "leaves not the slightest doubt about the cosmic origin of the granules contained in that hail." It is interesting to note that, some time ago, M. Czernik collected at the same spot hail which contained granules of volcanic ashes from Vesuvius.

ADMIRAL MAKAROFF, the well-known explorer of the North Pacific, has lately made the proposal to reach the North Pole by means of powerful ice-breakers. The proposal sounds rather strange at first, but the Russian Admiral bases it on sound scientific reasoning and on a good deal of actual experience. Ice-breakers have been used in Russia (at Cronstadt) since 1864, and lately great progress was achieved in their construction in America by arming such vessels with two screws at the stern and a third one at the stem. The American ice-breaker, *Ste. Marie*, 3000 horse-power, easily sails through ice 2½ feet thick, and pierces ice-walls 15 feet high. Still more powerful ice-breakers have lately been built in America and in this country for the Trans-Siberian railway and the port of Vladivostok. Taking into account that, according to Nansen, the ice-walls (*toroses*) in the Arctic basin seldom attain the height of 25 feet, and that the polar sea is free from ice over, at least, one-third of its surface, while all the ice is weakened in summer by thawing, and especially by interior canals due to accumulations of salt, and by crevices, Admiral Makaroff concludes that an ice-breaking steamer of 20,000 horse-power would overcome all the difficulties which polar ice may oppose to her progress. The distance between the latitude of 78° N. to the pole being 720 miles, he calculates the various speeds at which such a steamer could make her way through ice of various thicknesses from four to seven feet, and he finds that the total distance could be covered in twelve days. Moreover, instead of one ice-breaker of 20,000 horse-power, it would be advantageous to have two such vessels of 10,000 horse-power each, it having lately been proved by actual experiment in Russia that two ice-breakers placed one behind the other, and the rear one pushing the front one by means of a special wooden frame, act as effectively as one single ice-breaker of a double force. Admiral Makaroff's proposal is, therefore, to build two special ice-breakers of 6000 tons and 10,000 horse-power each, provided with stem screws, and to force a way through the ice to the pole.

A SHORT account of a recent research, by Prof. Marinelli, on the progressive increase of the area of the Po delta is given in the *Geographical Journal*. From a comparison of the Austrian map of about 1823 with the result of modern surveys carried out in 1893, Prof. Marinelli is led to the conclusion that the mean annual increase during those seventy years has been about ·762 sq. kilom. (·293 sq. miles). Taking all known data into consideration, the estimated total increase during six centuries amounts to 516 sq. kilom. (198 sq. miles), which means that, by the action of one river alone, Italy has in that period gained no less than $\frac{1}{60}$ of its previous area, while recent surveys show that the increase is actively maintained at the present day. At the end of his article Prof. Marinelli gives some notes on the length of time which would probably be required to fill up the whole of the Northern Adriatic above 44° 45′ N. lat. The disposition now displayed by the mouths of the Po to bend in the direction of the axis of the gulf introduces a special element of uncertainty, but the conclusion is that the time required would certainly exceed 100 centuries, and would probably be more than 120.

IN connection with the reports which have appeared from time to time that Andrée's and other balloons have been sighted in the distance, it is worth while to direct attention to an observation recorded by Mr. F. F. Payne in the Canadian *Monthly Weather Review*. Looking at the sky one afternoon, Mr. Payne saw a large, grey, pear-shaped object sailing rapidly across, immediately behind a thin stratum of cirro-stratus cloud. At first the object was taken for a balloon, its outline being sharply defined, and its shape and size exactly corresponding to one; but as no cage was seen, it was concluded that it must be a mass of cloud, and after watching it for about six minutes, its mass became less dense and finally it disappeared. Whilst no whirling motion could be noticed, this balloon-like mass was undoubtedly of cyclonic formation, appearing less elongated when viewed at a distance probably of a mile and only about 30° from the zenith. The observation suggests an origin for strange war balloons and other aerial machines occasionally reported as having been sighted.

THE Quarterly Summary of the *Weekly Weather Report*, issued by the Meteorological Council for the months April to June last, show that the rainfall for that period has been above the normal amount in all districts. The mean for the wheat-producing districts was 6·5 inches, against 5·8 inches for the thirty-three years 1866-98; and the mean for the grazing, &c., districts was 9·2 inches, against 7·4 inches for the same period. For the whole of the United Kingdom the amount was 7·9 inches, as compared with 6·6 inches for the thirty-three years in question. Reckoning from the beginnng of the present year the rainfall to the end of July is, however, deficient in all districts save three—viz. the north of Scotland (where the excess amounts to 7 inches), the north-west of England, and the north of Ireland. The greatest deficiency is in the Midland counties, where it amounts to 5 inches. The general deficiency is due to the scarcity of rain in the first quarter of the year; and during the past month the fall has been, generally, much below the average, amounting to only about one-tenth of the average in the Scilly Islands.

THE remarkable sounds known as "mist pouffers" and "barisal guns," heard in many parts of the world at sea and near coasts, have frequently been described in these columns. The U.S. *Monthly Weather Review* (April) contains communications by Mr. Samuel W. Kain and others, which show that these sounds are very frequent on fine, calm summer days in the Bay of Fundy. Prof. Cleveland Abbe points out that the descriptions given of these oceanic noises show that sometimes they have precisely the same characteristics as the noises that may be heard in an aquarium when one stands alongside of a large glass tank and watches the motions of the drum fish. The salt water drum fish (*Pogonias chromis*) is common on the Atlantic coast of the United States, and other varieties will doubtless be found in other parts of the world. A large drum fish will give out a sound that may be heard a long distance, and it is suggested that some of the sounds which have been heard may have been produced by this or another fish. Prof. Abbe thinks that the noises proceeding from the ocean have probably very different characters and origins; some are due to the drum fish; others are made by the breakers dashing on rocky cliffs, whence heavy thuds spread for several miles through the air and many miles further through the ocean; others are due to the cracking of rocks in ledges near the surface, such as those on which lighthouses are built; others, finally, are occasionally due to genuine earthquakes occurring at the bottom of the neighbouring ocean. It is highly probable that a careful collation of observations from many stations in any given locality, such as the Bay of Fundy, will throw a clear light upon the locality whence the noises emanate.

THE locust disease fungus cultivated by Dr. Edington, director of the Bacteriological Institute, Grahamstown, for the purpose of destroying locusts, appears to be giving satisfactory results. A writer in the Cape *Agricultural Journal* states that he gave a number of healthy locusts (*Voetgangers*) internal doses of liquid in which cultures of the fungus had been dissolved, and afterwards placed them among the locusts at the head of three large swarms. On the fourth day after, numbers of locusts died, and on the seventh day after the introduction of those infected, the three swarms were entirely destroyed.

