THURSDAY, NOVEMBER 24, 1910.

HIGHER ASPECTS OF ELECTRICITY.

A Treatise on Electrical Theory and the Problem of the Universe, considered from the Physical Point of View, with Mathematical Appendices. By G. W. de Tunzelmann. Pp. xxxii+654. (London: Charles Griffin and Co., Ltd., 1910.) Price 15*s.* net.

THE partial success which has attended the recent attempts of Einstein and Minkowski to found an electromagnetic system of mechanics has tended to strengthen the popular idea that the solution of outstanding problems and mysteries must be sought in the domain of electrical rather than other physical phenomena. From being a disturbing element characterised by unaccountable vagaries, the "electric fire" has come to be an all-pervading element, closely approaching the alchemist's idea of a primal substance. Mr. de Tunzelmann's work is an ambitious attempt to apply the Faraday-Maxwell theory of electricity, as modified by Larmor in the atomistic direction, to what he calls "the problem of the universe." Incidentally, the book gives a great deal of information with regard to recent work and speculation, and although the titular object of the work has not been attained (it could hardly be otherwise in our present state of knowledge), it will be valued on account of the information given on such varied subjects as electrolysis, radiation, radio-activity, the age of the earth, the solar corona, and the place of mind in the universe.

As might have been expected in a book of this kind, the interstellar ether plays a fundamental part in most of the ultimate speculations. That being so, it is to be regretted that no serious attempt was made to present the modern aspects of the various ether theories. Possibly the author may have considered the matter as too controversial. The electromagnetic principle of relativity (as distinguished from the mechanical or Newtonian one) is of such outstanding importance that it is quite impossible to state modern electrical problems without at least acknowledging its existence. Yet, neither in chapters v. nor xxii., where some statement of the principle is urgently called for, nor indeed in any other part of the work, is it even mentioned. And, although Le Sage's hypothesis and its later variants are dealt with to a remarkably full extent, there is no reference to H. Witte and his proof that the only chance for a mechanical explanation of electrical phenomena lies in the assumption of an ether composed of discrete particles.

Of minor blemishes we have "cathion" instead of "cation" (p. 19) evidently due to mistaken etymology, a micromillimetre described as "a thousandth of a millimetre" (p. 321), "coronarium" instead of "coronium" (p. 371), and plain "Norman Lockyer" (p. 644) beside the full titles of other savants. In dealing with magnetism, Langevin's important and successful theory, based upon the Zeeman effect and Curie's law, is not mentioned. In dealing with light, the author suggests calling the velocity of light in space the "radiation constant" (a term already otherwise appropriated), and (p. 271) makes out that an absorbing body absorbs less (instead of more) energy in unit time on being moved in the direction from which the light is coming.

The chapter on "The Place of Mind in the Universe," is a fascinating one, though its connection with the main work is not very obvious. The author aims at an all-embracing system or hierarchy of ultimate realities, beginning at the absolute, or eternal self-consciousness, and passing through mind, energy, and ether down to matter. The chapter is well written, and most suggestive. It is, of course, open to criticism on many points, but as few physicists have the courage to penetrate far into that borderland on the confines of which they, more than others, are wont to dwell, a spirited attempt like the present deserves every encouragement. At a time when the ether is being tried for its very existence, it is unwise to describe such a philosophic scheme as based upon a substance the properties of which, as the writer somewhat hastily asserts, "are derived from empirical observation." And when that system is further "strengthened" by a reference to the discarded "N-rays," and a single experiment in thought transference unaccompanied by the elementary safeguards devised by the Psychical Research Society, the system put forward is placed at a disadvantage from the first. Nor is that disadvantage removed by too great an insistence on the principle of the conservation of energy, and its use to assign a time-limit to the existence of the visible universe. Such a time-limit is really a negation of science and philosophy, as it implies that *deus ex machinâ* from which all scientific achievement has had to liberate itself or perish.

There are eighteen appendices on miscellaneous electromagnetic and philosophical subjects. Many of these, especially that on astronomical anomalies, are very useful and valuable. E. E. F.

TECHNICAL DICTIONARIES.

The Deinhardt-Schlomann Series of Technical Dictionaries in Six Languages. By Alfred Schlomann. Vol. v., Railway Construction and Operation. Pp. xiii+870. Price 12*s.* net. Vol. vi., Railway Rolling Stock. Compiled by Dipl.-Ing. August Boshart. Pp. xiii+796. Price 10*s.* 6*d.* *net.* (London: Constable and Co., Ltd.; Munich and Berlin: R. Oldenbourg, 1909.)

THESE two volumes form part of a series of technical dictionaries in six languages—English, Spanish, German, Russian, French, and Italian—of which seven volumes have now appeared. They are edited and compiled by Messrs. Deinhardt and Schlomann, assisted by experts from all the leading countries in each branch of the subject. The essential features of the scheme are that the six languages are all on one page, and, wherever it is possible, sketches are given so as to elucidate the text and facilitate the use of the dictionary. At the end of each volume complete alphabetical indexes are given,

five of the languages under one alphabet, and the Russian under another. The general arrangement, and the ground covered by each volume, leave nothing to be desired, and this dictionary will prove invaluable to all those who are engaged in technical work. Repeated tests of both volumes show that practically nothing has been omitted, and the long lists of contributors and revisers for the two volumes, embracing men eminent in the railway world in Europe and America, are a sufficient guarantee of the accuracy of the work. The great difficulty which often arises of finding a definition in one language which should have its exact equivalent in another has been very satisfactorily overcome, and the sketches render misunderstandings almost impossible.

In the volume dealing with railway construction and operation, only those terms are included which are of general importance in such work; such details as earthworks, bridge-construction, &c., could only be exhaustively treated in volumes specially reserved for them. Nevertheless, the railway expert will find that such subjects have been quite adequately treated so far as he is concerned in this volume. In preparing this volume, the subject has been divided into sections to facilitate reference; these sections include track, permanent-way, connections between tracks, stations, signalling, and safety appliances, railway service, &c., and one special section has been given to electric railway installations. Each section is again divided into a large number of subsections, and, as these are given fully in the table of contents, it will be realised how much care has been taken to facilitate reference. It is essential to those who are engaged in the work of translating or making extracts from foreign technical books and journals that any technical dictionary should be so arranged that no time should be lost in ascertaining the ordinary English equivalents to any unknown foreign words or expressions; the alphabetical index at the end of each volume ensures this, and the division of the whole subject into sections and subsections still further makes for simplicity and saving of time.

The sixth volume is given up entirely to the important subject of railway rolling stock. Here, again, the subject is divided up into a series of sections, such as common equipment for locomotives and carriages, including such details as wheels, axles, drawbar and buffer gear, brakes, &c.; locomotives and motor coaches; carriages; systems of lighting trains; rolling stock for electric railways; and, lastly, railway workshops. This latter section is not, of course, intended to cover the subject of machine tools generally, but only in so far as special methods and working are employed in railway workshops.

With the help of these two volumes, the railway engineer, and all those who are concerned with the various industries which are devoted to the manufacture of the machinery and plant required for the working and upkeep of the railways of the world, will find that the task of keeping abreast of what is being done in other countries will be greatly facilitated. It is essential that every manufacturing firm should endeavour to learn from the technical Press what is being done in other lands, and a thoroughly trustworthy technical dictionary, such as this series now in course of publication, is indispensable for this purpose. These volumes should be found in the head office of every firm which aspires to keep itself up to date in business methods. T. H. B.

PHYSICAL CHEMISTRY IN ITS GEOLOGICAL APPLICATIONS.

Principles of Chemical Geology: a Review of the Application of the Equilibrium Theory to Geological Problems. By Dr. J. V. Elsden. Pp. viii+222. (London: Whittaker and Co., 1910.) Price 5*s.* net.

ALTHOUGH it is generally recognised that the new physical chemistry has far-reaching applications in geology, no less than in other branches of science, little has yet been done to bring this home directly, either to the working geologist or to the student. In Van 't Hoff's lectures on "Physical Chemistry in the Service of the Sciences," the only geological application discussed is that relating to the crystallisation of salts from sea water. The results of the chemist's beautiful investigation of this one problem are the first-fruits of work on these lines, and they serve to show how wide a field still remains to be harvested. Vogt and others have essayed to apply the laws of solutions to igneous rock-magmas, but in this much more difficult problem no more than a beginning can yet be recorded. Meanwhile, we suffer from that want of touch between workers in different branches of science which is one of the less happy consequences of specialisation. The chemist has, in most cases, little acquaintance with geological questions, while the geologist, of the older generation at least, has not usually a working knowledge of physical chemistry, or at best is unfamiliar with the specific results which have been obtained.

This gap Dr. Elsden has now endeavoured to fill. The book before us is a compendium of physico-chemical principles as applied to the more important questions of chemical geology and petrology. In accordance with this plan, the arrangement adopted is primarily a chemical one, thus differing from the older method of Bischof and others. Successive chapters deal with the crystalline and amorphous states, viscosity, diffusion, solution, surface-tension, vapour-pressure, polymorphism, and mix-crystals. Throughout the author insists that the key to the many problems here touched "lies in the determination of the conditions of equilibrium," and indeed this last word occurs in the heading of almost every chapter. Unfortunately, as is duly recognised, many geological phenomena (such, *e.g.* as the glass in volcanic rocks) prove that the adjustment of equilibrium may be indefinitely delayed.

A surprising amount of matter is brought together in the compass of these two hundred pages, and the numerous references given in footnotes will be very useful to the student. Sometimes, perhaps, this fulness is gained rather at the expense of clearness of treatment; or it may be merely a wholesome caution which makes the author content to cite conflicting opinions and leave the question at issue open. In

general, we are given an admirable, if condensed, summary of the subjects dealt with, though in places a critic may pick out a carelessly written sentence, *e.g.* the dictum (p. 2) that "no substance can at once possess both vectorial and scalar properties." Any work treating of a new and rapidly developing subject must inevitably contain statements which have become obsolete even before their publication, and in a second edition Dr. Elsden will doubtless revise such passages as those relating to quartz and tridymite (p. 104), amphibole and pyroxene (pp. 111 *et seq.*), and lime-olivine (p. 203). Meanwhile, the book, in addition to its intrinsic value, will attain the author's expressed desire to stimulate interest in this important branch of geology. A. H.

THE MAKING OF GARDENS.

Hardy Plants for Cottage Gardens. By Helen R. Albee. Pp. vi+309. (New York: Henry Holt and Company.) Price 1.60 dollars net.

THIS volume forms part of the American Nature Series: Group iv., Working with Nature. From the title one would expect to find the work severely technical and somewhat dull—"dull and useful as work clothes and garden boots," as the author herself describes a certain chapter. But the title, though appropriate for a section of the work, is to some extent inadequate, as the book proves to be an essay on garden-making, written in a light and racy style, reminiscent of Charles Dudley Warner's delightful "My Summer in a Garden."

The greater part of the volume is devoted to a detailed account of the evolution of the author's garden, through the various stages "In the beginning," "An incipient garden," "The garden grows," "My ambition grows," and gliding on by easy transition to such apparently inconsequent subjects as "the vices of plants" and "some gardeners I have known." But though the author in her narrative of the six years' labour involved in the formation of her garden ranges over a wide field of horticultural economy, the sequence is so easy and natural that the reader's interest is not allowed to flag, and it is with regret that one reaches the classified lists which occupy the last 122 pages of the book.

These lists are conventional, and call for little comment. The method of classification adopted, though at first sight somewhat complex, will probably facilitate reference. The lists comprise a selection of shrubs and perennials, with descriptions and brief cultural directions, and are arranged primarily under colour headings, and, secondarily, according to the months in which the plants flower. A selection of annuals arranged according to the same system follows. It may be pointed out that this might have been incorporated with the shrubs and perennials, thereby avoiding a somewhat bewildering multiplicity of headings. The work is profusely illustrated with views of the author's garden at various stages, and a copious index is provided.

The author has not laid down hard and fast rules for the formation of a flower garden. Nor does she desire that others should follow slavishly the lines on which she has worked. "It is not well to imitate another's work, but to follow where your own conditions lead." Her experiences are related with a view to stimulating others who may have the opportunity and the desire to create a garden after their own heart, but who may lack the courage to break away from the conventional or who are diffident as to their ability to shape a new course for themselves. By such the book will be found rich in suggestion. Above all is it a plea for the free play of imagination in the garden.

"No one should have a garden which grows nothing but flowers, and yields no other recompense to the gardener except successful plants. Over, beyond, and above must hover the spirit of poetry, of wonder, of mystery; otherwise there comes a day of disillusion when you awaken to the weariness, anxiety, and watchfulness, and begin to measure the reward. You need a larger insight, something that connects your efforts with the universal in nature, the ideal, the soul of things. Into this you may lift the garden, and at once drop the tired body and soiled hands, and the whole material aspect of labour."

PHARMACEUTICAL PRACTICE.

The Extra Pharmacopœia of Martindale and Westcott. Revised by Dr. W. Harrison Martindale and W. Wynn Westcott. Fourteenth edition. Pp. xxvii+1054. Price 12*s.* net. With supplement, *Organic Analysis Chart.* By W. H. Martindale. Pp. 80. (London: H. K. Lewis, 1910.) Price 3*s.* 6*d.* net.

THIS handbook, which is so familiar to medical and pharmaceutical practitioners, appears in its fourteenth edition in a slightly altered form, the size of the pages having been enlarged so as to allow of the inclusion of new matter without increasing the thickness of the book. It will, however, still fit comfortably in the coat pocket, which is not an altogether unimportant advantage.

The two years that have elapsed since the appearance of the thirteenth edition have yielded an unusual amount of valuable therapeutic literature, a judicious condensation of which forms, for the most part, the new matter of the fourteenth edition. There are new chapters upon lactic acid bacilli therapy, organic arsenic compounds, the electrical introduction into the tissues of medicaments in the ionised condition, and radiology. In addition, the most recent information relating to a number of new pharmaceutical and chemical preparations is incorporated, and recent progress in vaccine therapy, cancer research, trypanosomiasis, and the treatment of tuberculosis is noted. The results of the chemical and bacteriological inquiry into the value of disinfectants undertaken by *The Lancet* commission are summarised.

The above is a brief outline of the extent of the revision in so far as it is of direct interest to the medical practitioner, but it may be added that throughout the book there is evidence that the authors have scrupulously followed the medical literature of the past two years. Alterations which enhance the usefulness of the book to pharmacists are by no means inconspicuous. Details are given of about a hundred more patent or proprietary medicines than in the last

edition. The authors have indicated by means of signs the part of the poison schedule in which each poison falls; this is an innovation which will be welcomed by retail dealers in poisons, in view of the exacting nature of the Poisons and Pharmacy Act, 1908. Since the last edition was published, new issues of various foreign pharmacopœias have appeared, and these have been utilised where necessary in the preparation of the fourteenth edition.

The "Organic Analysis Chart," which is published as a supplement, is intended to assist the analyst in the recognition of a number of organic chemicals, both natural and synthetic, used therapeutically. This chart gives the results of the examination of more than three hundred substances, and is the outcome of work conducted in Mr. Martindale's laboratory. It is a useful addendum to a book which is indispensable to practitioners of medicine and pharmacy.

A FISHERMAN'S TALES.

An Open Creel. By H. T. Sheringham. Pp. xii+305. (London: Methuen and Co., Ltd., 1910.) Price 5*s.* net.

MR. SHERINGHAM'S contributions to angling literature are always welcome, and we are glad to find that he has published in book form—or, more accurately, has worked up with other materials into a book—some of his contributions to *The Field*. No one need hesitate to look into the "Open Creel"; they will find plenty of fish, some hundredweight and a half of trout, nearly as heavy a bag of salmon, and chub, pike, and bream by the stone. In the preface we are promised that we shall find no plethora of fish in the succeeding essays, and Mr. Sheringham would not have himself regarded as an over-successful angler; to the ordinary reader he certainly seems successful beyond the wont of fisherman, but success in angling, as in other walks of life, is seldom undeserved, and it is with interest that we look for its explanation in our author's own account of his adventures. This is to be found, we venture to think, in his persistency, and his advice to others is to persevere; he who would come home with a heavy basket must needs set forth "with patience and perseverance and a bottle of sweet oil," as the snail went to Jerusalem. Yet it was his oil bottle that so tried Mr. Sheringham's patience that it came within a little of ending an honourable career in the Coln at Bibury.

It would be invidious to select for praise any one essay in the book. "The Float" is excellent, so, too, are the accounts of "Some Kennet Days," and the obituary notice of "Two Colne Trout," and so are many others. Perhaps it is when he fishes for coarse fish that Mr. Sheringham is the best company; such fishing is a more leisurely pursuit, and leaves more time for contemplation and for those digressions into the byways of angling that show him at his best. Sometimes when dry-fly fishing he tends to become a mere compiler of lists of dates and waters, flies and weights of fish, yet he is never wearisome, and has a most amiable weakness for Wickam's Fancy. Did fly fishing give him leisure for contemplation, Mr. Sheringham might meditate upon the problem thus presented; we cannot help thinking that a man's character should be reflected in his taste in flies, and that he who loves Wickam's Fancy must be a happy and contented soul and a good companion at the water's side. At any rate, we have found him good company in print, and recommend others to see if they cannot do likewise. L. W. B.

OUR BOOK SHELF.

The Photography of Moving Objects and Hand-Camera Work for Advanced Workers. By A. Abrahams. Pp. 153. (London: G. Routledge and Sons, Ltd., and Dawbarn and Ward, Ltd., n.d.) Price 1*s.* net.

MR. ABRAHAMS has been known during the past few years as a very successful photographer of moving objects, especially those in rapid motion, and in this volume he describes his methods freely and fully. He illustrates his experiences with more than forty pictures, which are well reproduced, and these, if nothing else were known of Mr. Abraham's work, would demonstrate his right to speak with authority. After chapters on apparatus, exposure, development, and so on, he deals with the photography of railway trains, athletics, rowing, football, cricket, lawn tennis, horses, divers and swimmers, golf, common objects, winter sports, special subjects, and press photography, giving apparently all the practical details that can be given in a book.

It is of interest that Mr. Abrahams prefers pyrogallol with sodium carbonate and sulphite as developer, in spite of all the new reagents that have been introduced, and that he actually blames metol as the cause of a modified instead of a full success. He advocates swinging the lens when necessary to get better definition of details at various distances from the camera, and justifies his advice by means of at least one example. But when he says, "if you cannot swing the back why not swing the lens," he appears to support the common idea that the one is the equivalent of the other. There is, of course, the radical difference that swinging the lens moves the axis of the lens to a different part of the plate, while swinging the back does not. There is one other common error to which the author appears to lend support, when he says that the shutter-blind "should be really *in the focal plane*"; an obvious impossibility, because the plate itself is there.

Der Sternenhimmel. By Prof. J. D. Messerschmitt. Pp. 195+xiii plates. (Leipzig: Philipp Reclam, Jun., n.d.) Price 1.75 marks.

THIS little book is another well-meant attempt to interest the public in astronomical phenomena by describing in simple language some of the results obtained by continued observation. The general appearance of the sky and the changes produced by the diurnal rotation and annual revolution of the earth about the sun come under notice. Separate chapters are added on parallax and aberration, the precession and nutation of the earth's axis, and the variation of latitude, which last seems a small matter to introduce into a work that can only aim at presenting the more conspicuous features. The several planets are described, their general appearance and motion, and a few remarks are added on comets and meteors.

In the section devoted to the stellar system, the usual information is given concerning double and variable stars, clusters, and nebulæ, proper motion and the movement of the solar system in space. The ground covered is that with which we have been made familiar by many similar works, and it is not a little difficult to justify the appearance of another treatise

on popular astronomy, however accurate it may be in detail. No doubt it is always difficult to know what to omit when space is severely limited, but if the book is to attract the attention of those who are unacquainted with astronomical literature, we suggest that the object would be more likely to be attained if the author had devoted some space to the methods and results of spectroscopic observation. By practically ignoring this large section, he has neglected perhaps the best means of exciting the scientific imagination and awakening an intelligent curiosity in celestial phenomena.

Introduction to Physical Chemistry. By Prof. H. C. Jones. Pp. xv+279. (New York: The Macmillan Company; London: Macmillan and Co., Ltd., 1910.) Price 1.60 dollars net.

IN this book the author gives a rapid sketch of what is ordinarily known as physical chemistry. Compared with other books of its kind, the result can scarcely be described as satisfactory. The author has tried to cover too much ground in the allotted space, with the result that much of the information is of a fragmentary character. The book is evidently intended for junior students, but it is doubtful whether they would really get any grasp of fundamental principles from such a highly condensed account of physical chemistry.

There are many places where the author's statements are vague, if not erroneous. For example, when discussing solids, he says, "The density of solids is somewhat greater than that of liquids, and much greater than that of gases. This is just what we should expect, since the solid state represents matter in its most condensed form." The second sentence is quite misleading. Again, "Ozone seems to be stable below 200° and above 1000°." Prof. H. C. Jones is a zealous and energetic worker in the field of physical chemistry, and the reviewer would like to have been able to accord this book a hearty welcome. As it is, he feels bound to say that, although it may serve a useful purpose, there are, in his opinion, better works of a similar character already in existence.

Preliminary Physiology. By W. Narramore. Pp. xix+220. (London: Methuen and Co., Ltd., 1910.) Price 3*s.* 6*d.*

THIS little book will be mainly useful to school teachers and to junior students preparing for the first-stage examinations of the Board of Education. This class of reader has but little preliminary anatomical knowledge, and the bulk of Mr. Narramore's book is occupied with filling up this gap. There are many other excellent books of the same nature, but the chief merits of the present volume are—(1) it is correct so far as it goes, and it is admittedly of the most elementary nature, and (2) it is provided with excellent illustrations. The author recognises that books and pictures will never teach properly even the elements of an experimental science, and insists that practical work must accompany the course. One can only hope that this expression of opinion will bear fruit. So far as one's experience of the schoolmaster goes, it is just that practical element in his scientific training which is usually conspicuous by its absence.

W. D. H.

The Invicta Table Book. By J. W. Ladner. Pp. 18. (London: George Philip and Son, Ltd., n.d.) Price 2*d.*

GRAPHIC representations of the multiplication tables and of the commoner weights and measures—including the metric system—are provided, and these should prove very useful in schools where the compiler's number scheme is adopted.

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.*]

The Jodrell Laboratory at Kew.

THE award of a Royal medal to Prof. F. O. Bower for his long-continued researches in the vascular cryptogams suggests to me that it may not be inappropriate to put on record an anecdote in our scientific history in the last century.

In the fourth report of the Commission on Scientific Instruction and the Advancement of Science it was recommended (paragraphs 57 and 154) "that opportunities for the pursuit of investigations in Physiological Botany should be afforded in the Royal Gardens at Kew."

To this the Government paid as little attention as it usually does to the results of the labours of Royal Commissions. But the recommendation was not wholly fruitless, for it induced the late T. J. Phillips Jodrell, a personal friend of Sir Joseph Hooker, to offer to build and equip, at an expense of 1500*l.*, a modest laboratory for the purpose. As stated in the Kew report for 1874, it was originally intended that this should be associated with an extension of the herbarium building which was contemplated at the time; but in consideration of the risk of fire it was decided to have an isolated building contiguous to the propagating department of the establishment.

It was completed in 1876, and was first occupied by Prof. Tyndall for work on the putrefactive changes produced by bacteria, the results of which were published in the Phil. Trans. for the following year.

Since then the stream of research has continued steadily. I "handed in" to the "Botanical Work Committee" appointed by the Treasury in 1900 a list of published papers as the result of work done in the laboratory down to and inclusive of that year, and compiled from copies preserved in it.

The workers in the Jodrell Laboratory are, of course, independent. They are supplied with the material they require, and are at liberty to make use of the Kew library and to consult, if they care to do so, the scientific staff. The nature of the work has therefore been of the most varied kind, and does not represent the influence of any particular school. In this respect the outcome differs from that of an academic laboratory in which research is carried on under the direction, or at any rate with the aid of, the professor.

What I think is worth noting is that, of those who have worked in the Jodrell Laboratory during the fifteen years from 1876 to 1900, no fewer than six have subsequently received the Royal medal. I do not mean to say that it has been in each case wholly earned at Kew, but it is I think clear that the work done there has contributed to the result.

The following are the names, with the general scope of the research and the date of the award:—Burdon Sanderson, electromotive properties of Dionæa, 1883; Marshall Ward, embryology and mycology, 1893; Gardiner, continuity of protoplasm, 1898; Horace Brown, assimilation of carbon, 1903; Scott, fossil botany, 1906; Bower, morphology of vascular cryptogams, 1910. To these may be added, making in all seven medallists, the Davy medal awarded to Schunck in 1899, in part for his researches on chlorophyll.