BACTERIAL cultures have been made on almost all vegetables, but the potato and the carrot are the principal ones which are in daily use in bacteriology. M. Roger has, however, says the *Lancet*, reported to the Paris Society of Biology that in his opinion the artichoke possesses several advantageous qualities in this respect. Nothing is more simple than to prepare it for the purpose. After having stripped off the scales the thick part is cut up into little cubes, care being taken to preserve the fibres (*foin*). The pieces are placed in tubes plugged with damp wadding, the fibres being uppermost, so that the culture medium is represented by a fleshy mass surmounted by a sort of tuft. When the wadding is inserted the whole is heated in an oven to 115° C. for a quarter of an hour. In making the inoculation the germs must be deposited at the point of insertion of the flowers. Speaking at the same meeting of the Society of Biology, M. Carnot mentioned that he had ascertained that if a small quantity of liquid derived from a previous culture of Koch's bacillus is added to the ordinary culture media before they are inoculated with tuberculous material the effect is to hasten the growth considerably. In practice the same result is obtained by adding some drops of tuberculin to the culture media. If, on the contrary, the quantity of tuberculin is increased—if, for instance, thirty drops are added to a culture instead of five or six—the culture either does not undergo development or else its development soon stops.

A REMARKABLE testimony to the effectiveness of Prof. Haffkine's system of inoculation as a plague preventive is published in a report on the inoculations among the Khoja community of Bombay, referred to in the *Pioneer Mail*. His Highness Aga Khan, the head of the community, was himself inoculated as an example to his followers, and he established an inoculation station at Mazgaon, at which 5000 Khojas were inoculated between December 1897 and April 20, 1898, 184 other Khojas being inoculated in municipal stations. The daily strength of the inoculated for the period was 3184. It is calculated that there were 9516 uninoculated persons in the community, and among these there were 77 deaths from plague and 94 from other causes during the period mentioned. Among the 3184 persons inoculated during this period there were three deaths from plague and four deaths from other causes. These are the most striking results observed up to the present time. Eliminating the five deaths from plague and the fifty-six deaths from other causes which occurred among uninoculated persons under the age of three or over sixty, the figures are still sufficiently remarkable. There is a difference of 89·7 per cent. of deaths from plague in favour of the inoculated part of the community, and of 73·3 per cent. of deaths from other causes. Prof. Haffkine is justified in saying that, making allowance for inaccurate classification, and admitting that some of the deaths among the uninoculated may have been those of sickly persons who feared to undergo the operation, the results indicate that, besides being a protection against plague, this inoculation influences favourably the resistance to certain other diseases, a fact with regard to which exact material is being accumulated at the Research Laboratory at Bombay.

PROFS. LUMMER AND PRINGSHEIM have communicated to *Wiedemann's Annalen* the results of their determinations of the ratio of the specific heats of certain gases. These results were obtained from the relationship between temperature and pressure in an adiabatic expansion of the gas, a new form of bolometer being employed in the measurement of temperature. The final values obtained for the ratio in question are: for air, 1·4025; for oxygen, 1·3977; for carbonic acid, 1·2995; and for hydrogen, 1·4084. These values are rather greater than those obtained by the same writers in 1887, when a silver wire 0·04 mm. thick was used in the bolometer.

THE problem of the flow of water in uniform pipes and channels, said by Saint Venant to constitute a hopeless enigma, forms the subject of a comprehensive paper by Mr. G. H. Knibbs in the *Journal and Proceedings of the Royal Society of New South Wales* (xxxi.). The formulæ used by engineers in general are shown by the author to be systematically defective, even in respect of their mathematical form, and the main object of the paper is to indicate a scheme of empirical analysis of, and to develop a type of formula for, the flow of water in pipes and channels. By means of tables, the general expression supplied can be rendered easy of manipulation for the purposes of practical calculation. Mr. Knibbs concludes that the law of velocity as related to temperature with at least two (or better, three) pipes of very different roughness, requires further experimental investigation. The variation of the velocity with respect to the radius of pipes also needs investigation; this evidently should be done with, at least, three series having widely different degrees of roughness, so as to ascertain the influence of the roughness upon the variation. In channel investigations the author hopes that the triangular form may be adhered to throughout; the law of flow may then be discovered, and the influence of form constituted a subsequent subject of inquiry.

AN interesting series of determinations of the local variations in the intensity of gravity in the vicinity of Mount Etna and in Eastern Sicily generally is detailed by Signor A. Riccò in the *Atti dei Lincei*, vii. (2) 1. The observations were made with the assistance of Colonel Von Sterneck's pendulums, kindly lent for the purpose by the Hydrographic Bureau of Pola, while the staff of the Observatory at Catania all took part in the work of observing. The general results obtained are somewhat remarkable. In the neighbourhood of Catania and Messina the value of gravity, reduced to sea-level, exceeds that given by theoretical formulæ by about 150×10^{-5} units, an amount equivalent, according to Helmert, to that due to a stratum of rock of density 2·5, of 1500 metres thickness. But this excess diminishes rapidly in the neighbourhood of Mount Etna, and becomes a minimum at the summit, where it is less than 50×10^{-5} units. This diminution appears somewhat difficult to explain, even on the hypothesis of the existence of large subterranean cavities within and beneath the mountain. Another remarkable result is that at Catania the deviation of the vertical is small, and in a direction away from Mount Etna; this result, however, obtains a satisfactory explanation, according to Signor Riccò, in the attraction of massive basaltic rocks of Monte Lauro to the south of the station.

AN elaborate memoir by Dr. J. Zenneck on the markings of pythons, boas, and allied genera of snakes appears in the current number of the *Zeitschrift für wissenschaftliche Zoologie*. It consists of 384 pages and eight plates, and deals especially with the nature and extent of the variation in colour-markings possible within the limits of a species. Considering the great number of specimens of each species which Dr. Zenneck has had the opportunity of examining, the work should prove a valuable addition to the literature of systematic herpetology.

THE flat fishes of Cape Colony are described by Mr. G. A. Boulenger, F.R.S., in a bulletin just published by the Department of Agriculture at the Cape. Only five kinds of flat fishes were known from the coast of South Africa until recently, when Dr. Gilchrist, the marine biologist to the Cape Government, sent Mr. Boulenger a sixth, allied to the British Scald-fish, and representing a species not only new to the South African fauna, but also new to science. All the material obtained in the course of the investigation of the marine fauna undertaken by the Cape Government will be worked up by specialists, and the results published in bulletins similar to the present one. The investigations will deal with marine biology in the widest sense of the term, including the study of conditions of life dependent on physical factors, such as currents, temperature, &c.

THE third number of the second part of the second volume of the new enlarged edition of Dr. Ostwald's "Lehrbuch der allgemeinen Chemie" has just been published by Engelmann, of Leipzig. About three more numbers have to appear before the new edition is completed, and it is announced that they will be published as soon as possible.

VOL. iii. of "Among British Birds in their Nesting Haunts," illustrated by the camera by O. A. J. Lee, has been brought to completion by the issue of Part 12 by the publisher, David Douglas, Edinburgh. This part deals with the tree-creeper, blackbird, rock-pipit, magpie, ringdove, sedge-warbler, dipper, fulmar and dunlin.

ATTENTION may appropriately be called at the present time of year to the publication of a new edition of the late Mr. John Ball's Alpine Guide, vol. i., dealing with the Western Alps. The work has been reconstructed and revised on behalf of the Alpine Club by Mr. W. A. B. Coolidge, and its place is between such a Guide for ordinary travellers as "Murray," and such a special series as the "Climbers' Guides." We shall review the new edition in a future issue, and content ourselves now with merely announcing its publication by Messrs. Longmans, Green, and Co.

A SECOND and revised edition of the standard work on "Hydrographical Surveying," by Rear-Admiral Sir William J. L. Wharton, K.C.B., has been published by Mr. John Murray. The work originally appeared in 1882, and has instructed many naval officers in the principles of marine surveying. The new edition is in the same form as the old one, but the descriptions of instruments and fittings which have changed in the interval between the two issues have been brought up to date, thus increasing the usefulness of the book for members of the nautical surveying service.

THE *Agricultural Gazette* of New South Wales (for May) is as usual, full of valuable articles and notes. The present issue contains the continuation of articles on "The Growth of Gall-making Insects," "Bees, and how to manage them," and "The Bee Calendar," besides a number of other contributions likely to be of practical service to all who take an interest in agricultural and kindred pursuits. We notice that a series of articles especially intended as a guide for beginners in the application of science to agriculture and horticulture is to be commenced in the next number of the *Gazette*.

THE Manchester Microscopical Society may take credit to itself for the volume of *Transactions* just published. A number of interesting papers are published in the volume, and the report shows that the session in which they were read was in every respect a successful one. A paper by Mr. Mark L. Sykes, on "Natural Selection in the Lepidoptera," illustrated by eight good plates, deserves special mention. The butterflies shown upon the first two plates illustrate the mutual protection afforded by the simulation of various inedible species to each other in the same region; while the six remaining plates illustrate mimicry of inedible by edible species. Among other subjects of papers in the volume are: the Hemiptera-Homoptera, influence of light and temperature on vegetation, the functions and structures of leaves, and adaptations in plants.

THE current issue of the *National Geographic Magazine* (Washington) is a National Educational Association number, and contains many interesting and valuable contributions. Mr. W. J. McGee writes on "American Geographic Education" and "Geographic Development of the District of Columbia," and Mr. Henry Gannett, of the U.S. Geological Survey, shows, in an article entitled "Geographic Work of the General Government," how, through a number of bureaus and departments, the United States Government is engaged in promoting the study of geography in its various branches. The longest, and perhaps most valuable, contribution to the number is by Mr. G. K. Gilbert, of the U.S. Geological Survey, on the "Origin of the Physical Features of the United States." This paper was, we are told, prepared as an introduction to a course of afternoon lectures planned by the late Mr. Hubbard, to present the effect of geographic environment on the civilisation and progress of the United States.

THE twenty-ninth annual report of the Norfolk and Norwich Naturalist's Society forms an important contribution to the natural history of the district, thirteen of the fifteen papers published being of a local character. The presidential address, delivered by Mr. A. W. Preston, is mainly meteorological in character, and is accompanied by a series of ten tables indicating the highest, lowest and mean temperatures, the monthly and annual rainfall, the prevailing direction of the wind, and particulars of the duration in each quarter; all these extending over the ten years ending 1897. Mr. Southwell contributes a paper (with map) on an ancient decoy at Feltwell, and some further remarks on the Swan pit at St. Helen's, Norwich. He also records the addition of two new species of birds to the Norfolk list, viz. the Mediterranean Herring Gull (*Larus cachinnaus*) and the Tawny Pipit, bringing the number of fully recognised species of birds which have been obtained in Norfolk to 308; in addition to eight doubtful species. Mr. Gurney contributes a paper on the "Economy of the Cuckoo," in which he considers in detail some of the moot points in the life-history of this common but still mysterious bird. Mr. A. Patterson sends his usual "Natural History Notes from Yarmouth," and Mr. G. H. Harris the eighteenth consecutive report on the herring fishery at Yarmouth and Lowestoft. These notes, in the absence of any official returns on the subject, should have more than local value. An obituary notice of the late Sir Edward Newton, as former president of the Society, should be mentioned; also the fact that mainly through the instrumentality of the Society the close-time for wild-fowl, other than ducks breeding in the county, has been extended to September 1 in each year. The Society is to be congratulated on the list of its members, its financial prosperity, and the excellent work it is so successfully performing.

THE additions to the Zoological Society's Gardens during the past week include a Mozambique Monkey (*Cercopithecus pygerythrus*) from East Africa, presented by Miss Ethel Ansorge; a Squirrel Monkey (*Chrysothrix sciurea*) from Guiana, presented by Mr. R. Routledge; a Hairy Armadillo (*Dasypus villosus*) from La Plata, presented by Mr. W. Harman; a —— Ichneumon (*Helogale*, sp. inc.), an Abyssinian Guinea Fowl (*Numida ptilorhyncha*) from East Africa, presented by Mr. R. M. Hawker; a Red-masked Conure (*Conurus rubrolarvatus*) from Ecuador, presented by Mrs. E. Henry; a

Raven (*Corvus corax*), European, presented by Mr. H. W. Mansell; two Yellow-bellied Liothrix (*Liothrix luteus*) from India, two Grey-headed Love-Birds (*Agapornis cana*) from Madagascar, two Passerine Parrots (*Psittacula passerina*) from South America, a Yellow-rumped Seed-eater (*Crithagra chrysopyga*), a Black-bellied Weaver Bird (*Euplectes afer*), a Grenadier Weaver Bird (*Euplectes oryx*), a Crimson-eared Waxbill (*Estrelda phœnicotis*), two Orange-cheeked Waxbills (*Estrelda melpoda*) from West Africa, a Superb Tanager (*Calliste fastuosa*) from Brazil, a Parrot Finch (*Erythrura psittacea*) from New Caledonia, two Red-crested Finches (*Coryphospingus cristatus*) from South America, five Amadavade Finches (*Estrelda amadava*) from India, two Chestnut-eared Finches (*Amadina castanotis*) from Australia, three Bar-crested Finches (*Munia nisora*) from Java, a Black-headed Finch (*Munia malacca*) from India, two Banded Grass Finches (*Poephila cincta*) from Queensland, two Lazuline Finches (*Guiraca parellina*) from Central America, a Red-tailed Finch (*Estrelda ruficauda*) from New South Wales, five Indian Silverbills (*Munia malabarica*) from India, presented by Mr. A. J. Aitchinson; a Common Wombat (*Phascolomys mitchelli*) from Australia, an American Siskin (*Chrysomitris tristis*) from North America, three Amphiumas (*Amphiuma means*) from North America, a Black Iguana (*Metopoceros cornutus*) from the West Indies, deposited; a Garden Dormouse (*Myoxus quercinus*), European, received in exchange; two Wapiti Deer (*Cervus canadensis*), born in the Gardens.