When one considers the names the results are not surprising, and though Kew enjoys some measure of prestige from being associated with them, that association is to a large extent accidental, at any rate limited to affording facilities. But some conclusions may be drawn. In the first place, the prevision of the Royal Commission is amply justified. In the next place, Phillips Jodrell, were he alive, would have every reason to be satisfied with the outcome of his generosity. But there is a further and more important point. I do not contend that the work I have enumerated was necessarily bound up with the Jodrell Laboratory in the sense that it could not have

been accomplished elsewhere, as, indeed, much of it has been continued. Of course, the medallists were all picked men, who did not lightly embark on research demanding much time and labour without a good deal of previous consideration. I think it may be fairly concluded that the provision of facilities with a sympathetic atmosphere may have operated as a determining influence. The final moral of the story may be summed up as the "open door."

And this applies elsewhere. The mathematician only requires his study. The physicist and the chemist are rarely at a loss for opportunity of research. But the position of the biologist is different. He must go to his material. Such institutions, therefore, as the Rothamsted Experimental Station, the Plymouth Laboratory of the Marine Biological Association, and the Biological Station at Naples, are peculiarly deserving of public support. And I think the story of the Jodrell Laboratory affords tolerable ground for the presumption, if, indeed, other experience did not afford it, that the generosity of those who have money to spare will not be fruitless in results if extended to institutions of the kind.

I cannot, however, omit to notice one piece of devoted service to the interests of the laboratory which, of its kind, is almost unique. A quarter of a century ago the Government looked with more indifference on research than happily it does at present. It merely acquiesced, with little interest, in a laboratory being provided at Kew from private funds. It was hopeless at the time to obtain for it any public financial support. Posterity will almost think it incredible that from 1892 to 1906 Kew should have had to owe to the present president of the Linnean Society, Dr. Dukinfield Scott, the unpaid performance of the duties of keeper. Such unrequited devotion has scarcely received the recognition it deserves. Fortunately, the utility of the laboratory as a necessary element in the Kew establishment has become sufficiently evident, and the keeper is now a member of the paid staff.

Witcombe. W. T. THISELTON-DYER.

Eel-larvæ (*Leptocephalus brevirostris*) from the Central North Atlantic [1]

IN a previous article in NATURE (November 10) I have given some information about the expedition executed by the steamer *Michael Sars* in the North Atlantic, from April to August this year, under the superintendence of Sir John Murray and myself. As would be seen from that article, the expedition crossed the Atlantic twice, first from the Canaries to Newfoundland, and then from Newfoundland to Ireland. During this cruise many hauls were made with pelagic tow-nets and trawls. It is characteristic of the manner of work that many nets and trawls —as many as ten—were towed simultaneously during several hours at each station. The nets and trawls were fixed on the wire as follows: one at the surface, the others at 100, 200, 300, 600, 1000, 1500, 2000, 2500, and 3000 metres. The very considerable number of pelagic forms captured is now being examined. The material includes several hundred Leptocephali belonging to many different species. Among these are forty-four larvæ of the common eel (*Leptocephalus brevirostris*). The localities where these were found are so interesting that a preliminary note may be useful, as suggestive for further investigation.

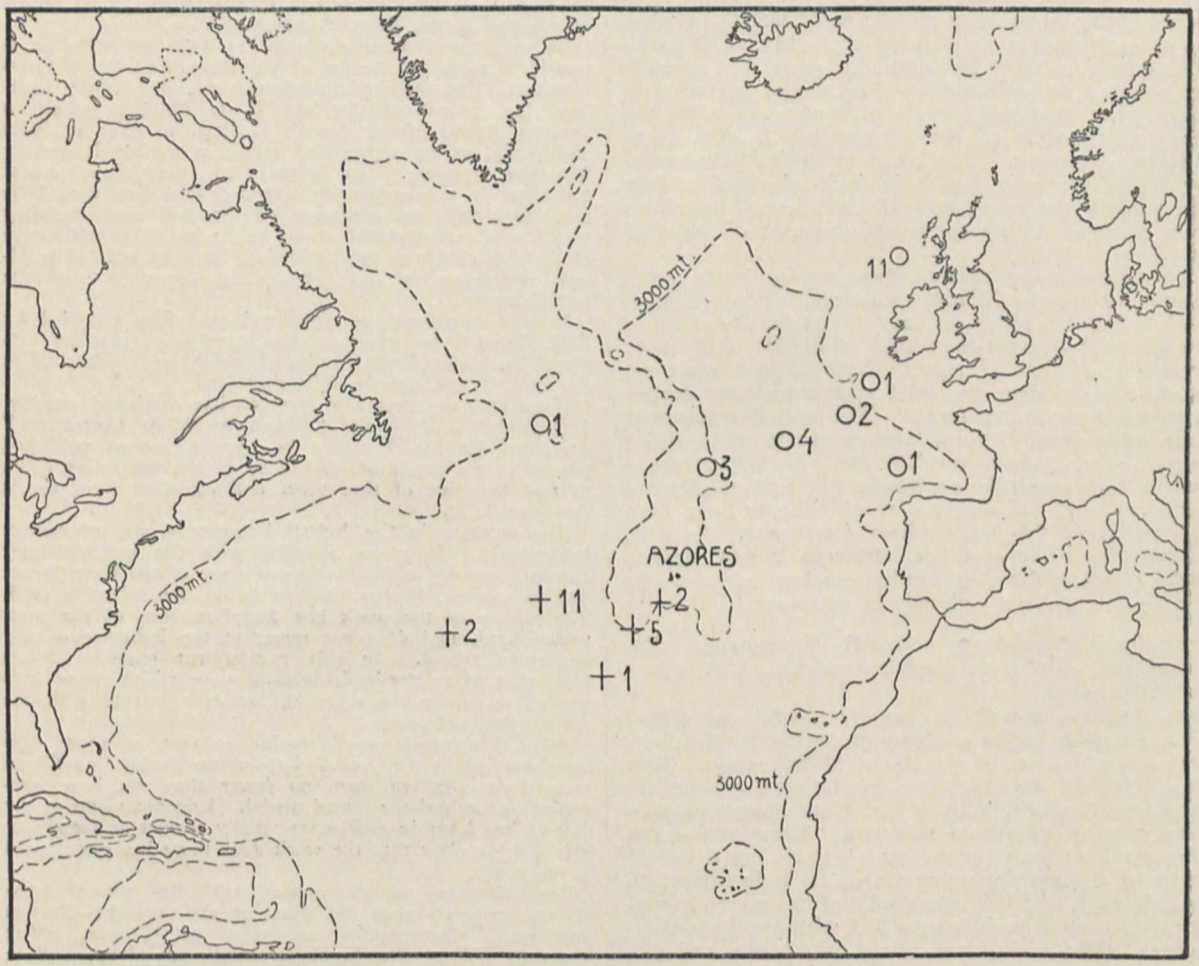


FIG. 1.—Chart showing places where eel-larvæ were found, and the number caught.

The accompanying chart (Fig. 1) shows the stations at

[1] Communication from the *Michael Sars* North Atlantic Deep-sea Expedition, 1910.

which eel-larvæ were found, the figures indicating the number of larvæ caught at each place. The chart shows the existence of eel-larvæ over the greater part of the North Atlantic between North Africa and North America. The excellent Danish investigations planned by Dr. C. G. Joh. Petersen, and carried out by Dr. Johannes Schmidt, succeeded with Dr. Petersen's young-fish trawl in catching eel-larvæ over depths mostly of 1000 metres along the continental slope from Shetland to Gibraltar. On the American side, larvæ of the American eel (*Anguilla chrysypa*) have already been found over the continental slope off the United States. The catches made by the *Michael Sars* now have this particular interest, that they prove the distribution of the larvæ, not only on the slopes, but also in mid-ocean over the greatest depths, both over the deep eastern and western basins and over the Azores ridge separating them.

According to their length, the larvæ may be divided into two distinct groups, one including specimens of 41 to 60 mm. in length, the other those of 66 to 82 mm. (see Fig. 2). All the specimens belonging to the first group, twenty-one altogether, were found at the stations south of the Azores, marked by a cross, and all those belonging

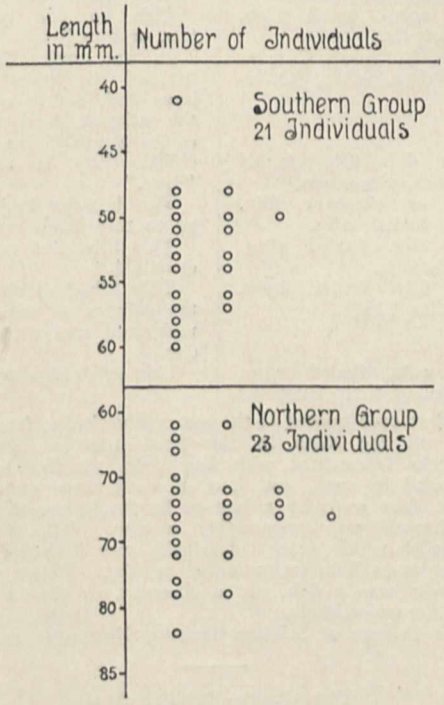


FIG. 2.

to the group of larger individuals were caught at the stations north of the Azores, marked by a circle. In order to control the determination of the larvæ, my assistant, Mr. Einar Lea, has counted the myomers of all the larvæ, and the results are given, for both groups separately, in Fig. 3. All the individuals—of either group—have a number of myomers not exceeding the limits, 111 to 119, given by Dr. Schmidt as characteristic of the larvæ of the common eel (*Leptocephalus brevirostris*). They are thereby distinguished from the larvæ of the American eel (*Anguilla chrysypa*). For the larvæ of the latter Eigenmann and Kennedy give the number of myomers as 105 and 108, and Dr. Schmidt has, by counting the vertebræ, fixed the limits at 104 and 110.

The larvæ of the common European eel previously found by Dr. Schmidt in the North Atlantic were all either full-grown leptocephalic larvæ or in subsequent stages of transformation. Dr. Schmidt describes five different stages. All the larvæ found by the *Michael Sars* north of the Azores belong to one or other of these stages. Outside the continental slope no larvæ of the transformation stages were found, but only full-grown leptocephalic larvæ corresponding to Dr. Schmidt's stage 1. This holds good both for the larva found in April in the Bay of Biscay and for the larvæ found in July between Newfoundland and Ireland. On the continental slope off the British Isles, however, larvæ in transformation stages (Schmidt's stages 2 and 3) were found.

The larvæ found by the *Michael Sars* south of the Azores are all smaller than the full-grown leptocephalic

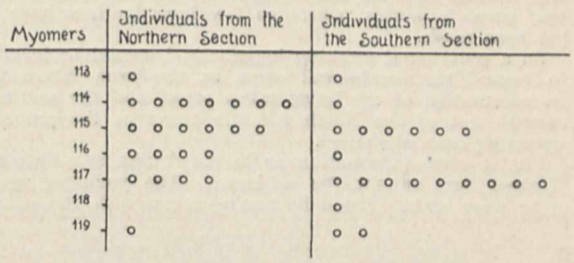


FIG. 3.

larva. I understand them to be stages in the development from the ovum to the full-grown larva. All have teeth which in every essential correspond to those characterising stage 1, as described by Dr. Schmidt. I must therefore consider the larvæ caught south of the Azores to be younger than any before found.

So far, no other stages have been discovered among the materials secured by the *Michael Sars*. More material is therefore needed to give a full explanation of the facts stated above. As, in the numerous Danish investigations and in all the hauls made by the *Michael Sars*, no single specimen belonging to the youngest stages has been found in the area north of the Azores, the conclusion seems natural that the spawning area of the eel must be sought in the southern central part of the North Atlantic. However, the spawning area can only be located by the evidence

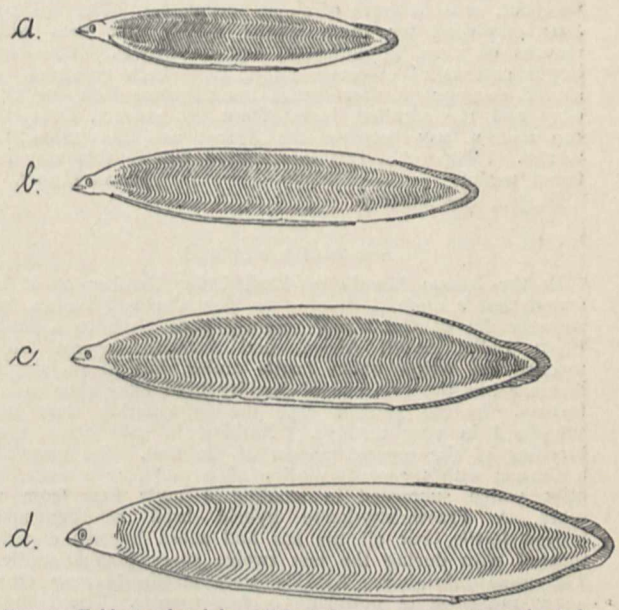


FIG. 4.—Eel-larvæ found by *Michael Sars*; *a–c*, caught south of the Azores; *d*, north of the Azores; *a*, the smallest larva found; *d*, a full-grown larva as the youngest previously found. All the figures are copied from photographs. Nat. size.

of ova. So long as the eggs have not yet been discovered the spawning area must also be considered as unknown; but it is natural to look for it in the neighbourhood of those localities where the youngest stages have been found. The discovery of the ova would not only give information about the geographical position of the spawning area, but also about the ages of the different larvæ hitherto found. It may then be possible to understand the distribution of the different stages—the youngest south and the eldest

north—as a drift with the currents. The negative fact that none of the smaller larvæ have appeared north of the Azores, and none of the larger ones south, seems to favour such an explanation. The further fact that none of the transformation stages, previously found so abundantly on the continental slope, were found in mid-ocean supports the same view. Nevertheless, I consider it dangerous to form any definite opinion from negative facts concerning such vast ocean expanses, where so few investigations have as yet been made.

As a provisional working hypothesis I should be inclined to regard the continental slope as the area where the transformation of the larvæ takes place, and the southern central part of the North Atlantic ocean as the probable spawning area of the eel.

Fig. 5 gives information as to the depths at which the *Michael Sars* caught the eel-larvæ. The youngest specimens were mainly found by towing a net with 100 metres

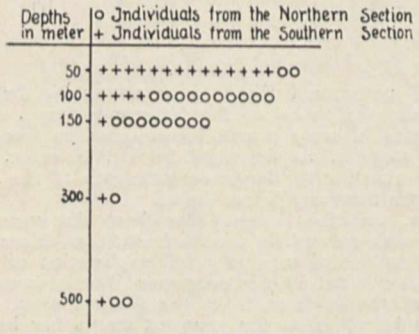


FIG. 5.

of wire out, or in a depth of about 50 metres. The eldest stages were found in nets towed with 200 metres of wire out, or at a depth of about 100 metres. The *Michael Sars* employed for these depths mostly silk nets with mouths of 1 m. in diameter, and no trawls. Otherwise larger catches of eel-larvæ might have been procured. I should recommend that future investigators look for the eggs and the smallest larvæ from the surface down to 100 metres, say between the Azores and Bermudas, in winter. I hope that this information will in this way be found useful.

JOHAN HJORT.

Bergen, November 7.

Are Mules Fertile?

IN the *Nuevo Mundo* of Madrid for October 27 it is stated that a mule, belonging to Don Carlos Gimenez, of Argamasella de Calatrava, recently gave birth to a foal. From India, South Africa, and America reports have reached the writer about fertile mules, but in no single instance has the evidence of fertility been altogether satisfactory. In the present case the information thus far submitted is very meagre. Nothing is said about the breeding of the reputed parent of the foal. She may be a she-ass with the conformation of a mule, or a mule in milk which succeeded in stealing a mule foal from a mare. A Przewalsky-horse hybrid bred at Penycuik proved fertile, but all the ass and zebra hybrids experimented with during the last twelve years proved sterile. The male zebra-horse hybrids were sterile because they never succeeded in maturing perfect sperms. The hybrid "Romulus," *e.g.*, had all the instincts of a pony stallion, and, so far as one could judge with the naked eye, he was capable of getting foals. When, however, a microscopic examination was made, it was ascertained that the sperms were quite or almost tailless—at the most the length of the flagellum was never more than three or four times the diameter of the head, and it was immobile. Why female mules are infertile has not yet been determined.

Sterility in birds seems sometimes to be due to structural changes in the germ cells induced by in-and-in-breeding. It is conceivable that similar changes may sometimes result from intercrossing. It must be admitted that the photograph reproduced in the *Nuevo Mundo* supports the view that the Calatrava foal is a mule, and that the reputed mother is also a mule.

But further and more definite information is wanted before a decision can be arrived at.

J. C. EWART.

The Origin of Dun Horses.

THE cases quoted by Prof. Cossar Ewart from Mr. J. B. Robertson in NATURE of November 10 would be good evidence against the theory that every dun horse must have at least one parent dun or grey if the data in the Thoroughbred Stud-book were absolutely trustworthy. This they are not, and all the cases quoted by Prof. Ewart have in them a very considerable element of doubt. Let me indicate these elements by placing the cases quoted in one column, in reversed chronological order, and the necessary remarks in another column parallel.

Cases Quoted.	*Remarks.*
Bay-dun filly, foaled 1907, dam, Unexpected.	This filly is registered "b. or dun."
Dun colt, foaled 1897, dam, Lobelia.	This colt is registered "b. or dun."
Dun filly, Sarah Curran, foaled 1892, dam, Cellulites.	In vol. xvii. Cellulites' foal of 1892 was said to have died, but in vol. xviii. the alleged dead foal becomes Sarah Curran.
Light dun filly, foaled 1886, dam, Danseuse.	This filly is registered "bay."
Dun or chestnut filly, Saneta, foaled 1884.	The breeder had doubts as to this filly's colour.
Dun filly, foaled 1829, dam, Octavia.	This filly died when two days old.
Dun filly, foaled 1763, dam, Miss Thigh.	This filly had eight foals the colours of which were registered, and not one was dun.
Dun colt, foaled 1730, dam, Young Kitty Burdett.	This colt's sire was grey.

The last case quoted is the mare Silverlocks, from which nearly all the duns in the Stud-book are descended. Silverlocks is credited with five foals, the first of which was foaled in 1738, and four of these were dun. Three of these four were by a bay or brown horse. So Silverlocks herself was presumably a dun. The Stud-book assumes that this mare Silverlocks was identical with a chestnut mare Silverlocks foaled in 1825. Either the 1825 Silverlocks was a dun, not a chestnut, or the two mares were different animals.

JAMES WILSON.

Royal College of Science, Dublin, November 15.

The Cocos-Keeling Atoll.

IN stating the depths to which the bores in the Funafuti lagoon were carried, and in drawing his deductions from them, the reviewer (NATURE, November 10) has fallen into a very curious error. He states that the first bore was driven to a depth of 41 fathoms, and the second to nearly 36 fathoms, but he overlooks the fact that he is giving the measurements from the surface of the lagoon water, and not from the lagoon floor.

The bores were started in 101 feet of water at low-water spring tide, and therefore, of the 41 and 36 fathoms mentioned by the reviewer, the top 17 fathoms in each case consist of nothing but lagoon water. The actual bores made into the lagoon bed penetrated no more than 24 and 19 fathoms respectively, or, as I pointed out in my last communication, a maximum of 144 feet.

F. WOOD-JONES.

MY depths of 41 and 36 fathoms were not intended in any way as a correction of Mr. Wood-Jones's letter. The important point is that lagoon débris *only* occurred above 27 fathoms; there was 10 fathoms of it. Below this depth we get coral rock.

It is a long time since any discussion has been held in this country on coral-reef formation, while much work

has been done during the last decade. I suggest that a public discussion, such as that on "The Origin of Vertebrates," held at the Linnean Society last session, would be valuable. THE REVIEWER.

IN our work in Challenger Office in connection with deep-sea deposits, we are very much impressed with the fact that solution of calcium carbonate is going on in the ocean, not only at great depths, but at all depths from the surface to the bottom wherever dead organisms which secrete carbonate of lime are exposed to the action of the sea water, as was recognised and insisted on by Semper, Murray, Agassiz, and others. We are therefore much interested in the discussion going on in NATURE regarding solution in the lagoons of atolls.

Mr. Wood-Jones considers that there are no actual proofs of solution in the lagoons of atolls, but, at the same time, admits the deposition of calcium carbonate.

The quantity of calcium carbonate present in solution in normal sea water is very small—only 0·12 gram per litre for water of specific gravity 1·026—and *no* precipitate is obtained on allowing it to stand for any length of time. When, however, sea water has remained for some period in contact with calcium carbonate it may take up a greater amount (up to 0·649 gram per litre). The solution is then supersaturated, and, on being allowed to stand, calcium carbonate is deposited in the crystalline form, and the deposition may go on until the solution contains less than is normally present in sea water.

The first condition, therefore, for precipitation is that *more* calcium carbonate than is normally present should pass into solution, and this can only occur when the sea water is in contact with a calcareous deposit for some time.

Would Mr. Wood-Jones say where the calcium carbonate which is precipitated in the crystalline form in the interstices of the massive corals in the lagoons comes from, for it is certainly not from the normal sea water which reaches the reefs from the open ocean?

It would appear that Mr. Wood-Jones's arguments against Sir John Murray's theory go rather in support of it. MADGE W. DRUMMOND.

Challenger Office, Villa Medusa, Boswell Road, Edinburgh, November 17.

The Flight of Birds against the Wind.

IN an interesting article (NATURE, November 10) upon bird migration and Mr. Power's recently published "Ornithological Notes," Sir T. Digby Pigott expresses surprise at the latter's conclusions that in the large autumnal migrations the birds invariably fly "almost directly against the wind even when it approaches a stiff breeze."

My observations on the flight of gulls during south-west gales off this coast lead to the conclusion that these birds during their aërial gyrations either face the wind or fly obliquely across the current. They very rarely fly, and, I believe, never soar, with the wind behind them. Perhaps less muscular energy is necessary in the former than in the latter case. Fish in rapid rivers, when not actively moving, according to my experience remain with their heads upstream. W. AINSLIE HOLLIS.

Hove, November 15.

THE ACCURATE MACGILLIVRAY, ORNITHOLOGIST.[1]

"THE accurate MacGillivray" is Darwin's designation of the subject of this notice, and "ornithologist" is the title which, when twenty-three years of age, he himself presaging his own powers, declared it would go hard with him if he did not merit.

Who MacGillivray was does not require to be told to the ornithologist conversant with the literature of his subject; but the general reader and the superficial bird-man have probably never heard his name. Yet that he was "the greatest and most original ornithological genius save one . . that this island has produced," is the verdict of so distinguished an ornithologist of our day as Newton. Why MacGillivray's biography should have tarried until his ashes had been fifty-eight years in the tomb is hard to understand, except probably that, born before his time, his contemporaries failed to perceive the genius of the man, or realise the pioneer he was.

William MacGillivray, born in Aberdeen in 1796, was the son of a military surgeon who died on the field of Corunna. The story of his self-denying life is that of not a few Scottish students, who, scantily provided with means, have yet by their indomitable will-power and love of learning achieved distinction, honour, and lasting fame. The future ornithologist's boyhood, from the age of three, was spent in Harris, in the Hebrides, where nature is wild and presents herself in many changing and impressive aspects. In the parish school a few miles from his home, he obtained, "under dull scholastic rule," a good elementary education, but his chief and unconscious preceptors were "the solitudes of nature" and "the moaning voice of streams and winds." At the age of eleven he set out for Aberdeen, to prepare, under more advanced tutors, for his entrance the following year into the University there, with a view to his father's profession. He probably on this occasion, as he invariably did at the beginning and end of the various college sessions, walked all the way athwart Scotland from his landing place on the west coast. When twelve years old he entered King's College, at that time the University of old Aberdeen (as then known), which (until 1860) was distinct from Marischal College, the University (junior by a century) of new Aberdeen. Having graduated M.A., when four years older, he proceeded at once to the study of medicine, of which one of the courses was botany, and with it, as he has recorded, he first began the study of nature "which has been particularly fascinating." A year later he took up zoology. His vacations were thenceforth spent in pedestrian excursions over the Highlands and islands, collecting plants and animals, keenly observing and carefully recording every aspect of nature.