OUR ASTRONOMICAL COLUMN.

WOLF'S COMET.—The following is a continuation of the ephemeris of Wolf's comet as computed by Herr Thraen (*Astr. Nach.*, 3506):—

12*h*. *Berlin M.T.*

1898.	R.A. h. m. s.	Decl.	Br.
August 12 ...	4 58 8 ..	+16 27·9 ...	2·4
13 ...	5 0 41 ...	17·1	
14 ...	3 14 ...	6·0 ...	2·5
15 ...	5 45 ...	15 54·7	
16 ...	8 15 ...	43·3 ...	2·5
17 ..	10 44 ...	31·6	
18 ...	5 13 12 ...	+15 19·6 ...	2·5

The comet is moving in the constellation of Taurus, lying some distance to the west of Aldebaran.

DR. GILL ON SIR JOHN HERSCHEL.—We have received a reprint (from the *Cape Times*, June 24) of an address which was delivered by Dr. Gill at the prize distribution, Diocesan College, Feldhausen, on June 23 last. On this occasion Dr. Gill uncovered a portrait of Sir John Herschel, which had been presented to the school by Mr. Gordon. The same generous donor has promised also a yearly Herschel prize. In his address, Dr. Gill, after referring to the earlier life of Sir John Herschel, and pointing out how he re-examined, with instruments made by himself, the whole of the nebulæ, star clusters, and double stars which had been discovered by his father, and finished this review of the northern hemisphere, mentions how Herschel began a similar study in the southern hemisphere. "Towards the end of 1833, being then forty years of age, he sailed for the Cape, and after a voyage of sixty-three days arrived in Table Bay on January 15, 1834. He selected the house and grounds of Feldhausen for his residence, and on February 22 began the work of observation which he concluded in 1838. On his return to England he spent nine years in the arrangement, the reduction, and the publication of these Cape observations, which were printed in one splendid volume at the expense of the Duke of Northumberland." In a later part of the address Dr. Gill refers to Herschel as "the prose poet of science; his popular scientific works are models of clearness, and his presidential addresses teem with passages of surpassing beauty. His life was a pure and blameless one from first to last, full of the noblest effort and the noblest aim from the time when as a young Cambridge graduate he registered a vow 'to try to leave the world wiser than he found it'—a vow that his life amply fulfilled."

THE PARIS OBSERVATORY.—On February 8 of this year M. Lœwy presented his report of the Paris Observatory for the year 1897 to the Council of the Observatory. Perhaps the most important fact which he communicated was the reorganisation of the meridian work. Up to the present time the greater part of the *personnel* of the meridian instruments has been employed in the revisions of the zones of Lalande, a piece of work that has been pursued steadily since the year 1854; in this, no less than 600,000 observations of stars of Lalande have been made. As this great enterprise is now nearly completed, M. Lœwy points out that other problems can now be attacked, and consequently a different organisation for meridian studies becomes necessary. The three meridian instruments, according to the new scheme, are each used by two astronomers, who make, reduce, discuss and publish the observations in their own names. The meridian circle *du jardin* has been used for the absolute determination of latitude and its variations, the large meridian instrument for absolute determinations of declinations of fundamental stars, while the instruments of Gambey have been employed for filling up gaps in the observations of the stars of Lalande.

During the year 1897 as many as 16,824 meridian observations were made, together with 333 planetary observations. The large equatorial coudé has been devoted to obtaining photographs of the moon which were required to make the series complete. The present report contains a beautiful heliogravure cliché of the moon relative to a phase which presents the greatest photographic difficulties. It was obtained immediately after the sun had set, the moon then having a very low altitude and being only 4 days 6·4 hours old. The equatorials in the east and west towers have been used, as formerly, for observations of comets, minor planets, double stars, nebulæ and occultations. The photographic chart of the heavens seems to be progressing, although the year was not very suitable for such work. The catalogue, we are told, is practically finished, with the exception of some isolated clichés. In the spectroscopic research department M. Deslandres has been continuing his interesting investigations. With the large reflector of 1·20 metres and a spectroscope of three prisms he has secured 47 negatives, which will furnish the velocities in the line of sight of the star studied, and in the laboratory he has been experimenting on the question of the relationship between coronal and kathodic rays.

The report contains, further, the work of the bureau of computations, observatory and personal publications, &c.; but even a brief account of these would render this note too long.

THE FRENCH ASTRONOMICAL SOCIETY.—The *Bulletin* of this Society for the current month is devoted nearly wholly to reproductions of some lunar charts obtained by Messrs. Lœwy and Puiseux at the Paris Observatory, and numerous accounts of the nearly total eclipse of the moon which took place on the 3rd of last month. In the former, four of these most excellent lunar pictures are reproduced, and the description which accompanies them points out the most curious objects in special relation to a better understanding of the order and succession of physical forces which have been at work on our satellite. In the observations of the lunar eclipse we are presented with some excellent reproductions from photographs of the phenomenon at different stages.

THE ELECTRICAL RESISTANCE AND MICRO-STRUCTURE OF ALLOYS.

IN a note in NATURE for June 18, 1896, on "The Electrical Resistance of Alloys," Lord Rayleigh suggested that the entirely different behaviour of pure metals and of alloys with respect to the resistance which they offer to the passage through them of an electrical current, might be partly due to thermo-electric effects.

Profs. Dewar and Fleming have shown that the resistance of a pure metal tends to disappear as absolute zero is approached, and quite recently Prof. Dewar has pointed out that the resistance of platinum in boiling hydrogen is reduced nearly to $\frac{1}{11}$th of its resistance when in boiling oxygen. So far as they have been examined, alloys show no such diminution in their

electrical resistance, and the following extract from Lord Rayleigh's note gives his suggested explanation on the supposition that the metals in an alloy are arranged in laminæ, and that the current flows across the laminæ.

"According to the discovery of Peltier, when an electric current flows from one metal to another there is a development or absorption of heat at the junction. The temperature disturbance thus arising increases until the conduction of heat through the laminæ balances the Peltier effect at the junctions, and it gives rise to a thermo-electromotive force opposing the passage of the current. Inasmuch as the difference of temperature at the alternate junctions is itself proportional to the current, so is also the reverse electromotive force thereby called into play. Now a reverse electromotive force proportional to current is indistinguishable experimentally from a *resistance;* so that the combination of laminated conductors exhibits a false resistance, having (so far as is known) nothing in common with the real resistance of the metals."

The structure of eutectic alloys seems to have a special bearing on this question, and seems to afford strong support to the view suggested by Lord Rayleigh. Guthrie pointed out in 1884 that the particular alloy of two metals possessing the lowest freezing point of any alloy of the two that can be made, and which he called the eutectic, is analogous to a cryohydrate, the cryohydrates being regarded as eutectics of ice and the particular salts employed.

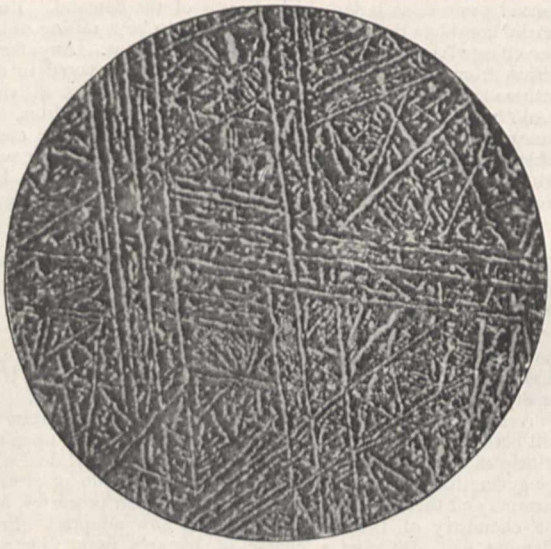

FIG. 1.—Silver-lead eutectic, × 100. Oblique illumination.

As Prof. Roberts-Austen in his valuable Cantor Lectures on Alloys (delivered March–April 1897) has pointed out, the analogy between cryohydrates, eutectic alloys and the pearlite of steels is now completely established. The elaborate microscopical investigations of steel and of eutectic alloys made by Osmond, Charpy, Stead and others, together with the work of Ponsot on the cryohydrates, reveal the presence in each case of two different constituents arranged in microscopic laminæ. In the case of the cryohydrates the two constituents are ice and the salt, in eutectic alloys they are the constituent metals, and in the pearlite of steels they consist of alternate layers of pure iron and iron carbide.

In connection with an investigation of the micro-structure of silver-lead alloys the writer has had occasion to examine the eutectic of these two metals, an alloy containing about 2·8 per cent. of silver, and the accompanying photographs of this convey an excellent idea of the structure of eutectic alloys in general.

Fig. 1 shows the appearance presented by a polished surface of a section of this alloy after etching for several hours with acetic acid at the ordinary temperature. The lead has partially dissolved, exposing the silver in bright plates, the edges of which, a good deal bent over and distorted by the action of the stream of wash water, are presented to the observer. A section cut at right angles to the one figured, which is cut parallel to the cooling surface, presents a similar appearance.

By acting on a portion of this alloy with the vapour of hot acetic acid for several weeks the lead was wholly dissolved, and the bright plates were separated and examined. They proved to be pure silver. They are translucent, the light transmitted through them being violet or greyish violet. Some of these plates were mounted in balsam, and Fig. 2 is reproduced from a photograph of one such preparation taken with a $\frac{1}{12}$" oil immersion objective. Measurements of a number of plates which happened to be lying on edge showed that their thickness was less than $\frac{1}{6000}$ of an inch, but accurate measurements in this way are not possible owing to the "black and white dot" effect well known to microscopists.

As will be seen from the figure, the plates exhibit distinct cleavage at angles of 60° or 120° to their longer axes. Some of them are seen to be crossed by a series of faint markings at these angles, markings bearing a very curious resemblance to those obtained by Commander Hartmann by subjecting metallic plates to compressional or torsional strain (Hartmann: "Distribution des déformations dans les métaux soumis a des efforts," Figs. 21 and 173, pp. 25 and 175). It is difficult to avoid the conclusion that they have a similar origin, the strain in this case being probably due to the shrinkage of the alloy on solidification or on subsequent cooling. A distinct folding or crumpling of the plate can be seen in the photograph, showing that in spite of their pronounced directions of cleavage the plates are not excessively brittle.

The bearing of this structure of an alloy on Lord Rayleigh's remarks will be readily understood. The greater number of alloys which have been subjected to tests of their electrical resistance are *partially* made up of the eutectic of their constituents, the remainder of the alloy consisting of one of the two metals or of a compound of the two. It is not conceivable that the work done in rolling and wire-drawing, though it may cause some splitting up of the plates in the eutectic, should entirely destroy this laminated structure; and its existence would almost certainly give rise to the thermo-electric effects which may be the cause of the abnormal resistance of many alloys compared with that of the metals of which they are composed.

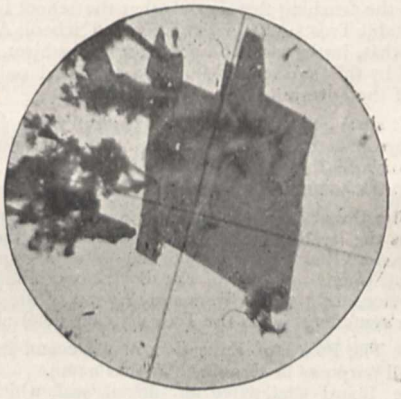

FIG. 2.—Eutectic silver plate, ×

SAVILLE SHAW.

THE BOARD OF EDUCATION BILL.

THE following are the clauses of the Bill introduced by the Duke of Devonshire in the House of Lords last week, and having for its object the establishment of a Board of Education for England and Wales.

I.—(1) There shall be established a Board of Education charged with the superintendence of matters relating to education in England and Wales.

(2) The Board shall consist of the Lord President of the Council, Her Majesty's Principal Secretaries of State, the First Commissioner of Her Majesty's Treasury, the Chancellor of Her Majesty's Exchequer, and one other person appointed by Her Majesty the Queen and holding office during Her Majesty's pleasure, and it shall be lawful for Her Majesty to appoint a

President, and, if he is Lord President of the Council, a Vice-President, of the Board.

II.—(1) The Board of Education shall take the place of the Education Department (including the Department of Science and Art), and all enactments and documents shall be construed accordingly; and as from the establishment of the Board of Education the Education Department Act, 1856, shall be repealed.