It was during this period that MacGillivray acquired his great dexterity with the scalpel, and became so accomplished an anatomist that he was appointed dissector to the lecturer on anatomy in Marischal College. Unable, however, to resist the call of natural history, he relinquished this not uncongenial post in order to devote himself exclusively to his mistress. As one of the means to "further his cognition of these things," he set out on foot from Aberdeen for London *via* Fortwilliam and Ben Nevis—hardly the direct route—to visit the British and other Metropolitan museums, and observe life by the way. Drenched or dry, tired or otherwise, he never neglected at the close of the day to record fully in his journal the valuable notes he had made. After an 837 mile tramp, full of extraordinary experiences, he reached the capital, "satisfied," as he says, "with my conduct"; and not unjustly so, for his expedition had gone far to mature the youthful enthusiast. His study of the various zoological collections in London convinced him that the methods of classification of modern ornithologists were such as he could not accept. Before he returned to Aberdeen he had formed the resolve "to become the author of a new system," which formed the aim of his life thenceforward. In 1819 or 1820, MacGillivray migrated from Aberdeen to Edinburgh, and as he had recently married, it

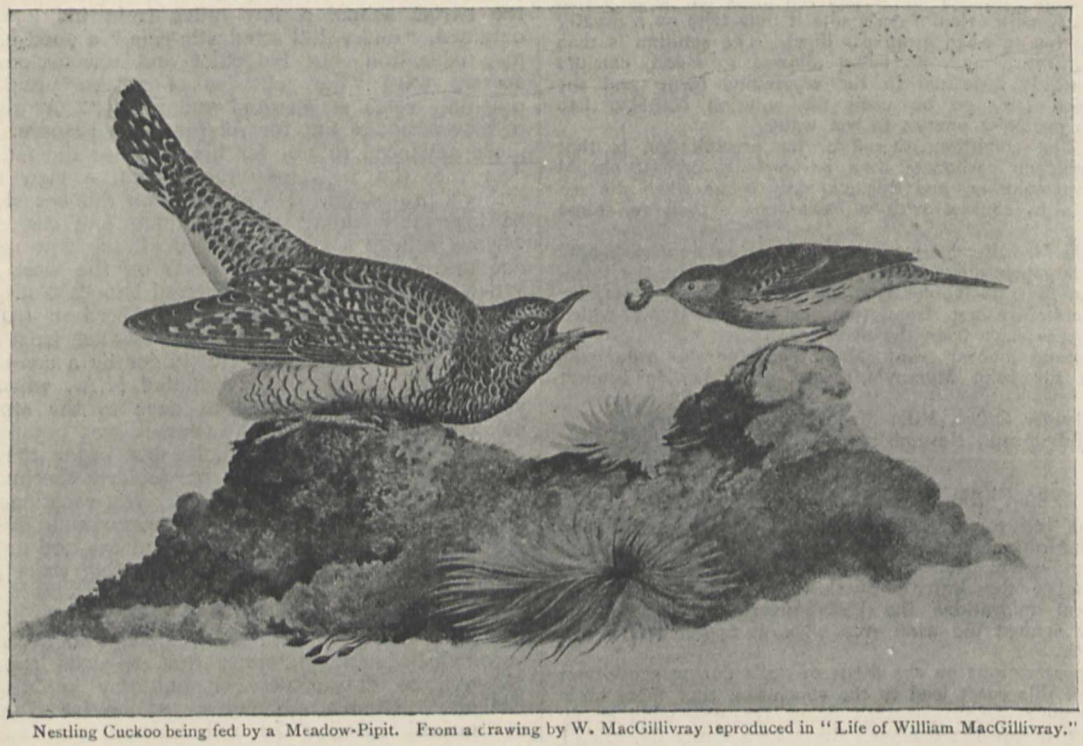
[1] "Life of William MacGillivray, M.A., LL.D., F.R.S.E., Ornithologist Professor of Natural History, Marischal College and University, Aberdeen. By William MacGillivray, W.S. With a Scientific Appreciation by Prof. J. Arthur Thomson. Pp. xv+222. (London: John Murray, 1910.) Price 10s. 6d. net.

became for financial reasons necessary to accept the post of assistant to Prof. Jameson, who then held the chair of natural history in that city. His beloved birds, however, enticed him away again to the fields for a few years, until in 1831 he received the entirely congenial appointment of conservator of the Museum of the College of Surgeons in Edinburgh. Here he accomplished splendid curatorial and research work—among much else replacing, through his accurate knowledge of living nature, the taxidermal monstrosities he found there by lifelike specimens—wherby his great scientific attainments became very widely recognised. His numerous anatomical investigations were continually supplying material for his new system of classification of birds, which, it was his peculiar merit to perceive, should not, as hitherto, be based on their external characters alone, but on their internal organisation as well. He specially devoted his attention to their digestive organs, undoubtedly too exclusively; but still, his was unquestionably a distinct advance on any method previously attempted. At this juncture he became associated as joint author with Audubon, the American ornithologist, in his "Ornithological Biographies."

In this great work all the technical and anatomical descriptions, and even some of the plates, are MacGillivray's, while Audubon's are the drawings and field notes on the species, of which he had an intimate acquaintance. During this period MacGillivray wrote many other books, but he was busy also with his projected "History of British Birds," the first three volumes of which appeared between 1837 and 1840. The wide reputation he had acquired in Edinburgh won for him early in 1841 the natural history chair in Marischal College, Aberdeen. Into his new duties there he entered with all the enthusiasm and energy of his nature, and with the ardent desire—not unrealised—that through his endeavours "the city might obtain a rank among those distinguished for the cultivation of natural history." So strenuously did he labour for eleven years to this end that he found no opportunity until early in 1852 to issue the fourth volume of his great history. It was published during his stay at Torquay, whither he had retreated "from the blasts of the North Sea," in the hope, which proved vain, of recovering his health, "assailed by disease." In July of the same year, within six weeks after the appearance of the concluding volume, this gifted naturalist and most lovable man passed away, amid the esteem of his scientific contemporaries and the special regard and affection of his former pupils, of whom a small remnant only now survives.

The above personal details are summarised from the first five chapters of this welcome "Life," in which all the available information about his distinguished relative has been brought together by a namesake. The succeeding chapter contains a warm appreciation of MacGillivray's scientific work by the present occupant—the fourth in succession—of the Aberdeen chair, Prof. J. Arthur Thomson, himself an ardent naturalist of the MacGillivray type. The final chapter is devoted to a series of delightful and characteristic descriptive passages from MacGillivray's writings, while a selection of his lifelike drawings from those in the British Museum illustrate the volume, one of which, by the courtesy of the publishers, is here reproduced. A volume on the "Natural History of Deeside and Braemar," found in MS. after his death, was purchased and published privately by Queen Victoria. Ornithologists everywhere will echo the regret expressed by Lady Geddes—whose personal recollections of the professor will be read with special interest—that no portrait of MacGillivray is in existence.

It has been peculiarly gratifying to the present writer to have been requested to bring this biography of MacGillivray under the notice of the readers of NATURE. The deepest pleasures of his own life have been derived from natural history pursuits in many parts of the globe, and he may perhaps be permitted to say that his love for nature was awakened in



Nestling Cuckoo being fed by a Meadow-Pipit. From a drawing by W. MacGillivray reproduced in "Life of William MacGillivray."

early childhood by his father, who imbibed his own interest in zoology and botany as a pupil of MacGillivray, and throughout his life never referred to his old professor without some term of affection. The writer, therefore, has always regarded himself as a grandchild of MacGillivray's influence. It was his fortune afterwards to receive in the same class-room his own zoological training, and to engage in curatorial work in the museum in which many of the specimens were labelled in MacGillivray's handwriting, and some years still later to follow closely the track of the *Rattlesnake*, the naturalist of which was John MacGillivray, the professor's eldest son, and its surgeon Huxley, also the writer's revered master. As familiar to the reviewer, too, is MacGillivray's beautiful handwriting—of which a specimen is reproduced on p. 68 of the "Life"—as if it were that of a member of his own family; for, by a strange chance, one of his brothers had the good fortune, while a student, perhaps about 1865, to rescue for a few pence from a butterer's mean uses a large bundle of MacGillivray's journals. Sad to say, only a few pages ran consecutively, but they were perused with something approaching to veneration. These contained, if memory serves, descriptions of some new species of mollusca; notes of excursions, with zoological and botanical observations—pages, perchance, of the second volume of "A Year's Residence and Travels in the Hebrides," which the "Life" records as lost; memoranda on the conduct and concentration of his pupils, while sitting for their class examination; the names tabulated according to "nations" (natal regions), and to harmony and disharmony in colour of their hair and eyes, with the proportion of successes or failures in these categories. Alas! it is to be feared that these pages have now also gone the way of all things.

It is gratifying, especially to Aberdonians, to find MacGillivray's memory so sympathetically revivified in this volume, and to feel that it will be kept green thereby for the future among his successors in the title of ornithologist.

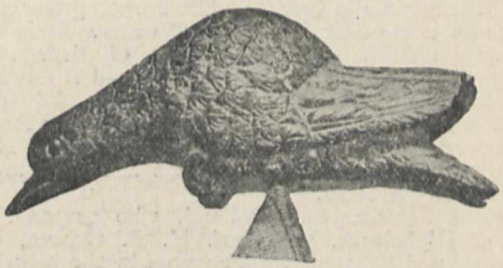
THE MAORIS OF NEW ZEALAND.[1]

MR. JAMES COWAN has done the student as well as the general reader a service in publishing the material he has personally collected from the *kaumatuas*, the old and learned men of many Maori tribes, for the time is rapidly approaching when very little more can be gathered from the natives. The book is by no means of the monographic kind, but consists of what are virtually a series of essays on different subjects, based entirely on first-hand information and the experiences of a lifetime of sympathetic intercourse with the Maoris.

The subject-matter may be grouped as follows:—The origin and migrations of the Maori and the settling of New Zealand; religion, tapu, omens, and the like; social customs, houses, canoes, tattooing; nature lore, folk-tales, poetry; while the last third is mainly devoted to the Maori in war, intertribal and with Europeans, and to cannibalism.

Comparatively early in the book we find it stated "that the Maori-Polynesian is a brand, though a distant one, of the Caucasian race is now generally accepted." It may be granted that the main stock of the Polynesians had, in the remote past, some relationship with the ancestors of certain peoples now living in Europe, but since then mixture has taken place with other races. A few students of Maori and other Oceanic languages have endeavoured to trace them to a Semitic origin, but there is no likeness between the grammar, and Polynesian and Semitic words are made in an absolutely different way, and there is no sort of likeness in the changes they undergo. The so-called evidence of connection is based only on the resemblances of certain words, but this is a method that could be adopted to prove any other theory. It comes therefore as a shock to read, "Certainly there seems to be adequate evidence to justify us in arriving at these general conclusions: that it was on or near the shores of the Persian Gulf and of Arabia that the ancestors of the Maori-Polynesian lived; that they had racial affinities with the ancient Chaldeans, from whom they gained most of their astronomical knowledge; that they also were blood relations of the Phœnicians, who were the most adventurous of ancient mariners; that they had affinity with the Egyptians, some of whose religious traditions they absorbed" (p. 31). "The coastal people of south-western Asia were from ancient times navigators with a knowledge of the stars; they, and probably the early Egyptians, were amongst the earliest sailors"—[what evidence is there that the Egyptians were ever a seafaring people?] "They coasted down the eastern shores of the African continent, at any rate as far as the Zambesi, and they also visited, and probably partly colonised, Madagascar; this would account for the resemblances between the Maori-Polynesian language and the Malagasy" (p. 35).

The sole evidence for this south-westerly migration



The Korotangi. From "The Maoris of New Zealand.'

of the ancestors of the Polynesians is the undoubted relationship of Malagasy with Austronesian languages. Malagasy is definitely related to the Indonesian group of languages, especially the Batta of Sumatra, Ngadju Dayak of Borneo, Sangir, and certain Philippine languages (*e.g.* Tagal), which must be regarded as more primitive than the Melanesian languages or the later Polynesian; but there is nothing Semitic about any of them, and we cannot at present profitably trace the Indonesian-Polynesian stock further back than to the supposed "Gangetic Race" of J. H. Logan, a conclusion to which S. Percy Smith evidently subscribes in his valuable little book, "Hawaiki." Mr. Cowan fortunately deals very little with such problematical questions, and we can feel more at ease when he confines himself to purely Maori ethnology.

There is an interesting account of the several voyages of the historic canoes to New Zealand, and an illustration is given of a carved stone bird, the *korotangi*, or "cying dove," which was brought in the Tainui canoe from the ancient home of the race. Mr. Cowan asserts, and we can well believe him, "it is not of Maori manufacture"; it is 10¾ inches long, and "carved with high artistic finish out of a very hard and heavy dark-green metallic stone." Of especial value are the numerous translations of Maori invocations, charms, and poems. The chapter on social life is superficial, and tells us nothing about the real social organisation of the people. The account

[1] "The Maoris of New Zealand." By James Cowan. With numerous illustrations from photographs and drawings. Pp. xxiv+356. (Christchurch, N.Z.; London: Whitcombe and Tombs, Ltd, 1910.) Price 15s. net.

of the *whare-whakairo*, or large communal assembly hall, is of considerable interest. The book is well illustrated, and the note on Maori pronunciation is welcome, but an index is lacking. The get-up of the book is a credit to the New Zealand firm which publishes it.

THE ATTITUDE OF DIPLODOCUS.[1]

SINCE Mr. Carnegie gave a plaster cast of the skeleton of Diplodocus to the British Museum in 1905, he has distributed other copies of this remarkable Dinosaur to the museums of Paris, Berlin, Vienna, and Bologna. A large part of an actual skeleton was also given by the late Mr. Morris K. Jessup to the Senckenberg Museum in Frankfurt. A widespread interest has thus been aroused in the gigantic Sauropodous Dinosauria, and there have been many discussions as to their original form and mode of life.

When the late Profs. Marsh and Cope first obtained nearly complete skeletons of these reptiles, they compared the limbs with those of an elephant, and decided that the creatures must have walked in a quadrupedal manner, with the body well raised above the ground. Considering their immense weight, the position of their nostrils on the highest point of the head, and the feebleness of their dentition, which seems to imply a succulent food, the professors were agreed that the animals must have spent much of their life under water. Prof. Cope also supposed that the long neck, which characterises all the Sauropoda, would enable them to reach the surface to breathe while browsing on waterweeds in a considerable depth of water. It is now generally admitted that the theory of their semi-aquatic mode of life is well founded, and it has been observed that the feeble teeth are not placed in close series, but separated by small gaps, as if they formed a strainer for the food which was taken in. Much difference of opinion, however, has arisen as to the attitude of the limbs.

Messrs. Hatcher and Holland, who prepared the cast of Diplodocus, and Prof. H. F. Osborn, who mounted a skeleton of Brontosaurus in the American Museum at New York, followed Marsh and Cope in arranging the limbs for a quadrupedal walking gait. Dr. O. P. Hay, of Washington, on the other hand, subsequently maintained that the limbs must have been bent, like those of a crocodile, for crawling, and last year Mr. Gustav Tornier, of Berlin, elaborated this theory, publishing a somewhat fantastic sketch of the skeleton as he would arrange it. Prof. O. Abel, of Vienna, has now prepared an interesting summary of all these discussions, and finally concludes that the attitude of Diplodocus and its allies, with which the restorations have made us familiar, is really the correct one.

Prof. Abel begins his paper by deploring the fact that most museums restore the skeletons of extinct animals, partly by hypothetical plaster-work, partly by using the bones of more than one individual, without any clear explanation on the labels. He has, therefore, taken the trouble to state exactly the nature of the materials from which the well-known cast of *Diplodocus carnegii* was made, and he has no serious fault to find with its general composition. It is possible that two or three vertebræ are lacking, and part of the tail may not be sufficiently stout, otherwise there is little to criticise. He thinks that the axis of the head is in direct line with that of the neck, as usual in reptiles, and that the browsing attitude is due to the natural curvature of the end of the neck. He points to the deeply ovate cross-section of the trunk as showing that it is not adapted for crawling along the ground, but must have been lifted during locomotion. He then discusses the structure of the feet in detail, and demonstrates that they are digitigrade, the fore feet more so than the hind feet. As in Iguanodon (of which footprints show the impressions) there must have been elastic pads beneath the toes, and most of the weight of the body seems to have been supported by those below the reduced outer toes. The structure of the digitigrade feet necessitates nearly upright limbs, which would support the trunk and give the reptile a true walking gait. There would be a slight outward bend of the elbow, but otherwise no sprawling attitude. The Sauropoda, therefore, form no exception to the rule, that the extinct Dinosaurs resembled mammals and birds in their habits and movements.

[1] "Die Rekonstruktion des Diplodocus." By O. Abel. Abhandl. k.k. zool.-botan. Ges. in Wien. Bd v., Heft 3. Pp. 60+Tafel 3. (Jena: G. Fischer, 1910.) Price 2.40 marks.

THE PROTECTION OF NATURE.[1]

"IT is the first time a very comprehensive attempt has been made to do important public service of this character on purely non-partisan lines. . . . It is indeed a great work. We have here the first Commission of the kind ever established by a National Government. . . ." Thus the Hon. Clifford Sifton, chairman of the Commission for the Conservation of the Natural Resources of Canada, at the conclusion of the Commission's first annual meeting, held in January of this year.

The establishment of this Commission is a noteworthy departure, and is actually a method of insuring the future prosperity of the country. Canada is peculiarly amenable to such a step, as large areas of her land are in the hands of the Government, and also peculiarly in need of it. The latter point is obvious when it is remembered that owners of timber property are only just beginning to assimilate the idea of afforestation, that lumbermen are constitutionally destructive, and that forest fires are not an occasional catastrophe, but seasonally recurring and accepted phenomena. In England we hardly realise this last fact, or the destruction produced by a forest fire. The following statement gives a glimpse of the reality:—"The spring fires are not, as a rule, so dangerous to the forests, as they are what we call leaf fires, while the fall fires are soil fires. The leaf fire will run through the woods, and while it destroys a lot of timber, it does not have the same effect as a fire in the fall, because that not only takes the leaves and wood, but it takes the soil as well, and *burns down five feet, so that for a thousand years nothing will grow on that land*." (My italics.) It appears that railway locomotives cause the majority of these devastating conflagrations.

Destruction without perpetuation has been carried on in other departments. "In the Yukon there are," says Mr. Congdon, "hundreds of square miles where I do not think you could now find a single fur-bearing

[1] First Annual Report of the Commission of Conservation, Canada. By courtesy of the High Commissioner for Canada, 17 Victoria Street, London. (Ottawa: The Mortimer Co., 1910.)

Mitteilungen des Provinzialkomitees für Naturdenkmalpflege. Schleswig-Holsteinischen, No. 1 (1909); Pommerschen, No. 2 (1910); Sächsischen, No. 1 (1908); Westpreussischen, Nos. 1, 2, 3 (1908–10); und des Bezirkskomitees Regierungsbezirk Sigmaringen, No 1 (1909); Cassel und Waldeck, Nos. 1, 2 (1908–9)

Naturdenkmalpflege und Aquarienkunde. By R. Hermann and W. Wolterstorff. (Brunswick, 1909.)

Naturdenkmalpflege. By Prof. Gürich. (Sonderabdruck aus der Zeitschrift der Landwirtschaftskammer für die Provinz Schlesien, 1909.)

Über Zeil u. Methode der Naturdenkmalpflege. By Prof. Dr. B. Schaefer-Cassel. (Schmalkalden, 1909.)

Über das Tierleben in dem von der Staatsforstverwaltung geschützten Zwergbirken-Moor in Neulinum. By Dr. Th. Kuhlgatz. (Sonderabdruck aus dem 32, Bericht des Westpreussischen Botanisch-Zoologischen Vereins, Danzig, 1910.)

Neues aus der Naturdenkmalpflege. By Dr. W. Günther. (Naturwissenschaftliche Wochenschrift, August 7, 1910; Jena.)

animal. They have been absolutely exterminated by hunting, trapping, or by the decrease of the food-supply which occurred in the years 1904–5." An interesting cause is the disappearance of the rabbit. In 1904–5 "some disease smote the rabbits, and they died off by thousands." "In consequence of their disappearance, the animals which fed on them—the fox (the wolf, which need not be counted), the marten, the chief food of which, however, is mice, and other animals—died from absolutely no other cause than starvation." The problem of the conservation of the water supply is curiously bound up with afforestation. For instance, it has been found necessary to conserve the timber on the east slopes of the Rockies in order to conserve the river-heads. "It was shown that the destruction of the timber meant the disappearance of the regular water supply of those provinces, the agricultural production of which is the pride and the hope of Canada."

A list of the committees shows the scope of the Commission. They are seven in number, viz.:—Fisheries, game, and fur-bearing animals; forests; lands; minerals; waters and water powers; public health; press and cooperating organisations. Their reports on the first year's work, the chairman's speech, and the discussions are of unusual interest. Recommendations to Government have already commenced. Such a scheme for the scientific control of the ultimate natural resources of a country must inevitably be adopted elsewhere.

It has, however, one serious deficiency as yet, the absence of any organisation for the preservation of those sites and objects that have no commercial value, but the scientific and artistic importance of which is very great. Such conservation could easily be worked in with the main business. The latest reports of the committees for this special purpose in Germany are to hand. There are official directions giving the least injurious method of picking flowers. Every district seems to be thoroughly looked after and studied by its committee. There are very interesting maps of the habitats of rare plants, and studies of typical fauna, such as that by Dr. Kuhlgatz, on the animal life of the moors in Neulinum. Reference to maps shows that the districts preserved are remarkably numerous. The movement is not merely governmental, but aims at enlisting the sympathetic cooperation of the people. The propaganda is now being extended to the schools, and Prof. Schaefer-Cassel has an eloquent address on the subject. Cases for the "pillory" are recorded, as, for instance, that of a man who in a few years annexed 900 specimens of *Cypripedium calceolus*. This flower, once found near Settle, in Yorkshire, and perhaps in one or two other sites, has now, I understand, disappeared from this country. The same fate will attend many a rare plant, butterfly, or bird, unless we, too, adopt some system of preservation. The *Wild Birds' Protection Act*, it is to be feared, is a dead-letter.

If we had a national commission for the protection of all "monuments of nature," including beauty spots, places interesting for historic or geological reasons, woods, valleys, and hills remarkable for some species of plant, animal, or insect, we should not be a "nation of shopkeepers." But is the United Kingdom too far exploited for a commission for the protection of its natural resources, including its natural history? There would be difficulties in the way, but surmountable difficulties. One very obvious fact presents itself at once—these places of beauty, these habitats of species (by no means useless for the ends of commerce, since they subserve the ends of science), are precisely those which defy culture and would never make it worth while. To make them into natural museums would be a work for which future generations would be more grateful than we can realise. The museum of brick and stone has its uses; zoos and botanical gardens are of no little value; but neither can compare, either for interest or for scientific study, with a reservation. Not only Germany, but Australia, is setting an example here. Dr. Conwentz's book, recently published in England, and an excellent article by Dr. Günther in the *Naturwissenschaftliche Wochenschrift* of August 7 last, give a luminous exposition of the principle and its results.

In time perhaps the world will be full of such spots, where nature may have her Sabbaths and preserve her most interesting children, among whom, last but not least, will be aboriginal varieties of man himself. Is there not a reservation for the tribes of Central Australia? A. E. CRAWLEY.

AGRICULTURE IN THE DRY REGIONS OF THE BRITISH EMPIRE.[1]

THE ordinary farm crops on which the supply of food-stuffs depends seem to be produced best in regions where the rainfall varies between 20 and 35 inches per annum. Where the upper limit is exceeded in the British Islands, a good deal of pasture is found; on the other hand it is notable that the great wheat-producing districts, the eastern counties, are regions where the rainfall comes nearer to the lower limit. Special agricultural methods become necessary where there is less than 20 inches of rain, as is the case over large areas in Canada, Australia, India and South Africa. These methods fall into two groups: irrigation is required if there is less than 10 inches of rain, while special cultural operations, collectively known as "dry farming," are used when there is as much as 15 or more inches. Between 10 to 15 inches, sometimes the one and sometimes the other method proves the more economical.

"Dry-farming" methods are of great interest to the student of soil physics. Their object is to keep the rain water near the surface of the soil and to prevent loss by evaporation, by surface drainage, and, if possible, by percolation. A remarkable degree of success appears to be attained. An examination of the methods in vogue in different parts of the world shows that all have certain features in common. The land is ploughed up in a rough state and the subsoil compacted directly after harvest or before the rainy season, if there is one; in countries where the rain is unevenly distributed and torrential downpours occur, rather elaborate terracing is arranged to prevent any loss by running off the surface; any streams that form having to follow a sinuous course over the whole field, so that absorption may be as complete as possible. Directly the rain is over, the surface soil is thoroughly stirred, thereby losing a little water by evaporation, but forming a loose layer. The water is thus imprisoned between the compacted subsoil and the thin loose layer of surface soil. The greatest importance is everywhere attached to the maintenance of this loose layer on the top; cultivation is repeated as often as rain has fallen, or whenever for any other reason it is considered the layer has become compact. Incidentally this repeated cultivation has the effect of keeping down weeds, which, if unchecked, would use up a good deal of the water.

In the dry parts of Canada and the United States, where these methods are most highly developed, it is customary to take a crop—usually wheat—once in two years only, leaving the land fallow in the alternate year. It is considered that two-thirds or even more

[1] *Transvaal Agricultural Journal*, vol. viii., 1910.
Agricultural Journal of the Cape of Good Hope, vol. xxxvi., 1910.
"Water Requirements of Crops in India." By J. W. Leather. (Memoirs of the Department of Agriculture in India.)

of the year's rainfall may, under favourable conditions, be stored in the soil for the next year; thus, if only 15 inches fell each year, making a total of 30 inches in the two years, the wheat crop grown during the second year should have moisture available equivalent to 25 inches or more, on which, of course, it should do very well. Unfortunately, the rainfall does not necessarily remain near its average, but fluctuates considerably, and records are not available for many districts; it has occurred in districts where dry farming was considered a great success that the rainfall was, after all, about 20 inches, and ordinary cultivation would have been equally good.

However, the interesting problem is this: What is function of the compact subsoil and the loose surface layer? It is usual to suppose that the compactness of the subsoil facilitates the upward lift by surface tension of water from the permanent water table, but it would seem equally rational to suppose that the compact subsoil retards the percolation of the water. So far as the writer is aware, no crucial experiments have been made that show beyond doubt how far the upward movement of water by surface tension is a factor in ministering to the needs of the plant. That it takes place, of course, is not disputed, but its relative importance is unknown. The function of the loose layer on top, the "mulch," is not settled. It is commonly regarded as a break in the structure of the soil leading to a rupture of the "capillary films" of water. It may equally be a non-conducting layer shielding the mass of the soil from the sun's heat, and therefore lessening evaporation.

Until these problems are solved, little advance can be expected from the scientific point of view, although the practical man continues to effect improvements. The fundamental need seems to be a mathematical analysis showing how water will distribute itself over a mass of particles varying in diameter from below 0·002 mm. up to 0·1 mm., the bulk being below 0·01 mm., and how rapidly any disturbance in equilibrium will readjust itself. The pressing need of work in this direction may be gauged from a perusal of the Transvaal, the Cape, or the South Australian Agricultural Journals; in South Africa alone a considerable part of Cape Colony, the western halves of the Orange Free State and the Transvaal, the whole of the Bechuanaland Protectorate and a considerable portion of southern Rhodesia fall within the "dry lands" area. Some useful practical work may be expected from the newly established dry-land experiment station, but that will only intensify the necessity for a scientific study of the problem.

There is also need of work by the plant physiologist on the effect of insufficient water supply on plant growth. In Dr. Leather's paper data are given showing how much water is transpired by a plant in the production of one pound of dry matter, and on the basis of these figures a table is made out showing how much irrigation or rain water is needed to obtain crops of certain sizes. The values depend on the amount of food-stuff available; less water is needed per pound of dry matter produced in a rich soil than in a poor one. Although there is no direct causal relationship between transpiration and assimilation, the ratios obtained by different observers in various parts of the world are roughly of the same order; thus for barley the number of pounds of water transpired per pound of dry matter produced are:—

Lawes and Gilbert (Rothamsted, 1850)	257
Wollny	774
King (Wisconsin, 1894)	393
Leather (Pusa, 1910) on manured soil	480
" " on unmanured soil	680

E. J. RUSSELL.

THE CAVENDISH LABORATORY.

THERE is no more pleasant way of spending a week-end than by re-visiting the University Town of Cambridge in term time to meet the old friends and comrades of years gone by, and it was a happy thought that induced the writer of the "History of the Cavendish Laboratory" to choose a Saturday for presenting an edition de luxe of the book to the Cavendish Professor of Experimental Physics.

Saturday, November 12, was a red letter day for all who are interested in the Cavendish Laboratory, for it was the occasion of the assembling of a number of distinguished persons to do honour to the "boy professor" of a quarter of a century ago, who has so amply justified the confidence of the Board of electors in appointing so young a man to a post of such importance. Clerk Maxwell and Rayleigh were not easy men to follow; the standard they had set was a high one, the Cavendish Laboratory had become a prominent institution dependent for maintaining its position and for its further development not only on the scientific reputation of its Director, but on his power to attract the ablest young men of the day.

How far Sir J. J. Thomson has done this was evidenced by the number of distinguished visitors to Saturday's ceremony, among whom we noted: Lady Thomson and her little daughter Joan, Mrs. Sidgwick, the Vice-Chancellor, the Bishop of Ely, the President of Queens' and many Masters of Colleges, Sir T. Clifford Allbutt, Sir Robert Ball, Profs. P. V. Bevan, R. H. Biffen, F. C. Burkitt, Sir George Darwin, Prof. Ewing, Dr. Wm. Garnett, Profs. W. M. Hicks, F. G. Hopkins, B. Hopkinson, Dr. J. N. Keynes, Sir Joseph Larmor, Profs. Liveing, Leahy, Alexander Macalister, Dr. J. E. Marr, Profs. H. F. Newall, W. J. Pope, J. H. Poynting, E. Rutherford, Dr. J. E. Sandys, Mr. Sidney Skinner, the Hon. R. J. Strutt, Mr. H. M. Taylor, Mr. W. C. D. Whetham, Prof L. R. Wilberforce, Mr. C. T. R. Wilson, Prof. G. Sims Woodhead, and Prof. A. M. Worthington.

In the unavoidable absence of the Chancellor, the Vice-Chancellor presided, and declared his position a sinecure in that the speakers needed no introduction.

Dr. Glazebrook, in making the presentation, began by reading a message, contained in a letter to himself, from Lord Rayleigh, Chancellor of the University:—

My interest in the Cavendish Laboratory began with—indeed preceded—its inception, and I had the privilege of the acquaintance of that great genius, the first professor, on whom fell, of course, a vast amount of work in connection with the building and equipment. The laboratory had hardly more than got to work when British science sustained an irreparable loss by the death of Maxwell. My interest then became a responsibility. During the five years from 1879 to 1884 the educational work was greatly developed under yourself and Dr. Shaw, and in research some good work was done. But I must not dwell upon what, no doubt, most of the present students look upon as the dark ages. For six-and-twenty years Sir Joseph Thomson has had the direction, and under him the Cavendish Laboratory has assumed the first place among physical laboratories. By his own researches, pursued with astonishing ardour and success, he has opened up a new world, and, what is in some respects a task even more difficult, he has inspired and trained a number of followers, among whom I am pleased to reckon my own son. Cambridge has every right to be proud of the Cavendish Laboratory, its professor, and his staff.

I will ask you to convey my congratulations to Sir J. J. Thomson. For the future one can wish nothing better than that it should resemble the past.

Dr. Glazebrook, continuing, briefly sketched the history of the Laboratory as contained in the book, which he said was written by men who took part in the events they described.

The book has been written partly in the hope of enabling educated Englishmen who are not physicists to understand the meaning of the work done at the Cavendish Laboratory. . . . It covers a wide range of intellectual qualification from that of the M.B. student to that of the brilliant band Rutherford, Wilson, Townsend, McLellan, Langevin, Richardson, Zeleny, and the others who were research students ten years ago. The Master of Trinity in an eloquent speech a few months ago told his audience he was a dreamer of dreams, and in one dream he pictured a larger university with its portals opened wide and men of many nations and kindred flocking in from all lands to reap the rich harvest of ancient learning or modern science which only Cambridge can furnish, and to carry back to their distant homes the garnered sheaves to feed and fertilise the world. Sir J. J. Thomson has realised such a dream. The new regulations for advanced students passed in 1895 were accepted in large measure through his advocacy, and since that time an ever-increasing stream of men coming from every land has been directed towards Cambridge; the list of those who have carried on researches in the Cavendish Laboratory during the last forty years contains some 250 names; the list of published memoirs covers forty pages. Former students hold important posts in almost every great university; the fact that of the professorships of physics in the colleges of university rank in England all but one are held by Cambridge men shows the wide influence of the laboratory at home. Go where you will, not only in English-speaking lands, to any centre of physical study and you will find one or more who is proud to say he was a research student of the Cavendish Laboratory and a pupil of Sir J. J. Thomson.

As representing those pupils and in the name of the large assembly here present, in the name of the scientific world, I am here to express to you our high appreciation of the services you have rendered to science and to the University, to assure you of the affectionate regard for you personally of all your pupils, and to wish for you and Lady Thomson many years of fruitful activity and continued happiness. Can I do better than repeat the Chancellor's wish—that the future may resemble the past?

It is my privilege to ask you to accept this volume with its record of your great work as some slight recognition of all you have done.

Sir J. J. Thomson responded in a characteristic speech. There was no mention of his own work further than the expression of the wish, which raised a smile on all faces, that he had done more. His speech was an acknowledgment of all he owed to his College, his University, and those personal friends from whom, he said, he had received help without which there would have been no such celebration. He referred to the triumvirate Rutherford, McLellan, and Langevin, and mentioned that one of them had received the Nobel prize. No one was forgotten in the expression his thanks; the demonstrators, the students, the assistants in the Laboratory, were all remembered and many of them mentioned by name. To everyone full appreciation was accorded, and the one person not mentioned, whose work and influence were not alluded to, was the Director of the Laboratory, the Professor to whom all else was due.

The Vice-Chancellor briefly declared the proceedings ended, and passed, "as a business man," to the next item of the agenda, "Cavendish Laboratory Afternoon Tea," an institution of Sir J. J. Thomson, which has accompanied Cambridge Physicists to all parts of the world and, conversation becoming general, the afternoon ended most pleasantly.

S. J. D. S.

MR. W. R. FISHER.

AS announced with regret last week, Mr. W. R. Fisher, assistant professor of forestry at Oxford, died on November 13, after an operation. He had not been in good health for some time past, but his death occurred rather suddenly.

Mr. Fisher was born in 1846, at Sydney, New South Wales, where his father was Crown Solicitor, but became afterwards the first Attorney-General of New Zealand. He came to England quite young, and was educated at Cambridge, the home of his father and grandfather, the latter having been a banker in Petty Cury. He joined St. John's College, and took his degree in 1867, being placed 17 senior optime. Soon afterwards he became a mathematical master at Repton School.

In 1869 Mr. Fisher competed for an appointment in the Indian Forest Service, being bracketed first. After the necessary training in forestry, chiefly at Nancy, and partly in Scotland, he joined the Bengal Forest Department in 1872. On the establishment of the Assam Chief Commissionership, in 1874, he was transferred to that administration and remained there until 1878. During that time he started the Charduar Rubber Plantation (*Ficus elastica*), which was extended to an area of about 1000 acres. Mr. Fisher was thus one of the pioneers of artificial rubber plantations. In 1878 he was specially selected for the appointment of deputy-director of the newly-established School of Forestry at Dehra Dun, and he rose subsequently to become the director of the school and conservator of forests of the school circle.

In the year 1889 he came home on furlough, and in 1890 he joined the staff of the School of Forestry at Coopers Hill College. In the year 1905 he went with that school to Oxford, where he became a member of Brasenose College.

Mr. Fisher has left his mark upon forest science and practice. At Dehra Dun he taught chiefly forest botany, and he brought out a volume on plant physiology. After he joined at Coopers Hill, he taught silviculture, forest protection, and utilisation. He joined Sir W. Schlich in bringing out the latter's "Manual of Forestry," of which he undertook the preparation of vol. iv. on "Forest Protection," and of vol. v., on "Forest Utilisation," now in their second edition. Although these two volumes are adaptations of Hess's work on protection and Gayers's book on utilisation, Fisher's books are more than the original works, since he adapted the material to British and Indian conditions. They may be considered the standard works on the two subjects.

Throughout his life Fisher was an active writer, and it would be difficult even to enumerate the many articles on forestry which he published. He was an active member, and president for two years, of the Royal English Arboricultural Society, and editor of the society's *Journal*. After his arrival at Oxford, he started an arboretum of indigenous and exotic trees on land belonging to Magdalen College.

During his leisure time he advised many British proprietors on the management of their woods, and thus helped forward the question of forestry and afforestation in these islands. He was, in 1907, a member of the Departmental Committee of the Board of Agriculture in Ireland on afforestation, and lately of the committee sitting in London, dealing with agricultural and forestal education in Britain.

Mr. Fisher was a man of very simple character, with a warm heart, and he was universally liked, not only by the students, but also by a large host of friends. He conducted the annual excursion to France, and it was quite touching to see how French

forest officers and subordinates admired and honoured him.

He married, in 1876, Mary, eldest daughter of the late Dr. Briscoe, civil surgeon of Cooch Behar, in Bengal, and leaves one son, a lieutenant in a Ghurka regiment, and two daughters. By his death the Empire loses an enthusiastic forester, who can ill be spared at the present time.

NOTES.

We regret to see the announcement of the death on November 11, at sixty-two years of age, of Prof. Jules Tannery, the distinguished French mathematician.

Councillor Wiehl has just bequeathed, says the *Revue scientifique*, the whole of his fortune, of about a million crowns, to the Bohemian Academy of Sciences at Prague to encourage scientific and technical research.

A short time ago it was suggested that the Eiffel Tower should be used as a station for the daily transmission of time-signals to ocean-going vessels by means of wireless telegraphy. The Paris correspondent of the *Times* reports that this service was inaugurated on November 21 with satisfactory results. In future, time-signals will be sent out twice daily, at 11 a.m. and 12 midnight. Three signals will be made on each occasion at two-minute intervals. The morning transmission will not, however, take place on Sundays and holidays.

The Earl of Stair has accepted the presidency of the Royal Scottish Geographical Society in succession to Prof. James Geikie, F.R.S., who has held the office of president for the last six years. The anniversary meeting of the society was held on November 11, and was addressed by Sir John Murray, K.C.B., F.R.S., who chose for his subject "The Deep Sea." Before the address Prof. Geikie was presented with the society's gold medal in recognition of his distinguished services to geographical science, and Sir John Murray with the Livingstone medal in recognition, not merely of his prolonged and valuable oceanographical research, but also in commemoration of the completion of the great national work "The Bathymetrical Survey of the Fresh-water Lochs of Scotland."

In the interests of precision in scientific diction, a correspondent asks that the familiar expression "thunder and lightning" should be inverted in accordance with the natural sequence of cause and effect, and become "lightning and thunder." He adds:—"I never could grasp how the confusion originated, considering that, in agreement with the transmission of light and sound, the flash is seen before the thunder is heard."

The eighty-fifth Christmas course of experimentally illustrated lectures adapted to a juvenile auditory, to be given at the Royal Institution by Prof. Silvanus P. Thompson, F.R.S., promises to be of exceptional interest. The subject is "Sound, Musical and Non-musical." The dates and subjects of individual lectures are:—1910, December 29, production of sound; December 31, transmission of sound; 1911, January 3, reception of sound; January 5, combination of sounds; January 7, registration of sounds; January 10, reproduction of sound.

At a meeting of the executive committee of the British Science Guild, held on November 16, on the motion of Mr. A. Moseley, C.M.G., it was decided to form a special combined education committee to deal, in the first instance, with education of the governing classes of England. It was resolved to defer the circulation of the synchronisation report until a later date. It was decided to consider further the reduction of the rate of postage on scientific literature. It was also suggested that the annual meeting should in future be held in the month of April, and that the annual dinner should, if convenient, be held on the same day.

We regret to announce the death, at sea, at the age of thirty-one, of Mr. Richard Froude Tucker, Archæological Surveyor of the Northern Circle, India. Mr. Tucker held the post of curator of the Delhi Museum, and the catalogue of the archæological collections deposited there was recently prepared by him in collaboration with Dr. J. Ph. Vogel. Appended to this catalogue is a memoir by Mr. Tucker on the elephant statues at the Delhi Gate of the Delhi Fort. The untimely death of this promising archæologist is a severe loss to antiquarian research in India.

During the summer of this year excavations were carried on, under the superintendence of Dr. Felix Oswald, at the site of the Roman station of Margidunum on the Fosse Way, midway between Leicester and Lincoln. Some local pottery, Samian ware, coins of Victorinus, Carausius, Constans, and Eugenius, dated between 265 and 395 A.D., have been discovered. The main feature of the finds was the relative abundance of iron objects, such as swords, knives, a bolt of a spring-lock, rings, and nails. A skeleton of an old man and three infants was associated with bones of the Celtic ox (*Bos longifrons*) and other domesticated animals. These antiquities have been deposited in the museum at Nottingham Castle, where it is hoped they may form the nucleus of a Romano-British section.

The Rome correspondent of the *Times* announces that a decree was published on November 20 creating a commission to examine the view that pellagra is produced by a protozoal infection conveyed by an insect, and to formulate any changes in the existing law of protection that may be considered desirable. The commission consists of nine members, all doctors with the exception of Prince Teano, deputy, who was chiefly instrumental in directing the attention of the Italian Government to the work of the English Pellagra Investigation Committee. An article upon the investigations made by Dr. Sambon for this committee appeared in Nature of October 27.

On November 12 an extension of the natural history section of the Hull Public Museums was opened by Mr. T. S. Taylor, Mayor of Hull. In the ornithological section of the museum there is an unusually extensive collection of British birds. The extension consists of three large rooms, the largest of which is occupied by a collection of British birds containing more than 900 specimens. In the second room is a collection of local mammals, including the group of otters, badgers, stoats, weasels, and so on. The third room contains a collection of skeletons—animals and birds. The museum is fortunate in having been presented with the collection of birds formed by the late Sir Henry Boynton. This collection consists of about 200 cases containing 450 birds.

Attention has already been directed in Nature to the scheme of the British Empire League for the erection in London of a memorial to Captain Cook. We are glad to notice that the secretaries of the Royal Society have written to Lord Brassey, the honorary treasurer of the fund, expressing, on behalf of the Royal Society, approval of the scheme, and enclosing a subscription of twenty-five guineas from the society. Their letter includes the following paragraph:—"We are instructed to express the gratification of the Royal Society that public opinion has at

length taken form in this direction, to the extent that there is now a prospect of a memorial which shall be not inadequate to the merits and renown of this great explorer. As the circular issued by your committee states, the Royal Society was closely connected with the initiation of these famous voyages, with the selection of Captain Cook to the command, and with the working up and publication of the results of the expeditions. Many of its Fellows, including Sir Joseph Banks, one of Cook's companions in his first voyage, afterwards for many years president of the Royal Society, took a prominent part in that work; and the society still retains in its possession memorials of this connection."

UNDER the heading "Earthquakes in the Pacific," the *Times* of November 17 published a statement by Mr. J. J. Shaw, of West Bromwich, that there was evidence the ocean depths of the Pacific are in a state of great unrest. Mr. Shaw said that his seismograph recorded shocks at 8 a.m. on Monday, November 14, and at midnight and between 2 and 3 p.m. on Tuesday, November 15, all at a great distance. In reply to an inquiry as to these reported disturbances, Prof. Milne has sent us from Shide the following records of earthquakes in October and November:—"Although a few small earthquakes were recorded in October, the month was one of earth rest. During the first two weeks of November seismic activity was somewhat pronounced. The dates on which records were obtained, followed by the times of commencement and maximum movement in hours and minutes, were as follows:—November 6, 19.18 and 21.23; November 9, 6.16 and 7.50 or 8.5; November 14, 7.35 and 8.34; November 14, 19.58 and 20.27; November 15, 0.31 and 10.45, 6.1 and 6.21, 7.42 and 7.46, 9.16 a maximum, and, lastly, 14.35 and 15.21. The second of these was the largest, having an amplitude of 7 mm., which means that tiltings of 2·2″ occurred. The time employed is G.M.T. civil, or midnight=0 or 24h."

AT the first Optical Convention, held in 1905, a permanent committee was appointed, to which was entrusted the task of deciding upon a suitable date for the holding of a second convention, and of taking the necessary steps to initiate it. A general meeting of the committee and of members of the optical industry, representatives of optical bodies and societies, and others interested in optical questions, will be held on Tuesday, November 29, to consider and discuss proposals for the organisation of a second convention. The chair will be taken by Dr. R. T. Glazebrook, C.B., F.R.S., director of the National Physical Laboratory, as chairman of the permanent committee, and all interested are invited to be present at the meeting. The main features of the scheme which the members of the existing executive committee have in view, and the principal questions on which it seems necessary, at this general meeting, specially to invite discussion, are in broad outlines as follows:—(1) an exhibition of optical and allied instruments; (2) the preparation of a catalogue of optical and allied instruments of British manufacture to serve as a convenient work of reference for all users of optical and scientific instruments, not necessarily to be limited to instruments actually exhibited; (3) the holding of meetings for the reading of papers and for discussions and demonstrations on optical subjects; (4) the publication of a volume of Proceedings, in which these papers will be collected together.

WE regret to see the announcement of the death, on November 16, of Dr. J. F. Payne, emeritus librarian to the Royal College of Physicians, and the author of valuable medical works and many other contributions to science. From an obituary notice in the *Times* we learn that Dr. Payne was born on January 10, 1840, and took his degree at Oxford in 1862 with first-class honours in natural science. In 1863 he obtained the Burdett-Coutts scholarship in geology, and in 1865 the Radcliffe travelling scholarship. In accordance with the regulations of the Radcliffe scholarship he went abroad, spending some time in Paris and in Berlin, and proceeding later to Vienna. On his return to this country Dr. Payne was appointed examiner in natural science at Oxford, demonstrator of morbid anatomy and curator of the museum to St. Mary's Hospital. It was about this time that he revised, enlarged, and edited Jones and Sieveking's "Manual of Pathology." In 1871 he went to St. Thomas's Hospital, being appointed lecturer successively in general pathology, materia medica, forensic medicine, and finally on the principles and practice of medicine. About nine years ago he was appointed consulting physician to this hospital. In 1873 Dr. Payne was appointed to deliver the Gulstonian lecture of the Royal College of Physicians, and in later years he gave the Lumleian and the FitzPatrick lectures. In 1879, when the plague was prevalent in Russia, and the college was consulted by the British Government, they appointed Dr. Payne to accompany Surgeon-Major Colvill as commissioners to investigate and report on the disease. He became a Fellow of the Pathological Society in 1869, and was afterwards a councillor, a member of the morbid growth committee, secretary from 1880–2, vice-president from 1888–9, and president in 1897. He was twice president of the Epidemiological Society, choosing for his first inaugural address the subject of "Tuberculosis as an Endemic Disease," and on the second occasion "The History of Epidemiology in England." He was also president of the Dermatological Society, and was vice-president of the Royal Medical and Chirurgical Society in 1906. Dr. Payne was the author of "A Manual of Pathological Anatomy" and "Observations on some Rare Diseases of the Skin," and the life of Thomas Sydenham in the "Masters of Medicine" series.

THE Eugenics Education Society has distributed a special "Poor Law number" of the *Eugenics Review*, which is devoted to the eugenic aspect of Poor Law reform. The number contains a report of a committee of the society appointed to consider the reform of the Poor Law from this particular point of view; reviews by Dr. C. S. Loch and Mr. Sidney Webb, respectively, of the majority and minority reports of the Poor Law Commission; and a most valuable article, by Mr. E. J. Lidbetter, the General Relieving Officer of the Bethnal Green Union, on some examples of Poor Law eugenics. Of the report of the committee, the third section is the most important. Through the kindness of various boards of guardians, the committee has been allowed access to workhouse records, and, where necessary, personal interviews with paupers; three extensive pedigrees of pauperised families are in course of construction, and the most complete of these is now published, the chart being supplemented by a key giving detailed particulars of the cases included. The chart covers five generations, and indicates the intermarriage of five pauper families. Mr. Lidbetter's investigation supplements this report of the committee by some thirteen charts of pedigrees based on his personal investigation. The society and Mr. Lidbetter deserve unreserved commendation for carrying out such researches, which must have required much prolonged and laborious work. It is no reflection on the work if we add that it still remains a most difficult problem to determine, on the

basis of such data, the relative parts played by heredity in the strict sense of the term, continuity of environment, and example. We gather from an accompanying letter that the society finds it impossible, from lack of funds, to proceed with such investigations on any sufficient scale, and urges the formation of a Departmental Committee with power to examine records.

AT the recent conversazione of the Geologists' Association, held at University College, Gower Street, a series of worked flints from the Ipswich district was exhibited. The circumstances in which they were unearthed indicate that they are probably the oldest works of man yet discovered in this country. They are well chipped, deep brown and cream in colour, and several show scratches which may be the glacial striæ imprinted when they formed part of the gravel at the base of a glacier. Technically speaking, they are of pre-Crag age, that is to say, they long precede the Glacial period. Mr. W. Whitaker, F.R.S., who mapped the district for the Geological Survey, is satisfied that they come from undisturbed beds, and that the gravel from which the flints were obtained is of pre-Crag Age. This discovery, if it stands the criticism to which it will certainly be exposed, marks a memorable advance in the prehistoric anthropology of this country.