(2) There shall be exercised by the Board of Education the powers conferred on the Charity Commissioners by any scheme made in pursuance of the Endowed Schools Acts, 1869 to 1889, except that—

(*a*) any power with respect to a question as to the construction of a scheme or other document shall be exercised by the Charity Commissioners; and

(*b*) any power with respect to the control or management of property forming the capital of any endowment, shall be exercised by the Charity Commissioners with the concurrence of the Board of Education;

and for this purpose the powers exercisable by the Charity Commissioners under the enactments mentioned in the schedule may also be exercised by the Board of Education.

(3) The Charity Commissioners shall, in framing schemes in pursuance of the Endowed Schools Acts, 1869 to 1889, act in consultation with the Board of Education, and shall frame a scheme under those Acts if so requested by the Board.

(4) In addition to any powers exercisable under this section or otherwise, the Board of Education may, by their officers, visit, inspect, and examine any school, and give certificates in respect of the teaching therein, whether the school is subject to the Charitable Trusts Acts or the Endowed Schools Acts, or not. Provided that, in the case of a school not so subject, the power conferred by this sub-section shall be exercised only with the consent of the governing body of the school.

III.—It shall be lawful for Her Majesty in Council from time to time, by order, to appoint a consultative committee for the purpose of advising the Board of Education on any matter referred to the committee by the Board.

IV.—The Board of Education may appoint such officers and servants as the Board may, with the sanction of the Treasury, determine, and there shall be paid, out of moneys provided by Parliament, to any member of the Board not holding another salaried office, and to the officers and servants of the Board, such salaries or remuneration as the Treasury may determine.

V.—(1) The Board of Education may sue and be sued and may for all purposes be described by that name.

(2) The Board shall have an official seal, which shall be officially and judicially noticed, and that seal shall be authenticated by the signature of the President or some member of the Board, or of a secretary, or of some person authorised by the President or some member of the Board to act on behalf of a secretary.

(3) Every document purporting to be an instrument issued by the Board of Education, and to be sealed with the seal of the Board, authenticated in manner provided by this Act, or to be signed by a secretary or any person authorised by the President or some member of the Board to act on behalf of a secretary, shall be received in evidence and be deemed to be such an instrument without further proof, unless the contrary is shown.

(4) A certificate signed by the President or any member of the Board of Education that any instrument purporting to be made or issued by the President or some member of the Board is so made or issued shall be conclusive evidence of the fact.

VI. The President or Vice-President of the Board of Education shall be capable of being elected to, and of voting in, the Commons House of Parliament, and the offices of President and Vice-President of the Board of Education shall be deemed to be offices included in Schedule H. of the Representation of the People Act, 1867; in Schedule H. of the Representation of the People (Scotland) Act, 1868; in Schedule E. of the Representation of the People (Ireland) Act, 1868; and in Part I. of the Schedule of the Promissory Oaths Act, 1868.

VII.—(1) This Act shall not extend to Scotland or Ireland.

(2) This Act may be cited as the Board of Education Act, 1898.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

DR. D. K. MORRIS has been appointed lecturer on technical electricity in the Mason University College, Birmingham.

MR. J. J. FINDLAY, Principal of the Training Department of the College of Preceptors, has been appointed head master of the Cardiff Intermediate School.

THE following appointments to posts in University College, Sheffield, have recently been made:—Lecturer in physiology: Mr. C. F. Myers-Ward, of the Owens College, Manchester. Assistant lecturer in mathematics: Mr. G. St. L. Carson, late Fellow of Trinity College, Cambridge. Assistant lecturer and demonstrator of physics: Mr. Albert Griffiths, of the Owens College, Manchester.

"UNIVERSITY reform," on which so much public attention is now concentrated in this country, would appear to be a no less burning question in Italy, to judge from the opinions expressed by Prof. C. Ferrini in the *Rendiconti del R. Istituto Lombardo*, xxxi. 11-12. The principal evil of the Italian University system at the present time would appear to be the large and ever-increasing body of ill-prepared students swarming into university classes, many of whom possess little or no aptitude for study. This results in a lowering of the standard of teaching, the effects of which are already making themselves shown, and the supply of graduates seeking employment in the learned professions is largely in excess of the demand. Prof. Ferrini considers the most feasible remedy to be a raising of the fees charged for admission to university courses. Any funds arising from this increase might, of course, be devoted to the furtherance of advanced work, but the main object in view would be to exclude idle and incompetent students from the class rooms, and to stimulate those who entered on the curriculum to make better use of their opportunities, with, moreover, better prospects of obtaining employment afterwards in a less overcrowded market. Having had nearly equal experience of German and Italian universities, Prof. Ferrini considers that the introduction of the German system into Italy could only lead to pernicious results, the principal reason being the great difference in the preparation provided in the two countries for lads before they enter college.

THE London Technical Education Board have arranged for the Session 1898-99 a number of evening science classes, and Saturday morning classes for teachers, in conjunction with University College, King's College, and Bedford College. At University College, Profs. Hudson Beare, Fleming, and Ramsay will between them deliver a course of twelve lectures upon the principles of chemical technology. The lectures will deal with the generation of power and its cost, the generation of electric currents and their application in electro-chemical processes, and the chemistry of the various processes now adopted. Prof. Fleming will also give a course of lectures upon electrical measurements, and Prof. Hudson Beare a course on mechanical engineering. At King's College, evening courses of lectures will be delivered by Prof. Robinson on civil engineering, Prof. Banister Fletcher on architecture, and Prof. Grylls Adams on physics. These courses of instruction will afford an opportunity to students who can study only in the evenings to obtain instruction in well-equipped University laboratories, and will make available to evening students the same advantages as are enjoyed by University day students, but they are only intended for those who are practically engaged during the day in some trade, business, or occupation.

Saturday morning classes have been arranged by the London Technical Education Board for teachers. At King's College, a course of about ten lectures will be given by Prof. Hudson, on the teaching of elementary mathematics. The object of these lectures is to help those who are practically engaged in teaching, and wish to become acquainted with modern methods and improvements in order to render their teaching more effective. A course of about fifteen lectures on heat engines and general laboratory work will be delivered by Prof. Capper. The object of the course is to acquaint teachers with modern methods of teaching the subject, and to illustrate the use and preparation of laboratory apparatus for demonstration. At University College, a course of ten lectures will be given by Prof. Fleming, on magnets and electric currents. The object of the course is to give instruction in modern methods of science teaching. It will consist in the delivery by the professor

of a model lecture to exhibit methods of dealing with the subject, adapted for science teachers and teachers in Board schools who, having some knowledge of the subject, desire to receive instruction in the scientific construction and use of experimental apparatus and the improvements of methods of teaching. A course of ten lectures with demonstrations on advanced graphical statics as applied to girders and arches will be delivered by Prof. Karl Pearson. A course of twenty lectures on physiology will be delivered by Prof. Halliburton. Some of the meetings of the class will be devoted to the performance by the students themselves of the fundamental experiments in connection with the microscope and the methods of chemically testing substances of physiological importance, such as foods, the air, &c. A course of ten lectures on elementary physical measurements, each lecture followed by a class for practical work, will be given by Miss Edith Aitken at Bedford College. The Technical Education Board is doing very valuable work by thus assisting to extend the knowledge of the principles of rational science teaching.