IN the October issue of *Man* Mr. D. Alexander gives an account of a performance of a Nigerian Punch and Judy show, which in some ways resembles the drama which is familiar to us. A forked stick is thrust into the ground, the performer kneels, and, taking off his black gown, throws it over the stick, the opening for the head of the wearer serving to provide a space for the display and withdrawal of the figures. The conversation between the puppets is carried on, as in the European performance, in a squeaky tone. The place of origin of this play is somewhat uncertain, but there seems to be no doubt that it is an indigenous invention. In the same issue of *Man* Captain A. J. N. Tremearne discusses the system of bull-fighting among the Fulani, a race of cattle breeders in northern Nigeria, who seem to be of Berber origin. In contrast to the conditions of the sport in Spain or Portugal, the Nigerian variety is comparatively tame, no horses being used, the performers being unarmed, and the bulls escaping any kind of injury.

TO the *Irish Naturalist* for November Dr. Scharff communicates an article on the whale-fishery which has been carried on by Norwegians during the last three years at Inishkea, and for a rather shorter period at Ely Point, on the Mayo coast. At the former station 124 whales have been taken during the last two seasons, most of these being rorquals, although five black right-whales, of an estimated value of between 1500*l.* and 3000*l.*, were captured in 1908. A single blade of the whalebone of this species is worth about two guineas, and the total yield of this substance may be as much as a quarter of a ton, with a value of about 400*l.*

IN a pamphlet on the distribution and migration of North American shore-birds, issued by the U.S. Department of Agriculture as Bulletin No. 35, Mr. W. W. Cooke emphasises the economic importance of this group. For many years the abundance of larger birds, such as swans, geese, and ducks, caused the waders to be neglected, but with the killing off of the former gunners directed their attention to the latter, which now stand in need of immediate protection. In addition to their value as food, the plovers and some others do valuable service as destroyers of noxious insects, while all the members of the group are of special interest from an æsthetic point of view. Details of the distribution and migrations of the various species form the bulk of the pamphlet.

IN the October issue of the *Irish Naturalist* Mr. A. Williams directs attention to the presence of sanderlings during the last three years on the shores of Dublin Bay throughout July, a month when these birds are generally supposed to be residing in the far north for the purpose of breeding. These July birds are evidently non-breeders—either old or barren—but it has yet to be determined whether they remained in Ireland when the bulk of their kind winged their way northwards, or whether they were the first of the main body to return south. During their sojourn in Ireland these non-breeders undergo a considerable change in plumage. "They have been found with the red colouring entirely absent, and also the soft grey margins of the feathers, which conceal the nuptial plumage in spring, completely worn away, and in some instances the ruddy coloration faded out, causing the birds to present a totally changed and misleading appearance."

THE Manchester Museum is one of the most flourishing of the provincial museums in this country, and its report for the year 1909–10 is good evidence that there has been no falling off in its usefulness and no disposition to interfere with its healthy and regular growth. During the year Mr. W. M. Tattersall has succeeded Dr. Hoyle as keeper of the museum. The number of additions to the collections has been large in every department, and the library has been considerably strengthened during the year.

THE first issue of the *Naturalist*, the journal of the Natal Scientific Society, has been received. We understand that this scientific periodical is the only one of its kind published in South Africa. It is edited by Mr. R. Denley James, and, in addition to containing the society's transactions and proceedings, includes several articles. Among the latter may be mentioned notes on the life-history of the Pseudacræa by Mr. A. D. Millar, and a short note on the Ixodidæ by the editor. The syllabus of work which the society hopes to accomplish during the present session shows that most branches of science are to receive attention, and that already the society has received gratifying support.

THE decay of building stones was discussed by Dr. Tempest Anderson at the recent Museum Conference at York, and his address is published in the October number of the *Museums Journal*. After showing that stone-decay is not due to wind action, the opinion is expressed that "it is not a surface action at all, but, I believe, a decay or rot affecting the substance of the stone, and, like other decays and rots, is in every probability caused by the action of some low organism, like the moulds and fungi which rot wood, canvas, and other vegetable materials. About two years ago, to test this view and endeavour to find a cure, as all efforts based on the abrasion or chemical theories had failed, I had affected stones treated with various germicides, and the stones which have since best resisted the decay were those treated with sulphate of copper (5 per cent. solution), bichloride of mercury, and creosote."

THE specimens of beaked whales (Ziphiidæ) in the collection of the United States National Museum form the subject of a profusely illustrated monograph, by Mr. F. W. True, published by the Smithsonian Institute as Bulletin No. 73. On account of the rarity of these cetaceans—exclusive, of course, of the bottle-nosed whale—the memoir

has an exceptional value to the students of the group, more particularly since the U.S. National Museum possesses, so far as the author could ascertain, about one-fourth of the whole available material. Of the genera Mesoplodon, Ziphius, and Berardius, Mr. True could find records of only about one hundred specimens in collections, of which more than half belong to the first genus, Berardius being known only by about fourteen examples. The most important addition to our knowledge of the group in recent years was the discovery of representatives of all three genera at Bering Island by Dr. Stejneger, two of these being regarded as distinct species, one of which was named in 1883 and the other in 1885. About six years ago it was ascertained that the range of the Bering Sea forms extends to the eastern North Pacific. After a descriptive catalogue of the specimens in the Washington Museum, with notices of some examples in other American collections, the author concludes his memoir with a list of the recognisable existing species of the group. Inclusive of the two representatives of Hyperoödon, this list embraces thirteen species.

THE November number of the *Quarterly Journal of Microscopical Science* (vol. lv., part iv.) contains a very interesting paper by Miss Muriel Robertson and Prof. E. A. Minchin on the division of the collar-cells of the calcareous sponge *Clathrina coriacea*. It appears that these cells multiply by longitudinal fission, the division of the nucleus being accompanied by a typical mitosis. The chief interest attaches to the behaviour of the "blepharoplast" in this process. In the resting cell this organ appears as a "basal granule" in connection with the flagellum; in mitosis it behaves as a typical "centrosome," dividing into two parts, which cave to lie at opposite poles of the nuclear spindle. Each of these daughter centrosomes becomes the blepharoplast of one of the daughter cells, and a new flagellum grows out from it. Around each new flagellum a new collar develops, the old collar and flagellum of the mother cell completely disappearing. The authors discuss the bearing of these facts upon the vexed question of the interpretation of the "kinetonucleus" in trypanosomes, and conclude that the latter is a true nuclear body, and not a blepharoplast or centrosome.

THE destruction of agricultural plant pests by chemical means is reviewed by Mr. H. C. Long in *Knowledge* (November). The practice is based on direct experiment, as plants differ considerably in their resistance to chemical solutions; thus charlock and dandelions are readily attacked by a copper sulphate solution, while *Cnicus arvensis* and clover are much more resistant. According to Bolley, shepherd's purse, *Camellina sativa*, chickweed, corn-cockle, bindweed, and plantain are all amenable to chemical treatment, whereas sow-thistle, *Bromus secalinus*, wild oats, and couch grass cannot be effectively controlled. The author directs attention to the desirability of carrying out systematised experiments in different parts of the country.

AN account of the Arnold Arboretum, well known by name to British botanists, is contributed by Mr. W. J. Bean to the *Kew Bulletin* (No. 8). Situated in a suburb of Boston, U.S.A., and extending over 200 acres, it is noted for the large collection of trees and shrubs in which north-east American and north Asiatic species predominate. A marked feature in the arboretum is the ground cover of shrubs in place of grass around the trees; various species of Vaccinium, Aster, Rubus, and other native shrubs are grown in this way. Mr. Bean pays a warm tribute to the energetic director, Prof. C. S. Sargent, for the excellent work that is being carried on; one of his greatest tasks has been the elucidation of North American species of Cratægus, of which specimens from type plants occupy 15 acres. A monumental work was provided by the "Silva of North America," in fourteen volumes, and another massive publication that will shortly appear is a bibliography of trees and shrubs of the world. Incidentally, the *Bulletin* contains evidence of cordial cooperation between Prof. Sargent and Kew in the publication of a list of new species of Impatiens from China, forwarded to Sir Joseph Hooker by Prof. Sargent for description.

THE report of the chief inspector of mines of the native State of Mysore for the year 1908 has just been issued, and affords satisfactory evidence that mining operations are being conducted here with energy and skill as well as with due attention to the safety of those engaged in the work. A small amount of manganese and chrome ore is being raised, but the principal mining operations are, as heretofore, confined to the Kolar goldfield. The report shows that there were ten companies at work, of which seven were producing gold, the value of the bullion produced being just over 2,000,000*l*. sterling, or almost exactly the same as in the previous year. The quartz raised contains gold to the value of just about 3*l*. per ton, the working costs amounting to about one-half of this figure. Elaborate tables are attached to the report, those relating to accidents being especially interesting. The accident death-rate is given as 4·70 per 1000 persons employed below ground, a figure which, though necessarily varying a good deal from year to year, shows upon the whole a downward tendency. A comparison with the similar figure for the Transvaal goldfields is decidedly in favour of the Kolar field, although in the Transvaal the accident death-rate per 100,000 tons of quartz treated is less than in Mysore, due to the greater efficiency of the Kaffir as compared to the Indian miner. In the Mysore there are about 4000 persons employed for each ton of quartz crushed, as against about 1000 in the Transvaal. A good deal of space in the report is devoted to a discussion of the "air-blasts and quakes," or violent bumps of ground, due apparently to the sudden relief of the strains in the ground as mining proceeds. These bumps have caused a good many serious accidents, and up to the present no means of preventing them has yet been suggested. It is to be hoped that a further study of this intricate question may lead at any rate to a determination of the conditions under which they are likely to occur, this being the first step towards taking measures to minimise the dangers resulting from them.

ON assuming his extraordinary professorship at the National University at Utrecht, Dr. E. van Everdingen delivered an interesting address, on October 17, upon "The Third Dimension in Meteorology." The establishment of a separate chair for meteorology was, he thought, an admission that it was now considered worthy of taking a place among the older sciences. If we inquired in what direction it had developed in the last twenty years, the answer undoubtedly was, in the third dimension: height. After glancing at the history of meteorology from the earliest times, he referred to the great importance of Buys Ballot's work in investigating simultaneous weather conditions and in formulating his law of the relation of wind to air-pressure, which is still the corner-stone of practical meteorology, and had infused new life into the subject. He discussed in considerable detail the various methods employed, and the valuable results obtained in the investigation of the upper air by (1) manned balloons; (2) kites; (3) captive balloons; (4) registering balloons (with instru-

ments); and (5) pilot balloons (without instruments). The use of Assmann's aspirating-psychrometer in manned balloons, and his employment of rubber both in registering and pilot balloons in lieu of paper, have proved of the greatest value. The author shows that much new light has been thrown upon questions relating to the general circulation of the atmosphere by the important discovery of the inversions of temperature at great heights and the existence of the isothermal layer, not only in our latitudes, but also in polar and tropical regions. At moderate heights these inversions play an active part in thunderstorm phenomena.

THE October number of *Himmel und Erde* contains an account of a popular lecture on the present position of wireless telegraphy, delivered six months ago by Dr. Karl Strecker, of the Imperial Post Office, Berlin. The account is well illustrated by diagrams, and is one of the best popular introductions to the subject we have seen. The author commences with the up-and-down oscillations of a weight supported by a spring, and the property such an arrangement has of setting in oscillation a similar arrangement suspended from the same beam as the first. By simple steps he passes to the oscillations of electricity in two conducting rods separated by a spark-gap, and to the way in which a duplicate apparatus at a distance will pick up the oscillations. The defects of the earlier apparatus are explained, and it is shown how in succession the means of detection of the oscillations and the means of producing them have been improved by the introduction of the coherer and by the utilisation of the oscillations produced by a cooled electric arc. Even the problem of privacy is not overlooked, and it seems the author considers rapid and prearranged changes of frequency of the oscillations as the future solution of the difficulty.

THE discovery by Messrs. Cotton and Mouton three years ago that a liquid may be rendered double refracting by the action of a magnetic field redirected attention to the Kerr effect, and as a result we now have theories which attempt to explain both effects. Prof. Voigt in his "Magneto- und Elektro-Optik" traces them to a direct effect of the electric or magnetic field on the electromagnetic oscillations which constitute light, while Prof. L. Natanson, in the June number of the Bulletin of the Academy of Sciences of Cracow, treats them as due to the directive action of the field on the electrons oscillating within the molecules. In the September number of *Le Radium* Prof. Langevin extends his theory of magnetisation so as to cover the two effects. According to him, the molecules of the liquid have axes along which the polarisation is an electric, and the magnetic moment in a magnetic field have values which differ from those in directions at right angles. Æolopropy of the molecule once secured, either on Prof. Natanson's or Prof. Langevin's theory, the investigation of the effects proceed along lines similar to those of Dr. T. H. Havelock's Royal Society paper of 1907, and leads to results in agreement with observation—that the amount of the double refraction is proportional to the square of the field, and the dispersion is expressed by Cauchy's formula.

AN interesting paper on the development of road locomotion in recent years was read by Mr. L. A. Legros at the Institution of Mechanical Engineers on Friday, November 18. It is difficult to realise the enormous increase in the use of the cycle both for pleasure and business purposes. It is estimated that about one person in every fifteen of the entire population of the United Kingdom is a cyclist. Post Office cycles cover a distance of 10,000 miles per annum per machine. The total number in use for postal purposes is 11,400. It is noteworthy that in the total mileage which has been run since the service was instituted, viz. about 600,000,000 miles, no fatal accident has occurred by the failure of any portion of a bicycle. The author estimates that the various public service horsed vehicles in London will become extinct as follows:—the horse-tramcar at the end of 1912; the horse-omnibus at the end of 1913; the hansom cab at the end of 1913; the four-wheel horse-cab before the end of 1921. The paper contains many useful suggestions regarding the management of traffic in London streets.

AN illustrated article on the removing of the wreck of the Quebec Bridge appears in the *Engineer* for November 18. The contract for clearing the site was awarded last December to Messrs. Charles Koenig and Co., of Quebec, and about half the quantity, viz. 5000 tons, has now been removed. A large amount of cutting has had to be done, and the choice of either dynamite or oxyacetylene for cutting a member is governed very largely by local conditions. Where the latter method has been used to greatest advantage has been in cutting up the heavy chords and posts into pieces that could be handled by the derricks, which have a capacity of not more than 10 tons. One web, 4 feet 6 inches deep, with a section of 190 square inches, was cut in 20½ minutes with a consumption of 112 cubic feet of gas. In cutting eyebars it was found that with a stream of pure oxygen gas one square inch of metal could be cut, on an average, in 5⅝ seconds, with a consumption of 0·4 cubic foot of gas, at a cost of 1·2 cents for the oxygen gas. Since the beginning of operations some 50,000 cubic feet of gas have been consumed, or an average of 10 cubic feet per ton of material removed.

MESSRS. SCHOTT AND GEN, of Jena, have sent us a copy of a well-illustrated catalogue of the new Jena glass laboratory requisites they are now in a position to supply. Extracts are published in the catalogue from a report from the Imperial Physico-Technical Institute, Charlottenburg, made after subjecting the new ware to various tests, and they indicate that these requisites, in comparison with older Jena glasses, have an increased power of resistance to sudden changes of temperature combined with a reduction of the amount of alkali given off into aqueous fluids.

OUR ASTRONOMICAL COLUMN.

THE TOTAL ECLIPSE OF THE MOON, NOVEMBER 16.—Not for many years have the conditions for observing a total eclipse of the moon been so generally favourable as they were on November 16. Reports from all over the country show how generally they were taken advantage of and appreciated, although, of course, no details of special scientific interest are yet published. Several meteors were observed before and during the eclipse, Mr. E. A. Martin having observed one at 6h. 55m. p.m. from South Norwood. Its path was from north-west to south-east, its colour reddish-yellow, and it was especially noticeable by reason of its extremely leisurely movement. Two faint meteors travelling in the same direction were seen from Gunnersbury during the eclipse. Madam de Robeck, writing from Naas, Ireland, states that the eclipse was a beautiful spectacle, and that she saw three meteors. One of these was a fine specimen, which travelled in a south-westerly direction from an apparent radiant just below the eclipsed moon. The penumbral shadow was barely discernible until after 10 p.m., when the relative darkening of the south-east limb could be detected. A slight flattening of the limb appeared to take place some minutes before the actual shadow could be seen on the disc, and throughout the eclipse the various prominent

lunar features were readily distinguishable through the deep copper-coloured shade. During totality the relative brightness of the limb was also noticeable, a thin ring appearing to encircle the darkened disc. The beauty of the phenomenon was considerably increased by the apparition of previously unseen stars, notably the Pleiades, when the extreme brightness of the moon was reduced. It is gratifying to notice that the new 8-inch equatorial of the Birmingham University Observatory was employed by Mr. Fournier in taking some fifteen photographs of the eclipsed moon during the various phases of the eclipse; exposures of from one to thirty seconds were given.

CERULLI'S COMET, 1910*e*.—Numerous observations of the comet discovered by Dr. Cerulli on November 9 appear in the supplement to No. 4454 of the *Astronomische Nachrichten*. As seen by Prof. Hartwig at Bamberg on November 11 the comet was of the tenth magnitude, round, 2′ diameter, and had a faint condensation.

From observations made on November 9, 10, and 11, Dr. Ebell has calculated a set of elements and an ephemeris, and from the former it appears that perihelion passage took place on September 15; at present the comet is about 95 million miles from the earth, and is receding at the rate of 720,000 miles daily. Apparently it is travelling nearly due south through the southern limits of Taurus, as shown by the following extract from the ephemeris:—

Ephemeris 12h. M.T. Berlin.

1910	α (true) h. m.	δ (true) ° ′	1910	α (true) h. m.	δ (true) ° ′
Nov. 23	3 37·3	+5 37·4	Dec. 1	3 36·9	+4 24·5
,, 27	3 37·0	+4 58·0	,, 5	3 36·9	+3 57·3

SELENIUM PHOTOMETRY OF STARS.—A paper of more than usual interest, in which the author discusses at length his measures of Algol, made with his selenium photometer, is contributed by Dr. Joel Stebbins to No. 3, vol. xxxii., of the *Astrophysical Journal*. The photometer was attached to a 12-inch refractor, and was kept at a uniform temperature of 0° C. or lower; the galvanometer current was kept working continuously, and between each ten seconds' exposure to a star the cell was rested for about a minute in order to recover; α and δ Persei were used as comparisons.

Under these necessary conditions very careful observations were made, and Dr. Stebbins considers that the results show the method to be capable of greater accuracy than is attained in visual observations. Among many interesting results accruing from the work, the following call for special mention. The companion gives more light than the sun, and is much brighter on the side turned towards Algol. A secondary minimum, some thirty-five hours after the principal minimum, was detected, the variation being only 0·06 magnitude. The discussion indicates that the radius of the companion is 1·14 that of Algol, while the limiting densities are 0·12 and 0·18 of the sun's density respectively. The total period comes out as 68·816h., and the duration of the eclipse as 9·8h. The greater luminosity of the one side of the companion, which appears to rotate and revolve in the same time, may be accounted for by supposing that it is intensely heated by radiations from the primary; this is in general agreement with Dr. Nordmann's suggestion that the temperature of Algol, as measured by his method, is great enough to raise the surface of the satellite to incandescence. Taking the parallax of the system as +0·07″ and the sun's magnitude as −26·6, the total light of Algol is 26; the total light of the faint hemisphere of companion is 1·7, and of the bright side 3·0; this would give stellar magnitudes of 2·2, 5·2, and 4·6 respectively. But if Kapteyn's adopted value for the parallax, +0·029″, and his magnitude of the sun, −26·1, be employed, these brightnesses become, respectively, 240, 16, and 28 times that of the sun.

Many other points, such as the density, magnitude, and form of the system of Algol, are also discussed in Dr. Stebbins's paper.

THE SECULAR ACCELERATION OF THE MOON'S MEAN MOTION.—In No. 4454 of the *Astronomische Nachrichten* Dr. Robert Bryant advances the tentative suggestion that the secular acceleration of the moon's mean motion may be due to the accretion of "dust" from interplanetary space by the moon and the earth. He finds that a deposit of 2 mm. of "dust" per century on the lunar surface would, if the density of the "dust" were equal to the mean density of the moon, account for about 6″ per century in the moon's longitude; a deposit on the earth would also be reflected in the longitude of the satellite.

It is also suggested that uniform distribution of the "dust" is improbable, hence irregularities would accrue. If the earth does collect sufficient "dust" in this way, its rotation period would be affected irregularly, and astronomy of precision would obviously be confronted by a serious difficulty.

PHOTOGRAPHIC MAGNITUDES OF SEVENTY-ONE PLEIADES STARS.—From the extra-focal images impressed upon thirteen plates taken early in March last, Herr Adolf Hnatek has determined the photographic magnitudes of seventy-one stars in the Pleiades group, and now publishes the results in No. 4449 of the *Astronomische Nachrichten*. The photographs were taken with the 14-inch photographic refractor of the Vienna Observatory, 10 mm. inside the focus, and the author publishes an interesting discussion of the results and the method whereby they were derived; an especially interesting point discussed is the effect on the apparent magnitude caused by the distance from the centre of the plate.

ELEMENTS AND NUMBERS OF RECENTLY DISCOVERED MINOR PLANETS.—Prof. Neugebauer publishes, in No. 4454 of the *Astronomische Nachrichten* the elements and permanent numbers of eighteen minor planets discovered during 1909; the last number allotted is 691, so that the total number of discoveries must, by now, be well above 700.

A NEW THEORY OF THE DESCENT OF MAN.[1]

THE first of the memoirs referred to below relates to the discovery of a new Palæolithic skeleton, and contains a careful report by Hauser on the excavation, along with a critical description of the skeleton and a comparison of the same with other known types, more especially with the Neanderthal man, from the pen of Prof. Klaatsch.

The conclusion arrived at is that the Neanderthal man and the Aurignac man represent two entirely different types of mankind.

According to Hauser's report, the skeleton of the Aurignac man was found early in 1909, at the Palæolithic site of Combe-Capelle, not far from Montferrand (Perigord), at a depth of 1·54 m. in a typical Aurignacian stratum, as was clearly proved by the artefacts found with the skeleton. The skeleton lay under a rock shelter, and was almost complete, the only imperfections being due to the displacement of certain parts by overturned masses of rock. As to the position of the body, the knees were strongly bent and drawn towards the head; the feet were also drawn together in a way which suggested a squatting position. After the whole skeleton had been removed, it was evident that the ground had been artificially prepared for the burial of the dead. There were found in the grave, typical Aurignacian artefacts of beautiful form, and perforated specimens of *Nassa reticulata*, a small marine snail, these articles being evidently intended for grave finery. The mode of burial showed the high state of culture of the Aurignac man.

A glance at diagrams of the Neanderthal and Aurignac skulls is sufficient to show the smaller breadth and more considerable height of the latter as compared with the former. Klaatsch directs attention to the stronger arching of the forehead of the Aurignac man, the greater bregma angle and calottic height, both according to Schwalbe's system as well as his own; the calottic height measurement of the Neanderthal skull is 40·4, while that

[1] H. Klaatsch und O. Hauser, "Homo aurignacensis Hauseri, ein palæolithischer Skelettfund aus dem unteren Aurignacien der Station Combecapelle bei Montferrand (Périgord)." *Praehistorische Zeitschrift*, 1910, Heft 3-4, pp. 273-338, Tafel xxv-xxxv und drei Beilagen. (Berlin, 1910.)
H. Klaatsch, "Die Aurignac-Rasse und ihre Stellung im Stammbaum der Menschheit." *Zeitschrift für Ethnologie*, Jahrgang, 1910, Heft 3-4, pp. 513-577, Mit Tafel ii-iv und 46 Figuren im Text. (Berlin, 1910.)

of the Aurignac skull is 54·45. The excessive prominence of the Neanderthal skull in the frontal region is absent in the Aurignac skull, in which there is no development of an undivided torus supraorbitalis. Corresponding differences between the Aurignac and the Neanderthal skulls are found in the posterior region. The marked separation of the torus occipitalis transversus into a right and left half, which characterises the Neanderthal skull, is completely wanting in the Aurignac skull, of which the posterior region exhibits a quite remarkable conical extension. The place corresponding to the transverse inion prominence of the Neanderthal type is occupied by a sharp transverse ridge. The region of the planum nuchale lying below this shows a slightly hollowed surface.

In adults of primitive types of men, the sinus transversus does not coincide with the linea nuchae superior, as in modern Europeans. This condition is found both in the Neanderthal and in the Aurignac skull; it is, however, not to be regarded as evidence of an affinity between these two races, but merely as a character preserved from a common primitive condition.

In the temporal bone there is, in the case of the Aurignac man, a considerable protuberance of the conical-shaped mastoid, which contrasts strongly with the broad, low mastoid of the Neanderthal skull.

The cavity for the origin of the posterior belly of the digastric muscle is, in the case of the Neanderthal skulls (Spy, Moustier), wide and flat, and makes its appearance behind the mastoid. In the Aurignac skull the digastric groove is narrow and slight.

The tympanicum is, in the Aurignac skull, of remarkable delicacy, but is of considerable thickness both in the Moustier and Spy remains (Neanderthal type).

The formation of the facial bones also shows quite fundamental differences in the two types.

A fuller discussion of the anatomical details of the skeletons is outside the scope of a short article, and for this the reader is referred, especially as regards the anatomy of the extremities, to the original memoir.

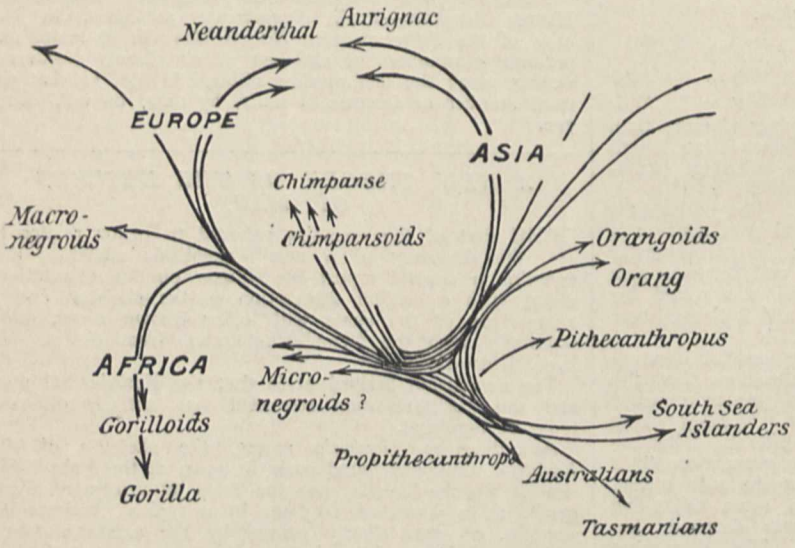
The second memoir lays claim to the widest interest, especially as regards its conclusions about the general biology of man, and promises to open up new paths for the study of the morphological details of the skeletons of the primates. A series of special morphological results leads to the discovery of a parallel between the differences of the Aurignac and Neanderthal men, and the differences of the gorilla and orang-utan.

These considerations demand especially a rigid separation of accidental convergence phenomena from such characteristics of morphological details which must have been conserved by heredity alone, since they have no demonstrable connection with functional adaptations.

The external resemblance of the orang, of the gorilla, and of man in the sagittal and occipital crests is a convergence phenomenon. It is to be regarded as such because it is essentially a superficial resemblance, and exhibits great differences in its mode of origin. For example, the temporal muscles have left their imprint on quite different parts of the sides of the skull, from which it is to be inferred that before the beginning of this process the two skull forms were undoubtedly different, the orang having a higher forehead and a smaller supraorbital prominence than the gorilla.

On the other hand, Klaatsch finds in the ratio of the longitudinal and transverse diameters of the head of the humerus a morphological character which is important for the determination of affinities. We can here select only a few of the numerous details which serve as vouchers for the affinity between the orang and the Aurignac man on one hand, and between the gorilla and the Neanderthal man on the other.

The spina tuberculi majoris and the sulcus intertubercularis of the humerus in the case of Aurignac man and the orang run almost straight down, while in the case of Neanderthal man and the gorilla they both describe a medial convex curve. The peculiar rough insertion of the pectoral muscle is common to the Neanderthal and the gorilla. On the tibia, the relief of the posterior surface of the malleolus—the grooves for the flexor muscles—is deeper in the case of the orang than in the case of the gorilla; the same distinction holds between the Aurignac and the Neanderthal. On the femur, the trochanter minor in the case of the Neanderthal and gorilla is further down the shaft, and projects more inwards, while in the case of the Aurignac and the orang it projects backwards. The Aurignac-orang type exhibits also in the distal part a distinctly projecting, obliquely descending, crista intertrochanterica; in the Neanderthal-gorilla type there occurs that weakening of the ridge above the trochanter minor to which Klaatsch has already directed attention in the Neanderthal femur.



The shaft of the Aurignac femur is remarkable for its extraordinary straightness, and we find the same character in general with the orang. In contradistinction to this is the forward convex bend of the Neanderthal and gorilla femurs.

Klaatsch supports his theory by many more morphological details. Of special interest are the congruence phenomena which are shown by the curve diagrams of the tibia to exist between Aurignac and the orang and the gorilla and Neanderthal, as well as the similarity of the shaft proportions of the tibia of Spy and the gorilla.

All these details show that there exists an affinity in important morphological details between the Aurignac man and the orang-utan and between the Neanderthal man and the gorilla, and that this does not rest only on the general impression produced by the graceful and slender appearance of many of the parts of the orang and Aurignac as contrasted with the rough and thick-set build of the gorilla and Neanderthal.

These considerations unfold to us promising views of the coming problems of anthropology, and throw new light on our present conceptions of the phylogeny of the human race. From a study of the osteological details we are driven to the conclusion that at a very early epoch there branched off from the primeval common mass of our forerunners—Propithecanthropi, as Klaatsch calls them—a great western stream and a great eastern stream. Inside each of these groups new segregations occurred which led partly to the formation of races of anthropoid apes and partly to the formation of races of men.

The anthropoid apes are to be regarded as representing the unsuccessful attempts and dashes forward towards the goal of the definite creation of the human race—submerged branches of the primeval humanity which, in adapting themselves to special conditions of life, were

compelled in the struggle for existence to sacrifice important parts of their organisation, while a more favoured collateral branch, in quiet progressive evolution, developed into a human race.

By a new kind of diagram Klaatsch endeavours to elucidate the distribution of the human races and the anthropoid apes. The femur of Pithecanthropus fixes its position in the neighbourhood of the eastern group. The chimpanse is in many respects further removed from the gorilla than from the Neanderthal man. The African races exhibit some affinities with the Neanderthal type. As to the eastern people, the similarities between the skulls of young orangs and the skulls of Javanese, which impressed certain authors, require further investigation.

With the help of his new theory, Klaatsch promises us a new interpretation of single pieces of the diluvial find of Krapina, some of these apparently belonging to the Aurignac type and others the Neanderthal type.

Of all earlier finds, the skeletal remains from Galley Hill, Kent, have the greatest affinity with the Aurignac man. Less certain are the affinities of the skull from Engis. A new comparison of the other diluvial and early prehistoric finds from the point of view of the new theory appears to be highly desirable.

RICHARD N. WEGNER.

MINERAL PRODUCTION OF INDIA.[1]

THIS quinquennial review of the mineral output of India is probably the last official publication of Sir Thomas Holland in his capacity as Director of the Geological Survey of India, and it is especially appropriate that this should be so, seeing not only that he originated this most useful form of publishing the records of Indian mineral production, but that he has been the first of all the directors of the Survey to recognise that the chief duty of this survey is to assist and encourage the development of the mineral resources of the country. It is an undoubted fact, to which the present report bears eloquent witness, that the mineral production of India increased during Sir Thomas Holland's directorship at a rate with which no previous similar period of Indian history can show any comparison.

A glance at the records before us shows that the last five years have continued the energetic development of the mineral resources of the peninsula; as pointed out by the authors, it is practically impossible to set up any unexceptional standard of valuation, so that accurate comparisons cannot well be looked for; yet, even allowing for this fact, an increase in the estimated value of the output from 3,455,565*l.* in 1898 to 5,047,201*l.* in 1903, and from this figure, again, to 7,880,832*l.* in 1908, is a clear proof of a steady rise in the exploitation of these important resources of our Indian Empire. Of the total value thus assigned to the production, about two-thirds are made up of two items, gold and coal, the latter being now by far the more important; in 1903 the value of the gold was nearly twice that assigned to the coal, whereas in 1908 the latter figure was about 50 per cent. greater than the former. The gold output has, in fact, remained just about stationary during the period under review, the great bulk of it coming, as hitherto, from the Mysore mines.

The important increase in the coal production is perhaps one of the most satisfactory features indicated in this report; from 1½ million tons in 1884, the output rose steadily to 8½ millions in 1905, and then more rapidly to nearly 13 millions in 1908. About 90 per cent. of the entire output comes from Bengal, and about 50 per cent. from a single coalfield, namely, Jherria, which is now the leading coalfield, having gone ahead of Raniganj since 1906. A very interesting statement is here published concerning the geological age of these Bengal coalfields; they occur in the Damuda series of the Gondwana system, which has always been looked upon as of Mesozoic age, the Lower Gondwanas being classed as probably of Triassic and the Upper Gondwanas as probably of Jurassic age, thus making the coal-bearing formations much younger than those of Europe. On palæontological evidence, it is now possible to assert that the Lower Gondwanas are Palæozoic, and "certainly not younger than the Upper Carboniferous. Thus the Indian Coal-measures are not much younger than, and may even be of the same age as, those of Europe."

The only other point of especial importance is, in contradistinction to the first one, a purely economic one, namely, the fact that within the period under review the first battery of bye-product coke ovens has been erected on an Indian coalfield, namely, at Giridih.

During the five years to which this report refers the number of persons engaged in coal-mining has increased from 92,740 to 129,173, the numbers of those at work underground being respectively 64,969 and 83,164. The output has thus risen more rapidly than the number of persons employed, showing an increase in efficiency in the workers. The output per person employed has risen from 88·6 tons in 1904 to 98·8 tons in 1908, and per worker underground from 126·4 tons in 1904 to 153·5 tons in 1908. The efficiency of the Indian worker is thus approximately one-third of that of the worker in the United Kingdom; as is correctly pointed out in the report, this figure does not properly represent the ratio of labour efficiency, because in India a great deal of work is done by hand which in the United Kingdom is done by machinery, simply on account of the cheapness and abundance of labour in the peninsula. The death-rate from accidents has shown a marked tendency to increase during the last five years, but it is not possible to say whether this fact is due to the increasing depth of the mines or to accidental circumstances; its average over the five years 1904–8 is 0·98 per 1000 persons employed, or 10·2 per 1,000,000 tons of coal raised; the corresponding figures for the United Kingdom in 1906 were 1·29 and 4·37 respectively.

Another mineral that now bulks largely in the mineral production of India is manganese ore, the output of which shows a very marked increase, namely, from 150,190 tons in 1904 to 674,315 tons in 1908. The output in this latter year was about 228,000 tons less than that of the previous year, the falling off being due to market conditions, and in no wise indicating that the productive capacity has reached its zenith and is commencing to decline; on the contrary, it may be confidently anticipated that the general expansion above indicated will continue. The interesting economic question is raised whether it would not be preferable to smelt a considerable proportion of this ore on the spot, and thus export ferro-manganese instead of manganese ore; seeing that about one-fourth of the selling price of the ore represents the cost of freight, it is obvious that the possibility exists of effecting a very considerable saving, and the question should well merit investigation at the hands of the producers of manganese ore.

India is of great importance as a producer of mica, the Indian output being well over one-half of the world's total production. Here again a great increase is to be noted, namely, from 22,164 cwt. in 1904 to 53,543 cwt. in 1908.

The production of petroleum, still almost entirely from Burma, has also shown an increase, namely, from 118,491,382 gallons in 1904 to 176,646,320 gallons in 1908; even this latter figure is insufficient to supply the needs of the country, which imported about 70 million gallons in 1908.

It may be fairly said that the above comprise the mineral products of most importance; there are, of course, numerous others, and in most cases these show a marked increase in output. It is gratifying to find that the exertions of a scientific institution like the Geological Survey are having such a beneficial effect upon the economic development of the peninsula; and whilst congratulating Sir Thomas Holland upon the success in this direction that has attended his tenure of the directorship of the Geological Survey, we may express the hope that this expansion of the material interests of the country will continue to be the first care of his successors, with the same gratifying results.

H. LOUIS.

1 "Quinquennial Review of the Mineral Production of India during the Years 1904 to 1908." By Sir Thomas H. Holland, K.C.I.E., F.R.S., and Dr. L. Leigh Fermor. Records of the Geological Survey of India, vol. xxxix. Pp. 280+8 plates. (Calcutta: Geological Survey; London: Kegan Paul and Co., Ltd., 1910.) Price 2 rupees.

SCIENCE AND ENGINEERING.

AT a meeting of the Junior Institution of Engineers on November 15, Sir J. J. Thomson, F.R.S., president of the association, delivered an address on the relations between pure science and engineering. The distinction between them, he said, is one of aim, not of method. The methods employed by the physicist and the qualities of mind called into play in his investigations are to a large extent the same as those used by the engineer in the higher branches of engineering. It is not the business of the physicist in his researches to concern himself at all with utility. Almost every advance in pure physics has been turned to account by the engineer, the manufacturer, or the doctor. But nothing would be more disastrous to the progress of engineering than that the workers in pure science should hamper themselves by considerations as to the utility of their work, or confine their attention to points which have an obvious practical application.

The province of engineering is to survey the facts known to science, and to select those which seem to have in them the possibilities of industrial application, and then to study and develop them from this point of view. This can often best be done in laboratories attached to works engaged in active trade. The success of works' laboratories in Germany and the United States, and to a growing extent in this country, is one of the most striking features in modern industrial development. A closer connection with pure science would be of the greatest service to engineering and commerce in this country, and though strides have been made in this direction in recent years, Sir J. J. Thomson pointed out we are still behind Germany in the importance we attach to pure science and in the eagerness with which new discoveries are applied to industrial purposes. As an instance, to judge from the number of "Thermos flasks" met with, the manufacture of these flasks must constitute a large and profitable business. It is said, however, that none of these flasks is made in England. Yet the Thermos flask is an English invention, being nothing but what is known to physicists as the "Dewar vessel," which was invented by Sir James Dewar for the purpose of storing liquid air without evaporation, and was described by him some years ago. Although the discovery was made and first published in England, no English manufacturer took it up, but left it to foreign rivals to make it the basis of an important trade.

It is, he continued, the object of applied science to keep theory and practice at the same level. Theory and practice do better work when they are driven abreast rather than in tandem. The more intimate the relation between the workers in pure science and those engaged in the application of science, the greater will be the opportunities of deepening the faith in science of the practical man. Faith in the results of pure science is more robust in Germany and the United States than in this country; here we cultivate more exclusively things which ripen quickly and yield an immediate return upon the capital invested, and are inclined to turn aside from projects which, though more profitable in the long run, will, so to speak, take a long time before they come into bearing.

ZOOLOGY IN THE INDIAN EMPIRE.

TO the September number of *Spolia Zeylanica* Prof. Punnett contributes an important paper, illustrated by two double coloured plates, on mimicry in Ceylon butterflies, with a suggestion as to the nature of polymorphism. After giving a list of the hitherto recorded instances, which are relatively numerous in comparison with the extent of the fauna, the author points out that this mimicry is far less striking among the living insects than in museum specimens. Not only is this difference apparent on the under surface of the wings when the insects are at rest, but it is still more noticeable in the mode of flight, so that with very little experience the eye learns to distinguish between the mimic and the mimicked. In the well-known case of *Papilio polyotes*, with its three phases of females, one of which closely resembles the male of the same species, while the second mimics the male of *P. aristolochiae*, and the third that of *P. hector*—both the two latter being inedible, while the first is edible—the author observes "that though model and mimic may be readily distinguished at rest, whether with wings expanded or closed, yet the resemblance between them may be sufficient to deceive such enemies as attack them when flying. Such, however, is certainly not the case. The mode of flight of *P. polyotes* is similar for all three forms, and is totally distinct from that of *P. hector* and *P. aristolochiae*.

After referring to the distribution of the three species and the relative numbers of the males and females of the different forms in various localities, the author states that the facts "are far from lending support to the view that the polymorphic females of *P. polyotes* have owed their origin to natural selection in the way that the upholders of the theory of mimicry would have us believe."

For Prof. Punnett's suggestion as to the origin of polymorphic females our readers may be referred to the original paper, as it is too long to quote, but it may be mentioned that Mendelism plays a part in the explanation. Mimicry in other species, together with the natural enemies of butterflies in Ceylon, is likewise discussed.

In the same issue Mr. George Duncker, after mentioning that although the group is common in the fresh waters of India and East Africa, none has been hitherto recorded from those of Ceylon, states that during the summer of 1909 he succeeded in obtaining examples of four species—one of which is new—of pipe-fishes of the family Syngnathidæ from the rivers of that island.

With the exception of one devoted to a South African frog allied to *Rana corrugata* of Ceylon, the articles in part iii. of the fifth volume of the Records of the Indian Museum deal with invertebrates of various groups. Among these papers is one by Dr. Annandale on a new genus of psychodid Diptera from the Himalaya and Travancore, based on a minute species from Darjiling, described earlier in the present year by Dr. Annandale as *Diplonema superstes*; this now becomes *Brunettia superstes*, while the new Travancore species is to be known as *B. travancorica*. In a second paper the same writer discusses the Indian scalpelloid barnacles of the subgenus Smilium, while in a third Mr. S. Kemp describes three new Indian species of the marine decapod genus Gennadas. Most interesting of all is an article by Mr. C. A. Pavia on the larvæ of a common Calcutta mosquito, known as *Toxorhynchites immisericors*. It was suspected that these larvæ feed on the larvæ of another mosquito, *Stegomyia fasciata*, frequently found in water contained in earthen vessels, and experiment has proved the surmise to be true. The larvæ of *T. immisericors* feed, in fact, greedily on those of Stegomyia, "and as *S. fasciata*, the yellow-fever mosquito, is very common in earthern pots round Calcutta, one is justified in assuming that *T. immisericors* plays an important part in its destruction, in a manner which would be of great moment in the event of yellow fever being introduced into the country." R. L.

THE ARRIVAL OF MAN IN BRITAIN.[1]

THE address dealt with the antiquity of man as revealed in the geological record, and with the conditions under which Palæolithic man arrived in Britain. In the Tertiary period the higher (Eutherian) Mammalia appear, *en pleine évolution*, and afford the means of classifying it into the following well-marked divisions:—(1) The Eocene, in which living families and orders appear and there are no living genera. (2) The Miocene, in which there are living genera and no living species. (3) The Pliocene, in which the extinct species are preponderant and living species appear. (4) The Pleistocene, in which the living species are preponderant, and the extinct are few in number; Palæolithic man appears. (5) The Prehistoric, in which there are no extinct species of land Mammalia, and man is in the stages of culture marked by the use of Neolithic, bronze, and prehistoric iron implements. (6) The Historic period, in which the events are recorded in history.

In this classification the evolution of the Tertiary Mammalia takes the shape of a genealogical tree with

[1] Abstract of the Huxley Memorial Lecture delivered before the Royal Anthropological Institute on November 22 by Prof. W. Boyd Dawkins, F.R.S.

its trunk hidden in the Secondary period and its branches and twigs passing upwards through all the stages—a tree of life with the living forms as its fruit, the extinct species filling up the intervals between the living forms, and approximating to them in proportion as they approach nearer to the present day. In our search for the first traces of man on the earth, it is obvious that we cannot expect to find the most highly organised of the Mammalia in any portion of the geological record where there are no other living mammalian species, or, in other words, in the two earlier stages of the Tertiary period—in the Eocene, where there are no living Eutherian genera, and in the Miocene, where there are no living species. We may search for him in the Pliocene stage, when the living species come in, with some small chance of success, but our main efforts must be directed to the Pleistocene stage, when the living Eutherian forms were dominant and the face of nature as a whole was almost as it is to-day. If the doctrine of evolution be true there was no place for man in nature in the Eocene and Miocene stages, and if he had then been on the earth it is incredible that he should not, like all the other Mammalia then alive, either have become extinct or changed into a form that is no longer what it was before. As the evidence stands at present, man first appears on the earth in the Pleistocene age in that phase of the evolution of nature to which he belongs. The view of the higher antiquity of man based by M. Rutot on the presence of "eoliths," or chipped flints simulating the work of man in Eocene, Miocene, and Pliocene strata, is rendered untenable by the researches of Mr. Warren in this country and of MM. Boule and H. Breuil in France, who have proved that these forms can be, and in many cases have been, made by natural causes. These eoliths, therefore, cannot be used as anthropological documents in our inquiry.

The first starting point for our inquiry is presented by the discovery in 1894 of a skull and femur by M. Dubois in a Pleistocene river-deposit at Trinil, in Java, assigned by him to *Pithecanthropus erectus*, a form intermediate between the higher apes and man, and closely linked to the latter by the large brain and the erect gait. It is a veritable precursor of man, not only appearing at the point in the geological record where he might be expected, but in a tropical region taken by Lord Avebury and others to have been the birthplace of the human race. In Europe the implements and weapons of the Palæolithic hunter, associated with the bones and teeth of the animals that he hunted, afford ample proof of his presence in the caverns and in the river valley of the Pleistocene age over the whole region between the Mediterranean and the Baltic. The Palæolithic hunter presents two distinct phases of culture, those of the river-drift man and of the cave man, the former being the ruder and also the older, and the latter culminating in the wonderful artistic developments shown in the engravings, carvings, and painted frescoes of the caves of France and north-western Spain.

The conditions under which man found his way into Pleistocene Europe were strangely unlike those of to-day. The continent then extended southwards over the Mediterranean region, offering free passage to migration from northern Africa by way of Gibraltar and Sicily, and from Asia Minor by the elevation of the Ægean Sea and the Hellespont. On the Atlantic side the British Isles were united to France and Germany by the elevation of the beds of the intervening seas. On the east, too, a route of migration hitherto closed by a barrier of sea was offered to the Siberian fauna. The higher mountains were crowned with glaciers, and the climate was continental in character, with cold winters and hot summers. Under these geographical conditions the Pleistocene Mammalia invaded Europe both from the south and from the east and north-east at the close of the Pliocene age, and gradually took possession of the feeding grounds of the Pliocene fauna.

The invading forms may be divided into groups according to their present range, those that are now living (1) in temperate regions, (2) in northern, and (3) in southern climates. The first group, which includes most of the wild animals now living in middle and southern Europe, probably came from west central Asia. The second, including such Arctic species as the reindeer, musk sheep, and Arctic fox, came from the Siberian regions, and the third, represented by the lion, leopard, spotted hyæna, hippopotamus, caffer cat and others, came from the warmer regions, probably from northern Africa and perhaps Asia Minor. The extinct invading species, such as the mammoth and woolly rhinoceros, the cave-bear and the rest, also fall into one or other of these three groups. These animals ranged over the great Pleistocene continent, the northern so far to the south as the Alps and Pyrenees, and the southern over Spain and Italy, France and Germany, so far to the north as Yorkshire and Ireland, and both are found together in the caves and river deposits of the whole of central Europe and the British Isles.

There were, therefore, three distinct zones in Pleistocene Europe: the northern, into which no southern animal penetrated; the southern, in which no northern species is found; and the middle, extending from the Alps and Pyrenees over France, Germany, and the British Isles so far north as Yorkshire. In this the northern and southern forms were so mingled together that there can be no doubt that they lived at the same time. The spotted hyæna, for example, in the caves preyed upon the reindeer as well as the hippopotamus. This mixture of animals can only be explained by the migrating of these animals at different seasons in a continental climate with hot summers and cold winters, coupled with the secular changes in climate indicated by the development of an ice-sheet in the north and the spread of the glaciers over the lower valleys of the mountains.

The place of the river-drift man in these great migrations is clearly marked by his range. He came from the south, and his implements occur throughout the southern and middle zone so far to the north as Yorkshire. He also ranged in the Pleistocene age throughout northern Africa, Palestine, and Arabia into India, where he used the same implements as in Europe. He appeared and vanished along with the southern animals, and he lived in Europe during the time that the ice covered the higher grounds in the British Isles, as well as after the retreat of the ice from the districts which were covered during the maximum cold of the period.

The discoveries in the caves of Belgium, France, and Gibraltar establish the fact that the low type of river-drift man found in the Neanderthal cave ranged over those regions, and more recently Dr. Keith has noted it in the caves of Gibraltar. The river-drift man in Britain probably belonged to this primitive race.

The range of the cave man contrasts in every respect with that of the river-drift man. It is confined, with the solitary exception of the frescoed cave of Altamira, near Santander, to the region north of the Alps and Pyrenees, occupied by the northern group of Mammalia, the implements and weapons being met with in France, Belgium, Germany, and so far to the east as Moravia, and to the north as southern Yorkshire. They were successors of the river-drift men, and lived in the latest phase of the Pleistocene period.