SCIENTIFIC SERIAL.

Bollettino della Società Sismologica Italiana, vol. iv. No. 1.—The new volume begins with the rules of the Society and a list of the Fellows, there being forty-four Italian and nine foreign members.—Dr. Papavasiliou continues his list of earthquakes observed in Greece in 1897; during the last half of the year sixty-four shocks were recorded, fifty-two of which were felt in Zante.—Vesuvian notes for the year 1897, by G. Mercalli.—The Indian earthquake of June 12, 1897, by G. Agamennone; a summary of several preliminary notices in NATURE and elsewhere.—Notices of earthquakes observed in Italy (July 1–27, 1897), by G. Agamennone, the most important being the Garganic earthquakes of July 3 and 24, earthquakes in Alessandria on July 6, Carniola on July 15, and Pisa on July 27, and distant earthquakes on July 22 and 27.

SOCIETIES AND ACADEMIES.

PARIS.

Academy of Sciences, August 1.—M. Wolf in the chair.—Further researches on the metal-backed glass mirrors of antiquity, by M. Berthelot. The three mirrors described were originally discovered in Thrace and Egypt. The metal backing consists of almost pure lead, which, in the molten state, appears to have been poured on the concave surface of discs cut from balloons of blown glass.—On the theory of the abacus of alignment, by M. Ernest Duporcq.—On the theory of reed-pipes, by M. A. Aignan. Remarks and experiments on the production of sound in pipes with free and beating reeds.—Action of pure hydrogen phosphide upon cupric sulphate, by M. E. Rubénovitch. The results obtained by previous experimenters seem to show that the product of the action of hydrogen phosphide upon salts of copper is of variable composition. The author, however, by working with pure hydrogen phosphide obtained by the dissociation of phosphonium chloride, and by taking precautions to exclude air or oxygen from the apparatus employed, finds that a well-defined copper phosphide of the formula $P_2Cu_5H_2O$ is produced. This is a black substance, which, on heating to 150° C., loses all its water and becomes of a reddish brown colour. It oxidises slowly in the air, and dissolves in sulphuric acid with liberation of hydrogen phosphide, whilst excess of oxygen during its preparation gives rise to rapid decomposition with formation of metallic copper and phosphoric acid.—Action of bromine upon normal propyl bromide in presence of anhydrous aluminium bromide, by M. A. Mouneyrat. It has been shown, in a preceding note, that by treating ethyl bromide with bromine in presence of aluminium bromide, the hydrogen atoms may be successively replaced by bromine, the final product being hexabromethane, C_2Br_6. The present paper describes a series of similar experiments with normal propyl bromide, the highest brominated derivative yet obtained being pentabromopropane, $CHBr_2—CHBr—CHBr_2$. In the reactions involved the aluminium bromide abstracts the elements of hydrobromic acid from the alkyl bromide and the ethylenic derivative, thus temporarily formed, immediately takes up two atoms of bromine.—On the hydrolysis of ethane-dipyrocatechin, by M. Ch. Moureu. The author has previously shown that ethane-dipyrocatechin yields, on hydrolysis with dilute sulphuric acid, pyrocatechin and a compound of the formula $C_8H_8O_4$. This latter, it is now proved, is identical with the orthohydroxyphenoxyacetic acid obtained by the interaction of monochloracetic acid and the monosodium derivative of pyrocatechin. The mechanism of this singular reaction is discussed.—On a new *Trichophyton* productive of herpes in the horse, by MM. Matruchot and Dassonville. An epidemic of herpes among the horses of an artillery regiment was found to be due to a fungus which the authors succeeded in isolating, and the pathogenic nature of which was verified by inoculation experiments on guinea-pigs and on man. The organism is a *Trychophyton* related to, but not identical with, the species described by Sabourand and Bodin as producing herpetic affections.—Physiological function of iron in the vegetable organism, by M. Jules Stoklasa. It has long been recognised that iron is necessary for vegetable life, and microscopic observations have led to the supposition that the metal exists in organic combination in the nucleus of the cell. It is not present in chlorophyll. The author has extracted from onions and from peas a substance, containing 1·68 per cent. of iron, which closely resembles, in composition and properties, the hæmatogen obtained by Bunge from yolk of egg. This compound is also contained in non-chlorophyllaceous plants, as was proved by its being obtained from moulds (*Mucor mucedo*) and fungi (*Boletus edulis*).—Fructifications of *Macrostachya*, by M. B. Renault.—On pietine, or stalk disease, in wheat, by M. Louis Mangin. This disease has been attributed by MM. Prillieux and Delacroix to the action of *Ophiobolus graminis*, but inoculation experiments carried out by the author tend to prove that the injurious effects are, for the most part, caused by *Leptospæria herpotrichoides*, although the two parasites are frequently associated.

NEW SOUTH WALES.

Linnean Society, June 29.—Prof. J. T. Wilson, President, in the chair.—Observations on the vegetation of Lord Howe Island, by J. H. Maiden. The author visited Lord Howe Island in H.M.C.S. *Thetis* in March and April last, spending nine days on the island. Hemsley's Flora of the island (*Annals of Botany*, x. p. 221, June 1896) records 206 plants and three introduced ones, total 209. The author has added 16 species and one named variety to the indigenous flora, and 17 species of introduced plants, while he has removed five species of supposed indigenous plants from Hemsley's list. So that, according to the present paper, the flora of Lord Howe Island stands at present at 217 indigenous species (being a net addition of 11), and 10 introduced ones.—Notes on *Sterculia* (*Brachychiton*) *lurida* and *S. discolor*, by J. H. Maiden and E. Betche. The authors give reasons for believing that *Sterculia lurida* is but the young state of *S. discolor*, and cannot even rank as a distinct variety, much less as a species.—On two well-known, but hitherto undescribed, species of *Eucalyptus*, by R. T. Baker. The author shows that under *Eucalyptus Stuartiana*, F.v.M., no less than three species and one variety are included.—Descriptions of some apparently common Australian Nematodes found at Sydney or in Port Jackson, by Dr. N. A. Cobb. Nineteen species and one variety, referable to eleven genera, are described as new. With two exceptions they are marine forms.

AMSTERDAM.