Unfortunately, the caves of Great Britain throw no light on their physique. Nor are we helped in solving the problem by the caves of the Continent, because even if all the alleged discoveries be accepted, it does not follow that the same tribes lived in Britain. From the identity of their culture with that of the Eskimos, and from the fact that at various places in Siberia there are old camping grounds containing implements and the remains of the animals, both living and extinct, that are found in the caves of Britain and France, it is probable that the cave men have in remote times been in touch with the latter in northern Asia. The physical relations of the two peoples can only be decided by further discoveries in Europe, and especially by the archæological survey of Siberia. As the case stands now, the cave man probably came into Europe with the northern Mammalia from, and retreated with them into, northern Asia at the close of the Pleistocene period.

The Pleistocene period was undoubtedly of vast duration, and the antiquity of man is correspondingly great. It is to be measured by the sequence of geological events, by the changes in animal life, and by the advance in culture of successive races of mankind. It cannot be measured in years, because there are no chronometers in nature that record so small a unit of time. Outside history we

get a simple sequence of events following one another in due order, and with intervals of varying length, and these we are tempted to look upon without allowing for the perspective. The more minutely the events that have taken place since man appeared in Europe are examined, the more profound is the impression of the vastness of his antiquity and the futility of any attempt to compute it in terms of years.

THE DUKE OF THE ABRUZZI'S EXPEDITION TO THE KARAKORAM HIMALAYAS.[1]

THE expedition undertaken in the summer of 1909 by the Duke of the Abruzzi to the head of the Baltoro and the Godwin Austen glaciers in the Karakoram was essentially a mountaineering expedition. On the way out the longer summer route was followed across the Punjab Himalayas over the Zoji-La (11,230 feet), and down the valleys of the Dras and of the Indus, to Skardu, the capital of Baltistan. Here the route quits the Indus to ascend the Shigar and Braldoh valleys up to Askoley, the last inhabited spot, after which the glacier region is entered. While traversing Baltistan the expedition had the opportunity of seeing much of the Balti population and of photographing several groups of them. There can be no doubt that the great majority of the Baltis belong to the Aryan stock, and not to the Mongol-Thibetan, as has been stated by all English writers on the subject. The distinguished Hungarian anthropologist Ujfalvy had already demonstrated their close affinity to the Dards by comparative anthropometrical measurements.

A few miles above Askoley the Braldoh valley is intersected by the snout of the Biafo glacier. This glacier has undergone considerable variations in a recent period. In 1861, when Colonel Godwin Austen first visited it, it was wedged against the opposite or left bank of the Braldoh valley in such a way that the emissary stream of the Baltoro flowed through a tunnel underneath it. In 1892 Sir Martin Conway noted that it had withdrawn to such an extent as to leave free more than half of the valley, upon which it had deposited a deep layer of moraine. Since then the movement has again been forward, and in 1909 there were only from 200 to 300 yards between the snout and the rocks of the left wall of the valley.

On May 18 the expedition climbed up on to the Baltoro glacier. The snout of this glacier still corresponds absolutely with the description of it given by Conway in 1892. It may possibly be stationary, but certainly shows no sign of shrinking. All the tributary glaciers appear to be on the increase, and stretch out for a long distance on the top of the Baltoro, the surface of which they strew with broken seracs. Here angular measurements were taken, which were repeated two months later on the return journey, and established that the rate of motion of the centre of the glacier is on the average 5½ feet a day during the months of June and July.

Later on the rate of the upper Godwin Austen glacier was observed. In the course of seven years the movement gave an average daily rate of barely 2 feet—considerably less than that of the lower Baltoro, although the grade is much steeper.

Near Rdokass were noticed on the glacier the strange pyramids of pure white ice which were first observed by Colonel Godwin Austen in 1861. At this point they appear as isolated cones, from 10 to 20 feet high; next as sharp pinnacles; and at last, higher up, as huge blocks from 100 to 150 feet in height, shaped like irregular prisms, and getting nearer and nearer together until they seem to be arranged in longitudinal rows.

The Karakoram range does not seem likely to offer an opportunity of solving the problem of the highest altitude attainable by man. The greater portion of the chain looks absolutely inaccessible. The difficulties of the ice and the rock are in most places so great that not even European alpine porters could carry up a load without the help of fixed ropes. This prevents the establishment of high camps, and was the obstacle which frustrated the Duke's one attempt to ascend K_2 by the rocky south-eastern arête.

[1] Abstract of a lecture delivered before the Royal Geographical Society on November 21 by Dr. F. De Filippi.

The exploration of the Godwin Austen glacier was completed by the end of June, and the Duke now decided to attempt the Bride peak (Karakoram No. 8 of T.S. of India, 25,110 feet), as being the highest and offering the additional advantage of having been trigonometrically fixed by the T.S. of India.

The Duke succeeded in establishing a camp on the Chogolisa saddle (20,778 feet), between the Golden Throne and the Bride peak. From this camp, an altitude of 24,600 feet, a little more than 500 feet below the summit, was reached on July 18.

The calculation of the altitude reached is based upon a barometric reading ($12\frac{9}{2}$ inches) referred to those taken on the same day at Skardu, Leh, Srinagar, and Gilgit.

The result of the survey is a map which comprises the upper basin of the Baltoro glacier, the whole of the Godwin Austen glacier, with its tributaries, which encircle three-fourths of K_2, and the mountain chains which enclose them. A number of new altitudes are given on the map. Of these, the most important is the one which assigns to the Broad peak an altitude of 27,133 feet. This altitude, added to that of Teram Kangri (27,610 feet), at the head of the Siachen glacier, brings up to seven the number of peaks now known to be above 27,000 feet. The other five are Mount Everest, K_2, the two peaks of Kanchenjunga, and Makalu.

The experience of this journey agrees with that of the Ruwenzori expedition in showing that the aneroid barometer is too delicate an instrument for mountain expeditions, and must be regarded as quite untrustworthy.

There is every reason to believe that the high regions of the Karakoram have a climate of their own which differs from that of the lower valleys, notwithstanding the shortness of distance as the crow flies. This experience confirms the observation recorded by previous explorers as to the absence of all electric phenomena in the atmosphere.

The expedition has recorded that the great chain of mountains comprising the Broad peak, the four Gasherbrums, and the Golden Throne, is composed of limestone and sedimentary rocks, whereas the opposite ranges, comprising the Staircase peak, K_2, and Bride peak, consist of crystalline rocks.

AHREN'S BILIQUID PRISM.

MR. C. D. AHRENS, the veteran prism-cutter, has lately devised a new type of liquid prism, which seems to have some advantages in optical work, both for direct-vision and for ordinary patterns of spectroscope. It is more than fifteen years since Wernicke proposed to employ in a direct-vision combination the highly dispersive liquid cinnamic ether. He found amongst modern sorts of optical glass one kind, a baryta crown, having the same mean refractive index, namely, 1·56, but having only about one-fifth as much relative dispersion. He was therefore able to make a flat-ended direct-vision prism by enclosing a glass prism of from 120° to 130° of refracting angle in a cell filled with the cinnamic ether, which thus constituted a triple combination, the glass prism being flanked by two reversed prisms of the ether. Several varieties of Wernicke's prism came into favour; but it had the drawback that cinnamic ether is expensive, and for some reason becomes cloudy after standing for a year or two in the containing cell.

More recently another highly dispersive organic liquid, also named by Wernicke, has found favour, viz. methyl salicylate. This substance has a mean refractive index of 1·5319, and its constringency (the reciprocal of its relative dispersion) is 24·7, as against 11·0 for cinnamic ether. Mr. F. Cheshire and others have used methyl salicylate with great success, in combination with reversed glass prisms, in apparatus that may be regarded as an improvement upon the prism of Wernicke. Methyl salicylate is, however, much cheaper than cinnamic ether, and does not become cloudy with lapse of time.

Mr. Ahrens has now produced a new type, the biliquid prism. It consists of a glass container divided by oblique partitions of thin plate glass into three triangular cells, one of which is filled with methyl salicylate, the other two with another liquid having a small dispersion relatively to

its refractive power. For the second liquid Mr. Ahrens has succeeded in finding in the paraffin series a white oil which is a suitable material in its mechanical as well as in its optical properties. It has not, however, the same mean refractive index as methyl salicylate, so therefore, for a direct-vision prism, the end faces cannot be square to the principal axis of the transmitted light. Their obliquity, however, is not great—not more than 15° if the refracting angle of the middle prismatic cell is from 120° to 125°. The dispersion of these prisms is very good, and there is much less absorption of the blue end of the spectrum than is usually found with a bisulphide or flint-glass prism. The writer, in a rough comparison of one of the Ahrens biliquid prisms with a Wernicke prism and a 60° bisulphide prism, found the following angular dispersions between

Ahrens's Biliquid Direct-vision Prism.

the C and F hydrogen lines :—bisulphide of carbon prism, 3° 27′; Wernicke prism, 3° 6′; Ahrens prism, 3° 12′.

If direct-vision is not desired, a prism of high dispersion can be made on the same biliquid plan by constructing a glass cell with the end faces at about 30° to the line of sight, and with internal oblique partitions at from 20° to 24° to the line of sight, dividing the whole into three prismatic chambers, the two outer of which are filled with methyl salicylate and the middle one with the white oil. This prism has marked superiority over a flint-glass prism of equal size. It must not, of course, be forgotten that all liquid prisms are unsuitable for fine definition of the spectral lines owing to the change of refractive index in the liquid when the temperature rises.

The biliquid prism is being put on the market by Mr. Pillischer.

THE REFORM OF MATHEMATICAL AND SCIENCE TEACHING IN GERMANY.[1]

THE revolt against formal culture which characterised mathematical instruction has within the last decade produced a large bibliography in English, French, and German, and inspired systematic inquiry into possible and needful reform. The movement has been assisted in Germany by an extension of the privileges of the Gymnasium to the Realgymnasium and the Oberrealschule, which in time may share the prestige of the Gymnasium and win for the exact sciences a place *ebenbürtig* with the classics.

When the Reformschulen were founded to provide a common foundation for all pupils in nine-class schools between the ages of nine and twelve, engineers were pronouncedly favourable, thinking that the exact sciences would benefit, and that an *Einheitsmittelschule* (secondary school with uniform curriculum) was in sight. But they were doubly disappointed; the classics have benefited, and the *Einheitsmittelschule* is condemned for systematic perfection.

Reform of mathematical and science teaching depends closely on the inexorable demands of civilisation, and for the understanding of modern culture a proper grasp of the meaning of a function is considered indispensable. On this account it is proposed to include analytical geometry and the calculus in the work of the nine-class schools. As no more time can be allotted to mathematics, any relief must come from further pruning of the syllabus. Hence elementary mathematics must be relieved of its lumber, the desire to achieve systematic perfection must be left unfulfilled, pedantic thoroughness must be killed by ridicule, and the exclusively deductive form abandoned, more value being attached to intuition than to a cunning use of the syllogism. Though mathematicians attack the isolation of their subject, they do not advocate *Fachbildung* (professional studies) in secondary schools. Professional bodies have always protested against it, and the protest has been taken to indicate the attitude of Trade Unions also. Nevertheless, German universities are trying to give the teacher an acquaintance with practical applications and arrange courses in applied mathematics or recognise attendance at technical high schools. The courses include descriptive geometry, mathematical methods of technical mechanics, surveying, life assurance, and laboratory work.

The introduction of practical work in the teaching of physics is urgently needed. It is provided in the best Prussian schools and in South Germany, notably at Munich, it forms part of the primary syllabus during the last two years. A statistical inquiry showed that 75 per cent., at least, of Prussian secondary schools desired facilities for experimental work, whilst only about thirty possessed them.

The minimum amount of time demanded is seven hours per week for science—physics, chemistry, biology, and geography—and four for mathematics. If proposals for introducing specialisation in the last three years are entertained, further hours may fall to the lot of the exact sciences.

The reintroduction of biology, which disappeared in 1879 as a result of the writings of Darwin and Haeckel, is being advocated as a training of the powers of observation, in which the German freshman is said to be woefully deficient, and as an exercise in the use of the microscope. Geography comprises economic geology, *Erdkunde*, and astronomy, as well as commercial products. To bring it into organic connection with mathematics, courses of lectures on the interconnection of mathematics are being projected.

Matters are still in an indefinite position, but there are indications that the Cambridge Congress of 1912 will mark the beginning of a new era. It is to be hoped, for our sakes, that the results of this congress can be laid before the Consultative Committee of the Board of Education to be recommended for adoption throughout the Empire.

[1] Abstract of paper read at the meeting of the Edinburgh Mathematical Society on November 11 by Mr. A. J. Pressland.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

BIRMINGHAM.—Mr. John Dale has been awarded the Walter Myers studentship for a further period of one year, having proved himself a student of exceptional merit. An award of the same studentship for the present year has been made to Mr. Cranston Walker. The value of the studentship is 150*l.* per annum, and it must be used for research in pathology or clinical medicine at some German university. Mr. Dale, the first holder, is working at Hamburg, and Mr. Cranston Walker is at the University of Freiburg, in Baden. The holder must possess a degree in science in addition to degrees in medicine and surgery.

CAMBRIDGE.—An election to an Isaac Newton studentship will be held in the Lent term, 1911. It will be the duty of the student to devote himself during the tenure of his studentship to study or research in some branch of astronomy or of physical optics, according to a course proposed by himself and approved by the electors. The student's course of study or research must be pursued at Cambridge. The studentship will be tenable for the term of three years from April 15, 1911. The emolument of the student will be 200*l.* per annum. Candidates for the studentship are invited to send in their applications to the Vice-Chancellor between January 16 and 26, 1911, together with testimonials and such other evidence as to their qualifications and their proposed course of study or research as they may think fit.

Mr. A. E. Shipley, F.R.S., master of Christ's College, has been nominated by the general board of studies as a member of the board of electors to the professorship of zoology and comparative anatomy in succession to the late Mr. J. W. Clark; and Prof. W. J. Pope, F.R.S., has been nominated by the council of the Senate a member of the board of electors to the Allen scholarship.

OXFORD.—On November 22 another stage was reached in the discussion of the changes proposed by the Hebdomadal Council at the instance of the Chancellor of

the University. The preamble of a statute providing that Greek should no longer be a compulsory subject in Responsions was promulgated in Congregation, and on a division was rejected by 188 to 152. The form of statute was introduced on behalf of council by Mr. Matheson and opposed by Dr. James, president of St. John's College, and formerly headmaster of Rugby. Sir W. Anson, warden of All Souls', though not opposed to making Greek optional in certain cases, spoke against the proposal in its present form, a course which was also taken, on similar grounds, by Dr. Gilbert Murray, regius professor of Greek, and Mr. J. W. Mackail, professor of poetry. Mr. Cookson advocated the passing of the statute, and Prof. J. A. Smith argued on the same side. Mr. E. M. Walker opposed it. There is no doubt that the rejection of the preamble, which involves the loss of the statute, was largely due to the objection taken by Prof. Murray and the "moderate" party to the particular way in which the proposal had been framed. Rightly or wrongly, it was considered that no proper opportunity had been allowed for a fair discussion of possible limitations and alternatives, and the majority shrank from a measure that appeared to them unnecessarily drastic. Though for the present excluded by the vote of Congregation from the programme of university reform, it is not likely that the Greek question will be allowed to rest. But it must be remembered that, even if presented in a form acceptable to Congregation, the measure of relief has still to run the gauntlet of Convocation before becoming part of the statute law of the University.

It is announced that an Imperial Conference on Education is to be held in London next year, probably in April. The conference is, it is said, to take place at the invitation of the Imperial Government, and is to be regarded as an outcome of the congress held in 1907 under the auspices of the League of the Empire. Delegates are expected from Canada, Australia, New Zealand, South Africa, India, and the Crown Colonies.

The U.S. General Education Board, says *Science*, has made conditional appropriations amounting to 145,000*l.*, distributed as follows:—Baylor University, Waco, Tex., 40,000*l.*; Trinity College, Durham, N.C., 30,000*l.*; University of Chattanooga, Tenn., 30,000*l.*; Meredith College, Raleigh, N.C., 10,000*l.*; Wesleyan Female College, Macon, Ga., 20,000*l.*; and Amherst College, Amherst, Mass., 15,000*l.* From the same source we learn that Wooster University has received 20,000*l.* from Mrs. J. S. Kennedy, of New York.

As has been stated in these columns, a Congress of the Universities of the Empire is to be held in London in 1912. On November 19 a meeting was held at the University of London, at which the Vice-Chancellors and other representatives of the universities of the United Kingdom were present for the purpose primarily of drawing up a paper of subjects for discussion at the congress. The subjects fell under the following heads:—(1) university organisation; (2) universities in their relation to teachers and undergraduate students; (3) universities in their relation to post-graduate and research work; (4) universities in their relation to schools and to other agencies for higher education. The draft agenda paper is to be sent at once to the various universities in the colonies and in India for comments and suggestions. The representatives of the Home universities will meet again early next summer to consider any representations made by the Colonial and Indian universities, and to select speakers to introduce the different topics to be discussed at the congress. It has been decided to hold the congress during the first week of July, 1912. We are glad to know that most of the universities throughout the Empire have accepted already the invitation to take part in what should prove an important and historic gathering. The secretary of the congress is Dr. R. D. Roberts, who may be addressed at the Congress Office, University of London, South Kensington, London, S.W.

Last April Sir Henry Roscoe, F.R.S., as chairman of the Appeal Committee, made a public appeal for 70,000*l.* for providing new chemical laboratories at University College, London, including the purchase of the proposed site in Gower Place. The death of King Edward led to the postponement of the Mansion House meeting arranged, and this necessity gave a check to the work of the committee. Sir Henry Roscoe has now made a second urgent appeal, which has two objects: the first is to raise a sum of 25,000*l.* for the acquisition of the proposed site, the second to raise 45,000*l.* to erect the laboratories. The sum of 25,000*l.* must be raised before December 25 next if the Senate of the University is to be in a position to exercise the option which it holds to purchase the site. Towards this sum the committee has collected more than 9000*l.*, leaving a balance of 16,000*l.* to be raised forthwith. The appeal is addressed especially to all those who realise the national importance of scientific research and its bearing upon the commercial prosperity of the country, to Londoners who desire to see university teaching in London developed in accordance with the needs of the nation, and also to the friends and admirers of Sir William Ramsay, the professor of general and inorganic chemistry at University College, to assist in this attempt to provide new chemical laboratories by gifts which will insure the acquisition of the site. It is earnestly to be hoped that the comparatively small sum of 16,000*l.* will be forthcoming before Christmas Day, so that the site adjoining the college, and eminently suitable for the proposed laboratories, may be secured. It may be pointed out that the number of students of chemistry at University College has increased greatly in recent years, and that the accommodation available has long been inadequate. The present laboratories were built in 1871, and to keep pace with modern requirements and to compete on something like equal terms with Continental universities a new building is required with up-to-date conveniences both for teaching and research. Donations should be addressed to Sir Henry E. Roscoe, F.R.S., at University College, Gower Street, London.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, November 17.—Sir Archibald Geikie, K.C.B., president, followed by Mr. A. B. Kempe, vice-president, in the chair.—Harold **Wager**: The effect of gravity upon the movements and aggregation of *Euglena viridis*, Ehrb., and other micro-organisms. *Euglena viridis* and some other micro-organisms, when placed in shallow vessels or narrow tubes in the dark, become aggregated into peculiar network-like patterns or more or less well-defined groups. In a narrow tube, placed horizontally in the dark, the aggregation takes the form of a series of groups which look like green bands crossing the tube from one side to the other. Each group shows a constant cyclic up and down movement, the denser central region moving downwards under the influence of gravity, and a lighter peripheral area consisting of organisms moving upwards, mainly by their own activity. The aggregation depends upon the number of organisms present, their activity, and the depth of the vessel in which they are contained, and may persist with its regular cyclic movements for several days. The downward movement appears to be a purely mechanical one, dependent upon the specific gravity of the organism, and is not due to a stimulus which evokes a physiological response, as in geotropism or geotaxis. The upward movement is, on the other hand, due partly to the activity of the organisms themselves, partly, no doubt, to the upward currents set up in the liquid by the friction of the downward-moving stream. The upward movement of Euglena is more or less vertical, and appears to be controlled, so far as the orientation of its elongate body is concerned, by the action of gravity. The aggregation resembles the cohesion figures produced when fine sediments are allowed, under certain conditions, to settle down slowly in a liquid, and are probably brought about much in the same way. The movements of certain micro-organisms are apparently controlled, therefore, in a purely mechanical fashion by gravity, combined with cohesive forces, and this is of advantage to species which, like Euglena, are often found in large numbers in a confined space, in that it prevents their accumulation in such dense masses as would be likely to interfere with their assimilatory and respiratory functions.—Miss Jean **White**: The

proteolytic enzyme of drosera.—L. S. **Dudgeon**, P. N. **Panton**, and H. A. F. **Wilson**: The influence of bacterial endotoxins on phagocytosis (including a new method for the differentiation of bacteria). Second report. The authors have failed to demonstrate in any of their experiments an action of the endotoxic substances on the leucocytes, and experiments leading to similar results were obtained by allowing bacteria to be exposed to the action of the specific endotoxic substances. They confirm the results published in the first communication, that the phagocytic result is dependent upon the interaction of endotoxin of serum. They have shown in the case of normal serum that the amount of phagocytosis permitted when bacteria and endotoxin interact is not related to the amount of hæmolytic complement present. The action of endotoxin appears to be specific even with bacteria so closely related as the typhoid and paratyphoid family. These results strongly suggest that this method can be employed for the differentiation of bacteria. The amount of endotoxin has been shown to be strongly thermostable.—S. B. **Schryver**: Some investigations on the state of aggregation of matter. Parts I.–III. *Part I. The action of salts in heterogeneous systems and the nature of the globulins.*—When complex substances, such as those which form colloidal solutions, enter into chemical reaction, the ordinary laws of chemical mass action are not always obeyed, the deviations therefrom depending upon the medium in which the reaction takes place. These are due to the adsorption of molecules from the medium on the surface of the large molecules of the colloid, which sterically inhibit chemical reaction. These conclusions were deduced chiefly by the study of the action of formaldehyde on Witte's peptone, whereby a methyleneimino derivative is formed, which readily, either by polymerisation or condensation between two molecules, forms an insoluble complex. The formation of this complex is inhibited by the presence of salts, the inhibitory action of a series of which has been quantitatively measured. The degree of inhibition was found to depend, in the case of monobasic sodium salts, on the physical properties of their aqueous solutions. The lower the surface tension and the lower the viscosity of the solutions, the greater the inhibitory action. The effect of surface tension could be deduced from the general study of adsorption phenomena, whilst the effect of viscosity could be deduced by the extension of the generalisations of Whitney and Noyes, and of Nernst as to the reaction rates in heterogeneous systems. The globulins, which are insoluble in water but soluble in salt solutions, are assumed to be complexes formed by the action of a basic group in one molecule with an acid group in another, by means of which a salt is formed, which undergoes slight but definite hydrolytic dissociation in the presence of water. In the presence of most salts, owing to adsorption by the dissociated globulin molecules, hydrolysis proceeds further than in presence of water alone, with the consequence that more globulin is dissociated and "dissolved." The solvent action of the salts here again depends upon the surface tensions of the solutions. Salts exert also a similar action in other heterogeneous systems in bringing about disaggregation, and the differences of solubility of various crystalline substances in salt solutions can be thereby explained. The physical constants of the salt solutions employed, and the solubilities of edestin and serum globulin in these solutions, are given. *Part II. The action of formaldehyde on Witte's peptone.*—The experimental details of this investigation are given. It is shown that the insoluble precipitate, formed by the interaction of the solutions, is derived chiefly from the more complex polypeptides. *Part III. The solubility of phenol and certain crystalline substances in salt solutions.*—The deductions as to the action of salts in heterogeneous systems are illustrated by the determination of the critical solution temperatures of phenol and salt solutions, which is a function chiefly of the surface tensions of the latter, and of the solubility of the following substances in salt solutions:—*d-l*-leucine, *d-l*-phenylalanine, caffeine, benzamide, and *p*-toluidine. The solubilities are affected by both the surface tensions and viscosities of the solutions.—F. W. **Twort**: A method for isolating and growing the lepra bacillus of man. Experiments were undertaken to obtain a method whereby the lepra bacillus of man and allied bacilli might be cultivated outside the body on artificial media. The material tested was obtained from a typical leper. Cultivations were made on ordinary laboratory media and on media containing extracts from animal organs and tissues; these gave negative results. In view of the close relationship between the tubercle bacillus and the lepra bacillus, it appeared highly probable that these two micro-organisms would require the same chemical substances for building up their protoplasm which could be elaborated from the ordinary media only by the tubercle bacillus. It was thought that if these substances could be supplied already formed to the lepra bacillus it might grow, and the easiest method of supplying these substances would be by adding to some good medium the ground-up bodies of the tubercle bacilli containing them; accordingly a medium was made as follows:—egg three parts, 0·8 per cent. sodium chloride one part, ground tubercle bacilli 1 per cent., and glycerine 5 per cent. or less, mixed, placed in tubes, sterilised, and set in slopes. Leprosy material was placed in 2 per cent. ericolin to kill contaminating micro-organisms, and then inoculated on the tubercle medium. On this the lepra bacillus grew very slowly as a delicate, colourless streak along the inoculated track, and showed the typical morphological and staining characters of the lepra bacillus; the bacillus could be sub-cultured only on the tubercle medium. Experiments will be made to prepare a lepra vaccine and to grow the lepra bacillus of rat. In conjunction with Mr. Ingram, the author has also succeeded in growing the bacillus found in Jöhne's disease of cows. It grows on the same medium, much like lepra bacillus, but somewhat faster. It is hoped soon to prepare a diagnostic vaccine for Jöhne's disease.—G. J. **Fowler**, E. **Ardern**, and W. T. **Lockett**: The oxidation of phenol by certain bacteria in pure culture. The investigation described in the paper arose out of a detailed examination of the effect of various antiseptic substances, including phenol, in bacterial sewage filters. It was found that the phenol apparently exerted a selective action on the bacteria present in the filter, only very few types appearing in the filtrate, more especially a liquefying organism (*B. liquefaciens fluorescens*) and a chromogenic organism. Pure cultures of these organisms were made, the medium generally used being ordinary peptone broth. The general method of experiment was to bubble air, under sterile conditions, through an aqueous solution of phenol to which a few c.c. of the culture were added. The strengths of phenol solution used varied from 8·4 to 16·5 parts phenol per 100,000 of water, and were determined by the oxygen absorbed from standard acid permanganate solution in three minutes. It was found that *B. liquefaciens* had no action, or only a very slight one, on phenol, even after exposure of a month or more, while on introduction of the chromogenic organism the phenol content diminished, slowly at first, and then, in two or three days, completely disappeared. In a final experiment, a solution was made use of containing 10 parts per 100,000 of phenol, together with the following ingredients:—

Ammonium sulphate...	... 0·1 grm.	per litre.
Potassium phosphate...	... 0·1 ,,	
Magnesium carbonate in suspension.	... ½–1 ,,	

After careful sterilisation this was inoculated with the organism, and incubated. After nine days the phenol had practically disappeared. Plate cultures were also made at the expiration of this time, and showed no evidence of the presence of more than one species of organism. The organism has been examined by Dr. Sidebotham, who concludes that it most nearly resembles *B. helvolus* (Zimmermann).