Royal Academy of Sciences, June 25—Prof. van de Sande Bakhuyzen in the chair.—Prof. H. Behrens and Mr. H. Baucke on Babbits' antifriction metal. By slow cooling this alloy (82Sn, 9Sb, 9Cn) is really split up into compounds of different fusibility. The separation and chemical examination of these compounds have been carried out by Mr. H. Baucke, analytical chemist, of Amsterdam. By pressure between hot iron plates a metallic mother liquid was squeezed out; the remaining cakes of crystalline metal were treated with hydrochloric acid and washed with water. An alloy, containing 90Sn, 10Sb, on being thus treated, yielded the same cubic crystals as Babbits' metal, which were found to answer to the formula $SbSn_2$ (found 33·7 Sb, calculated 33·8 Sb). With 42Sb prismatic crystal of the compounds SbSn were obtained (found 50·35 Sb, calculated 50·37 Sb). In Babbits' metal the copper forms brittle needles of whitish bronze containing no antimony. Such bronzes show less stability than the

compounds of tin and antimony. From an alloy of 90Sn 10Cn, the compound CnSn was obtained. Repeated heating and cooling brought the percentage of copper up from 35 to 58. Microscopical examination of bearings showed that cushions heated by running, were poor in cubic crystals of the compound $SbSn_2$. Babbits' metal is made amorphous by casting in cold moulds. Axles running on such metal get tinned; this leads to sticking and heating; finally recrystallisation sets in, and liquid tin is squeezed out; while a compact layer of crystals is formed on the axle. Microscopical examination of the metallic deposit from the lubricating oil led to the unexpected result, that metal with crystals of moderate size will develop ball-cushions. Tin is ground to a fine dust by the sharp fragments of the bronze needles, the hard cubes of $SbSn_2$ are rounded, undermined, and finally worked up into something like metallic pebbles of microscopical size (0·08 to 0·1 mm.). Similar spheroids were obtained from bearings of magnolia metal and of aluminium brass, but not from ordinary brass, nor from grey cast iron.—Prof. Lobry de Bruyn communicated a number of observations on the state of insoluble amorphous substances, which are made to form in gelatine as medium. These substances, which are precipitated from aqueous solutions, remain dissolved in gelatine as colloids, and on solidification yield transparent masses. With incident light some exhibit fluorescence or light reflexion; others do not do so, or only very sparingly.—Prof. van de Sande Bakhuyzen made a communication on behalf of Dr. E. F. van de Sande Bakhuyzen, entitled "The motion of the terrestrial pole according to the observations of the years 1890 to 1896."—Prof. Haga, on a five-cellar quadrant electrometer and the measurements of current intensity carried out with it. A description was given of a five-cellar quadrant electrometer furnished with a damper, consisting of a copper cylindrical mantle, moving in a magnetic field. Owing to the great stability and sensitiveness of the instrument, the strength of strong as well as of weak currents could easily be measured to within 0·1 per cent. by comparing the potential difference at the extremities of a known resistance with a normal Clark-element.—Dr. C. H. Wind, on the influence of the dimensions of the source of light in Fresnel's diffraction phenomena and on the diffraction of X-rays (third communication). The diffraction phenomena, modified by the widening of the light slit, were discussed, this time in connection with the optical delusion discovered by the author. By this discovery some difficulties that still remained were cleared up, but the conclusion as to the evidence of the undulatory character of X-rays, which was to be inferred from previous experiments, had to be retracted. Finally new experiments were communicated, in which a still faint indication of diffraction of X-rays manifested itself, and from which was inferred, with the greatest possible reserve, $T_x = 0{\cdot}1$ to $0{\cdot}2\ \mu\mu$.—Prof. Kamerlingh Onnes (*a*), on behalf of Dr. E. van Everdingen, jun., on the galvano-magnetic and thermo-magnetic phenomena in bismuth. Observations were made of the four transverse phenomena in *one* plate of bismuth decomposed by electrolysis. The results were compared with those arrived at by Von Ettingshausen and Nernst and with Riecke's theory of electrical and thermal phenomena in metals. Some among them appeared to agree neither with those results nor with the theory in its present form. (*b*) On behalf of Dr. J. Verschaffelt, on the deviation of De Heen's experiments from Van der Waals's law of continuity. (*c*) On behalf of Mr. C. M. A. Hartman, on composition and volumes of the coexisting phases of mixtures of methyl chloride and carbonic acid. The equilibrium between the two phases being established, parts of both are separated, each between two cocks, and then collected in gas-measuring tubes. The densities of the phases are inferred from the volumes of the gas, and the molecular proportions of the components are found by analysing. A remarkable result of the preliminary determinations is that there is a nearly linear relation between the pressure and the composition of the liquid phase, showing that the exponents in Van der Waals's formula for this case are nearly zero.—Prof. Lorentz, on the influence of a magnetic field on radiation. The elementary theory of the Zeeman-effect is not sufficient to account for the phenomena observed by Cornu, Michelson, Tolver Preston and Becquerel; it will therefore have to be replaced by a more general one. Fortunately, without entering into the details of the mechanism of radiation, it is possible to arrive at some general results concerning the state of polarisation in different cases. After discussing this question, the author shows how (as was suggested to him by Mr. A. Pannekoek) the equations in his paper in *Wied. Ann.*, 63, p. 278, may be made to furnish an explanation of Cornu's quadruplet. This explanation would, however, require a structure of the molecules which it seems difficult to imagine.

GÖTTINGEN.

Royal Society of Sciences.—The *Nachrichten* (mathematico-physical section) for 1898, part 1, contains the following memoirs communicated to the Society.

January 8.—E. Study: Proof of a theorem of Dedekind's.

February 5.—A. Peter: The anatomical structure of the stem in the genus *Scorzonera*; contributions (II.) to our knowledge of the *Hieracia* of Eastern Europe and Asia.

February 19.—E. Riecke: Theory of galvanism and of heat.

March 5.—A. Schönflies: A new geometrical method in the domain of differential geometry.—G. Kolossoff: A particular case in the motion of a "universal top" whose point of support is free to move in a horizontal plane.—A. Sommerfeld: Remarks on Hess's case in the motion of a top.

March 19.—E. Wiechert: Hypotheses subserving a theory of electric and magnetic phenomena.

April 30.—W. Voigt and L. Januszkiewicz: Observations on rigidity under homogeneous deformation.

The *Proceedings* of the Society, part 1, 1898, contain reports on the progress made in the publication of Gauss's works, by F. Klein; on the publication of the great Lexicon of the Egyptian language, hieroglyphic and hieratic, by R. Pietschmann; and on the oldest papal documents. There is also a sympathetic memoir of the antiquary Wattenbach, by Dr. P. Kehr.

CONTENTS.