Mineralogical Society, November 15.—Prof. W. J. Lewis, F.R.S., president, in the chair.—J. H. **Collins**: Further notes on wood-tin. It is concluded that wood-tin, which always contains a good deal of iron oxide, and is much more opaque and more soluble than ordinary cassiterite, is the chalcedonic form, the shot-tin having had a concretionary, and the botryoidal form a stalagmatic, origin.—J. M. **Coon**: The alteration of the felspar of granites to china-clay. The action has taken place from within the earth towards the surface below the underground water-

level, the water outlets being generally indicated by schorl and quartz veins. The nature of the products of the alteration was discussed.—Prof. W. J. **Lewis**: Wiltshireite, a new mineral from the Binnenthal. The crystals were tin-white in colour, russet-brown when tarnished; small, but aggregated in parallel position, with monoclinic symmetry $a : b : c = 1{\cdot}587 : 1 : 1{\cdot}070$; $\beta = 100° 44'$. Paucity of material prevented a chemical analysis, but no doubt it is a lead sulpharsenite. Named after the late Rev. Prof. T. Wiltshire.—Arthur **Russell**: A new locality of phenakite in Cornwall. A single specimen showing numerous colourless prismatic crystals of phenakite was found by the author at Wheal Gorland, Gwennap, Cornwall, this year. The specimen was obtained from a lode at present worked for wolfram and traversing the granite close to its junction with the killas.

Institution of Mining and Metallurgy, November 16.—Mr. Edgar Taylor, president, in the chair.—A. Moncrieff **Finlayson**: Secondary enrichment in the copper deposits of Huelva, Spain. This paper embodies the results of an investigation of variations in the ore-content of the lodes in the mining district named, with subsequent microscopic examination of the ores, with the view of determining the paragenesis of the minerals and the nature and extent of alteration. The following general conclusions were arrived at:—that the copper in the pyrites occurs primarily as a definite mineral (chalcopyrite), and is not chemically combined with the pyrite; that the order of deposition of the primary minerals was pyrites, chalcopyrite, blende, galena; that the processes of secondary enrichment consist, in lean ores, in a change from chalcopyrite to chalcocite, and in richer ores in a gradual aggregation of secondary chalcopyrite accompanied by chalcocite; that the preliminary changes due to enrichment extend to considerably greater depths than is indicated by the percentage composition of the ore. The characteristic process is undoubtedly the formation of chalcocite from chalcopyrite, chalcocite being formed, in part at least, during the oxidation of the leached heaps.—J. Bowie **Wilson**: Notes on the Mount Morgan ore deposits, Queensland. This paper is a brief account of the development of these deposits, brought up to date, the latest of previous technical papers on the subject being at least ten years old. Considerable space is devoted to a consideration of the geology of the deposit. The author considers that the deposit was formed in an area of country rock much shattered by intrusive dykes, which has allowed free circulation of ascending mineral-bearing solutions, the mineralisation occurring simultaneously with metamorphism of the original sedimentary rocks forming a background to the deposit. He admits, however, that there are several phenomena which do not absolutely fit in with his theory.—D. M. **Levy**: The successive stages in the bessemerising of copper mattes as indicated by the converter flame. This paper, which is accompanied by four coloured plates reproduced from Lumière photographs, deals with the two main stages in the process of bessemerising copper mattes, the "slagging" stage, during which the iron-sulphide is eliminated, and the second stage, during which the sulphur is finally eliminated, the slag being poured off and the white metal blown up to blister copper. The colours of the flames at these two stages are characteristic, and there are other points, at first blowing and at the end of the slagging stage, when the flame colour is equally indicative of the stages reached in the complete operation. The author follows out the process in detail, and appends observations made during a typical "blow."

Royal Meteorological Society, November 16.—Mr. H. Mellish, president, in the chair.—Miss M. **White**: Results of the hourly balloon ascents made from the Meteorological Department of the Manchester University, March 18–19, 1910. Twenty-eight small rubber balloons carrying Dines's meteorographs were liberated hourly, and of these twenty have been recovered. The balloons left Manchester going at first in a southerly, and later south-easterly, direction, and were found in the Worcester, Hereford, and Monmouth districts, one reaching North Devon. The direction of the upper wind was constant during the period over which the ascents extended, and did not vary with height. The average height of the stratosphere was 10·7 km. Whereas at the ground level the temperature was remarkably constant throughout the course of the experiments, showing a maximum variation of fewer than 2° from the mean, the isothermals at the higher levels show a well-marked rise throughout the first fifteen hours; *e.g.* a temperature of −40° C. was at first encountered at a height of 6 km., but continued to recede, until at the end of twelve hours it was not met with until 8 km. height.—W. H. **Dines**: Results obtained from the registering balloon ascents carried out during the two international weeks, December 6–11, 1909, and August 8–13, 1910. Balloons on each occasion were sent up from Manchester, Pyrton Hill, Ditcham Park, Crinan in Scotland, and also in the west of Ireland. Seventeen records were secured in the December ascents, and these show that the value for the height of the isothermal column or stratosphere are some of the lowest ever observed, and the temperatures are perhaps the lowest ever recorded, at a height of 5 miles. Of the balloons sent up in the August week seventeen were found. The average height attained was about 10 miles. The inversion of temperature at the commencement of the isothermal layer was larger than usual.—C. J. P. **Cave**: Pilot balloon observations made in Barbados during the international week, December 6–11, 1909. These observations, which were undertaken at the request of the Royal Meteorological Society, were carried out by Mr. Radcliffe Hall and several other gentlemen associated with him. The prevalence of clouds during the daytime interfered with the ascents, many of the balloons being lost to sight after a few minutes. It seems that the wind behaves like an east wind in this country, increasing to a maximum and then falling off above.—W. **Marriott**: Three registering balloon ascents carried out at the Royal Agricultural Society's Show at Liverpool on June 21–23.—Captain C. H. **Ley**: The irregularities of the wind at moderate altitudes.

CAMBRIDGE.

Philosophical Society, October 31.—Prof. Hobson, vice-president, in the chair.—Sir J. J. **Thomson**: A new method of investigating the positive rays. In this method the rays are received on a photographic plate inserted inside the discharge tube, and placed in a light-tight case until it is wished to photograph the rays, when the plate is lifted from its case by a mechanism worked from the outside, and the rays are allowed to fall upon it. It is found that a photographic plate is very sensitive to the rays; a pencil of these only one-third of a millimetre in diameter gave a good photograph in less than five minutes. The photographic plate, besides being much more sensitive than the willemite screen hitherto used by the author, has the advantage of giving a permanent record and allows of greater accuracy of measurement. Using this method, the author has detected in the positive rays, in addition to the atom and molecules described in his paper in the October number of the *Philosophical Magazine*, positive rays of a secondary nature having values of m/e, 1·5, 2·5, &c., that for the hydrogen atom. Photographs taken by this method were exhibited at the meeting.—R. **Whiddington**: Preliminary note on the properties of easily absorbed Röntgen radiation.—R. T. **Beatty**: The ionisation of heavy gases by X-rays. When X-rays pass through matter their energy is absorbed in the production of δ, β, and γ rays. X-rays the absorption of which in aluminium ranged from $\lambda = 230$ to $\lambda = 4$ were passed through AsH_3 and SeH_2, and the absorptions in these gases were measured. It was found that β and γ rays occurred together when the characteristic γ radiation of SeH_2 was excited. On subtracting the increase in ionisation due to these rays, the ionisation due to the direct formation of δ rays, relatively to the ionisation in air, remained constant for all the radiations used. It thus appears that the processes which go on when the characteristic radiation is produced do not alter the rate at which direct ionisation takes place in the gas. Incidentally, Lenard's law of absorption of corpuscular rays is confirmed to a few per cent.—S. G. **Lusby**: The mobility of the positive ion in flames. The mobility of the positive ions due to salt vapours in a flame was determined in these experiments. It was found that for all salts of all metals of the alkali and the alkaline earth groups this mobility was a constant

quantity, and at a temperature of 1500° absolute was 290 cm. per second. From a theoretical formula it was further deduced that the ion at this temperature had the mass of a hydrogen atom. Experiments are proceeding to test further this latter result.—G. W. **Todd**: Mobility of the positive ions in gases at low pressures. By an adaptation of Rutherford's alternating field method, the mobilities of the positive ions produced in gases by means of X-rays have been measured between pressures of 1 and 25 millimetres of mercury. Unlike the negative ions, no change was observed in the law that the product of the pressure and the mobility is constant for the same gas. Further experiments are in progress with the positive ions given off from aluminium phosphate.—G. H. **Hardy**: Fourier's double integral and the theory of divergent integrals.

PARIS.

Academy of Sciences, November 14.—M. Émile Picard in the chair.—The president announced the death of M. Tannery, free member of the academy.—M. L. Teisserenc de Bort was elected a member in the place of M. E. Rouché.—A. **Perot**: The spectroscopic measurement of the rotation of stars possessing an atmosphere, with special reference to the sun. A mathematical investigation showing that, in the absence of knowledge as to the true direction of the light ray at the point where it meets the reversing layer and of its propagation in the layers through which it then passes, caution is needed in translating radial velocities into velocities of rotation.—M. **Javelle**: Observations of Halley's comet made at the Nice Observatory with the Gautier equatorial of 76 cm. aperture. Observations are given for November 3, 8, 10, 11, and 12, together with the positions of the comparison stars. The comet was extremely faint, being reduced on November 3 to a vague white spot about 1′ in extent, without visible condensation.—P. **Chofardet**: Observations of Cerulli's comet (1910c) made at the Observatory of Besançon with the bent equatorial. Data are given for November 10, 11, and 12. The comet appeared as a round nebulosity 30″ to 40″ in diameter, and was estimated to be of the eleventh magnitude.—M. **Coggia**: Observation of Cerulli's comet made at the Observatory of Marseilles with the Eichens equatorial of 26 cm. aperture. Data given for November 11.—Louis **Bachelier**: The movement of a point or material system submitted to the action of chance forces.—M. **Arnodin**: The bridge at La Cassagne (Gisclard system). An account of a suspension bridge of a new type constructed on the electric railway over the Pyrenees between Villefranche and Bourg.—Madame M. **Dussaud**: Discontinuous sources of light. A commutator is fixed on to the mechanism of a kinematograph in such a manner that the lamp is extinguished during the time that a forward step is made by the film, the latter being only illuminated when stationary. The advantages of this arrangement are enumerated.—Jean **Becquerel**: Polarised phosphorescence and the correlation between the polychroïsm of phosphorescence and the polychroïsm of absorption. An account of experiments on the phosphorescence of rubies at low temperatures (the boiling point of nitrogen). A change in the orientation of the exciting rays results, not in a change in the state of polarisation of each line, but a variation in the intensity emitted, and this variation may vary from one line in the spectrum to another. These results necessitate a modification of the views previously admitted.—A. **Cotton** and H. **Mouton**: The absolute measurement of the magnetic double refraction of nitrobenzene. Comparing the method previously described by the authors and that of Skinner on the same subject, a source of error has been discovered in the latter, and, allowing for this, both sets of measurements are in good agreement.—Edmond **Bauer** and Marcel **Moulin**: The blue colour of the sky and the constant of Avogadro. According to a theory of Lord Rayleigh, the blue colour of the sky is due to the dispersion of sunlight by the molecules of the air, and from this theory an expression is deduced giving the Avogadro constant N (the number of molecules in the gram-molecule), in terms of the ratio e/E (brightness of the sky to that of the sun), the dielectric constant of the air, the apparent diameter of the sun, and other measurable data. The measurement of the ratio e/E is the most difficult, too large a value being found in the presence of large particles. An account is given of determinations of this ratio carried out in August, 1910, at the Vallot Observatory at the summit of Mt. Blanc. The weather was unfortunately unfavourable, but the figures obtained were of the same order as those of Rutherford and J. Perrin, based on different considerations. The results are favourable to Lord Rayleigh's theory.—A. **Lafay**: The inversion of the Magnus phenomenon.—F. **Michaud**: A capillarimeter for the measurement of the surface tension of viscous liquids. The capillary tube is bent at right angles, and the horizontal portion placed just under the surface of the liquid. The liquid is brought to a fixed mark on the horizontal portion by the pressure of an indiarubber ball, and the hydrostatic pressure then measured.—L. **Grenet**: The tempering of bronze.—M. **Barre**: The double sulphates formed by the sulphates of lanthanum and cerium with the alkaline sulphates.—J. **Taffanel**: Safety explosives employed in mines. An account of experiments carried out at the testing station of the Central Committee of French Collieries. The results obtained showed the importance of freeing the hole from coal-dust before fixing in the cartridge; that paraffined paper as an envelope for the cartridge produced injurious effects was also made clear by these experiments.—A. **Besson** and L. **Fournier**: The reduction of phosphoryl chloride by hydrogen under the influence of the silent discharge. The main reaction is the formation of the oxide P_2O, hydrochloric acid, and water.—Marcel **Delépine**: The action of pyridine upon the iridodisulphates.—G. **Guillemin** and B. **Delachanal**: Research on the gases occluded in the copper alloys. The metals examined included various kinds of brass, bronze, phosphor bronze, and tin, and the gases were only given up after fusion in a vacuum. Carbon dioxide and hydrogen were present in all the metals examined, methane and carbon monoxide being also present in the majority of cases.—G. **Darzens**: A new method for the preparation of the glycidic esters. Ethyl dichloroacetate and acetone react readily in benzene solution with magnesium, α-chlor-β-oxyisovalerianic ethyl ester being formed. From this the theoretical yield of dimethylglycidic ethyl ester is readily prepared in theoretical yield by treatment with sodium ethylate.—Gabriel **Bertrand** and G. **Weisweiller**: The constitution of vicianose and vicianine.—Ch. **Mauguin**: Liquid crystals in convergent light.—Méd. **Gard**: A hydrid of *Fuscus platycorpus* and *F. ceranoides*.—Lucien **Daniel**: A perennial bean.—Jules **Amar**: The working of the human machine.—A. **Fernbach** and M. **Schœn**: The influence exerted by the reaction upon certain properties of malt extracts. The extracts were made neutral to different indicators, and the resistance to the effect of a rise of temperature and the increase in diastatic activity after keeping were measured.—L. **Launoy**: The toxicity of some mineral and organic compounds of arsenic: effect of repeated non-toxic doses.—Louis **Léger**: The muddy taste in certain fresh-water fish.—J. **Deprat**: The tectonic of Yun-nan.—Th. **Giangeaud**: The western edge of the Montbrison basin.—F. **Grandjean**: A measure of the lamination of sediments (limestones and schists) by means of the tourmaline crystals.

NEW SOUTH WALES.

Royal Society, June 1.—Mr. H. D. Walsh, president, in the chair.—G. H. **Knibbs**: Note on the influence of infantile mortality on birth-rate.—L. **Cohen**: The determination of alkali in arsenical dip-fluids.—Prof. A. C. **Haddon**: Note on Mr. L. Hargrave's paper, "Lope de Vega."—T. Harvey **Johnston**: Australian avian entozoa.—T. W. **Keele**: The great weather cycle.

July 6.—Prof. T. W. E. David, F.R.S., president, in the chair.—A. **Duckworth**: The respective limits of Federal and State legislation in regard to companies.—J. H. **Maiden**: Records of the earlier French botanists, as regards Australian botany.—Dr. W. G. **Woolnough**: Stone rolls, in the Bulli coal seam of N.S. Wales.—Dr. J. Burton **Cleland** and T. Harvey **Johnston**: Worm-nests in Australian cattle due to *Filaria* (*Onchocerca*) *gibsoni*, with notes on similar structure in camels.—T. Harvey **Johnston** and Dr. J. Burton **Cleland**: The anatomy and possible mode of transmission of *Filaria* (*Onchocerca*)

gibsoni.—C. F. **Laseron**: Palæontology of the Lower Shoalhaven River.

August 3.—Prof. David, F.R.S., president, in the chair.—A. **Duckworth**: White Australia.—Dr. J. Burton **Cleland** and T. Harvey **Johnston**: The hæmatozoa of Australian batrachians, No. 1. In this paper the authors give a list of frogs which were searched for the presence of hæmatozoa. In ten species, represented by thirty-four specimens examined, the results were negative, while in three species, represented by seven specimens, blood parasites were detected. A hæmogregarine, *Haemogregarina* (*Lankesterella*) *hylae*, infesting *Hyla caerulea* is described as new, and a trypanosome from *Lymnodynastes tasmaniensis* and *L. ornatus*? is regarded as being similar to, though probably not identical with, *Trypanosoma rotatorium*.—E. C. **Andrews**: An excursion to the Yosemite, or studies in the formation of Alpine cirques, steps, and valley treads. In a previous report (corrosion by gravity streams) the writer gave a general account of stream corrosion. In the present paper a more detailed account is given of the origin of the cirque, and the "steps" and "treads" of Alpine Valley. A special application of the principle put forward is made to the case of the Yosemite and associated valleys in California.—T. Harvey **Johnston** and Dr. J. Burton **Cleland**: A note on the occurrence of pentastomes in Australian cattle. In a short note the authors deal with the finding of larval pentastomes (*Linguatula serrata*) in the mesenteric glands of a number of cows in the Illawarra district. The hosts were all affected with endemic hæmaturia, and the discovery of these parasites suggests that they may perhaps play a rôle of much economic importance.—H. G. A. **Hardinge**: The condition of the atmosphere during the recent proximity of Halley's comet. Analyses were made of the atmosphere collected at an elevated locality in the neighbourhood of Hornsby about a week previous to the supposed date of contact (May 19) until a week following that event. There were no appreciable differences noted in the composition of the air during the whole of this time, neither did spectroscopic examination reveal any peculiarities.

CALCUTTA.

Asiatic Society of Bengal, November 2.—Panchanan **Neogi** and Birendra Bhusan **Adhicary**: Reactions in presence of nickel. (*a*) Inability of nitrogen and hydrogen to combine in presence of iron and nickel. (*b*) Reduction of the oxides of nitrogen, sulphur, and phosphorus in presence of nickel. Johnson showed that nitrogen and hydrogen combine directly to form ammonia in presence of heated spongy platinum. This was contradicted by Wright, who showed that the ammonia obtained by Johnson was due to the reduction of traces of nitric oxide contained in nitrogen. Ramsay and Young showed that traces of ammonia are formed by the direct combination of nitrogen and hydrogen in presence of red-hot iron filings. The authors show, however, that the two gases *do not* combine at all, provided the nitrogen is rendered absolutely free from nitric oxide and iron from carbon. It has also been shown that ammonia is not formed by passing the mixed gases over heated nickel. It is further shown that nitric oxide, sulphur dioxide, and phosphorus pentoxide are reduced to the corresponding hydrides by means of hydrogen in presence of reduced nickel. The mechanism of the reactions has also been studied.

DIARY OF SOCIETIES.

THURSDAY, NOVEMBER 24.

ROYAL SOCIETY, at 4.30.—On the Sequence of Chemical Forms in Stellar Spectra: Sir Norman Lockyer, K.C.B., F.R.S.—The Influence of Viscosity on the Stability of the Flow of Fluids: A. Mallock, F.R.S.—On Atmospheric Oscillations: Prof. Horace Lamb, F.R.S.—A Theory of the Chemical Action of the Electric Discharge in Electrolytic Gas and other Gases: Rev. P. J. Kirkby.—An Electrostatic Voltmeter for Photographic Recording of the Atmospheric Potential: G. W. Walker.—Optical Dispersion, an Analysis of its Actual Dependence upon Physical Conditions: Dr. T. H. Havelock.—The Spectrum of Halley's Comet: C. P. Butler.—A Geometrical Proof of the Theorem of a Double Six of Straight Lines: Dr. H. F. Baker, F.R.S.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—Street Lighting by Modern Electric Lamps: H. T. Harrison.

FRIDAY, NOVEMBER 25.

PHYSICAL SOCIETY, at 5.—The Electric Stress at which Ionisation begins in Air: Dr. A. Russell.—The After-glow produced in Gases by Electric Discharge: Prof. the Hon. R. J. Strutt, F.R.S.—Exhibition of a Surface-brightness Photometer: J. S. Dow.—The Approximate Solution of various Boundary Problems by Surface Integration combined with Freehand Graphs: L. F. Richardson.

MONDAY, NOVEMBER 28.

ROYAL SOCIETY OF ARTS, at 8.—Industrial Pyrometry: C. R. Darling.

INSTITUTE OF ACTUARIES, at 5.—Inaugural Address by the President: G. H. Ryan.

TUESDAY, NOVEMBER 29.

ROYAL ANTHROPOLOGICAL INSTITUTE, at 8.15.—Certain Physical Characters of the Negroes of the Congo Free State and Nigeria: Dr. A. Keith.—The Search for the Original Home of the Maori: A. W. Newman.

ZOOLOGICAL SOCIETY, at 8.30.—On a Possible Cause of Pneumo-enteritis in the Red Grouse (*Lagopus scoticus*): Dr. H. B. Fantham and H. Hammond Smith.—On the Alimentary Tract of certain Birds, and on the Mesenteric Relations of the Intestinal Loops: F. E. Beddard, F.R.S.—On the Specimens of Spotted Hyænas in the British Museum (Natural History): Prof. A. Cabrera.—The Development of *Solaster endeca* Forbes: Dr. J. F. Gemmill.

ROYAL SOCIETY OF ARTS, at 4.30.—The Progress and Prospects of Mining in Western Australia: A. Montgomery.

INSTITUTION OF CIVIL ENGINEERS, at 8.—*Further discussion*: Portland Cement, and the Question of its Aeration: H. K. G. Bamber.

WEDNESDAY, NOVEMBER 30.

ROYAL SOCIETY OF ARTS, at 8.—Argentina from a British Point of View: Campbell P. Ogilvie.

BRITISH ASTRONOMICAL ASSOCIATION, at 5.

THURSDAY, DECEMBER 1.

LINNEAN SOCIETY, at 8.—Spermatogonesis in Stenobothrus: Capt. C. F. U. Meek.—Reports on the International Botanical Congress at Brussels, 1910: Dr. Otto Stapf and others.

RÖNTGEN SOCIETY, at 8.15.—Osmotic Growths: Dr. Deane Butcher.

CONTENTS.