THURSDAY, JANUARY 4, 1906.

BRITISH PROGRESS IN ENGINEERING.

National Engineering and Trade Lectures. Edited by Ben H. Morgan. Vol. i., *British Progress in Municipal Engineering.* By W. H. Maxwell. Pp. 182. Price 6*s.* net. Vol. ii., *British Progress in Pumps and Pumping Engines.* By P. R. Björling. Pp. xii+92. Price 6*s.* net. Vol. iii., *British Progress in Gas Works' Plant and Machinery.* By C. E. Brackenbury, A.M.I.C.E. Pp. xii+105. Price 6*s.* net (London: Archibald Constable and Co., Ltd., 1905.)

THESE lectures, as they are termed, are stated to be "a project to stimulate and expand British trade in colonial and foreign markets," and their "primary object is to show colonial and foreign buyers what progress Great Britain has made up to the present time in the manufacture of all classes of machinery and goods. Each lecture will emphasise novel points of design and utility, and up-to-date methods of manufacture; and these points will be graphically illustrated by reproductions of photographs and drawings." They are, accordingly, evidently designed to have an advertising and business character, instead of the educational and instructive objects which are generally associated with lectures. Engineering is assigned the first place in the British industries to be dealt with; and the three volumes enumerated above are the first ones published of the engineering series, eleven more of which are stated to be in preparation by experts in the different branches.

The first of these books, relating to municipal engineering, is definitely divided into three lectures, the first commencing with an introductory review of the progress of sanitary science and the work of large British municipalities, and then proceeding to deal with road engineering and maintenance; the second lecture treats of sewerage and main drainage, and sewage and refuse disposal; and the third is devoted to water supply.

Each lecture contains more printed matter than could possibly be read within the usual allotted period of one hour, not allowing for any references to illustrations; whilst, on the other hand, the space given to these lectures is far too limited to enable these very important subjects, with their wide range, to be dealt with except in a very cursory manner. The aim, however, it must be remembered, of these so-called lectures is not to explain the principles and describe the practice of various branches of engineering, but to indicate to persons in the colonies and abroad, by the aid of illustrations and brief descriptions in some cases, what are considered the best materials and the newest and most useful types of machines for carrying out works in these different branches, and the names of the manufacturers in Great Britain who supply them. For this purpose, in addition to the names of manufacturers and companies, appended in many cases to references to municipal works, plant, and materials, in the text, and to the illustrations, a list is supplied at the end of each lecture of the various makers of the plant, machinery, tools, and materials used in the municipal works which it describes, occupying altogether forty-eight pages. A short appendix, also, at the end of the book, gives a very useful list of the literature bearing on municipal engineering, to assist persons desiring fuller information on the subjects referred to.

These lectures are well illustrated by 196 very clear figures and views, consisting of photographic reproductions and drawings, mostly in full-page plates, with a few folding ones; and a fairly full synopsis of each lecture, together with a list of the illustrations at the commencement of the book, is considered to serve the purpose of an index. Valuable particulars about certain important municipal works will be found here and there in the book; but, whereas the two succeeding volumes, on pumps and gas works, are fairly well suited for the business objects of these lectures, owing to their appertaining so closely to mechanical engineering, the scientific, biological, and civil engineering aspects of municipal works have had to be, to a large extent, sacrificed to the main purpose of these publications.

In the second volume of this series, a brief introduction indicates the importance of pumping and hydraulic machinery, and the main points that should be considered in the selection of pumps under different conditions; and the author then proceeds to describe, with the aid of illustrations, the principal types of pumps and pumping engines made by the chief British firms, pointing out the special features to be borne in mind in buying them, and the particular sort of work for which each form of pump is best adapted. Eight distinct classes of pumps are described in separate sections, namely, pumps worked by hand, pumps driven by water-power and wind-power, gas and oil engine, hot-air, and compressed air-pumps, electrically-driven pumps, and steam-pressure pumps; and the different forms of pumps in each class are given with the names of their makers, together with allusions to their merits in special cases, and any deficiencies in respect to certain conditions of work. Electricity is being rapidly extended as a motive power for pumps, especially for underground working in collieries and mines, and where the power has to be transmitted to a considerable distance; and the construction of directly-driven centrifugal pumps, pumps driven by single, double, and treble gearing, and by belt, the "Riedler" pump, and the sinking pump, is briefly explained. The descriptions of steam pumps occupy half the book, dealt with successively under the four types of direct-acting, rotative, pulsating, and rope- and belt-driven pumps. The book is illustrated by ninety-seven views and drawings of pumps, and at the end, after a short list of books on pumps and pumping-engines published in Great Britain, a directory of British manufacturers of these machines is given occupying twenty-one pages. As in the first volume, the table of contents and an unpaged list of plates are the only index provided in this and the succeeding volume; and the illustrated reference to the English De Laval centrifugal pumps

must have been added as an afterthought, as these pumps do not appear in the table of contents or in the list of plates. This volume should prove valuable in guiding persons requiring pumping machinery, both in the choice of the pump best suited to their requirements, and as to the firms from whom they can be purchased.

The third volume deals with the machinery employed in the various processes involved in the manufacture of coal-gas, such as the handling of coal, retorts, stoking, the removal of coke, condensers, exhausters, washer-scrubbers, purifiers, gasholders, and various gas appliances, with the names of the principal makers; but some of the subjects are referred to in a very cursory manner, two pages only being given, for instance, to water-gas plant, and also to the very important economic question of bye-products. The descriptions are illustrated by one hundred and thirteen views of plant and machinery; and following the principle adopted in the earlier volumes, a classified list of British gas-engineering literature is added at the end of the book, and also of British manufacturers of gasworks' plant and machinery, occupying respectively eleven and twenty-eight pages, amounting to two-fifths of the text of the book. The author holds very optimistic views as to the future of the gas industry, which he considers are borne out by the remarkable success of the recent Gas Exhibition at Earl's Court, and which, in spite of frequent gloomy prophecies of the injurious influence on it of the development of electric lighting, has more than doubled itself in the last twenty years.

Everything has been done on the publishers' part to render these volumes attractive, by very well reproduced illustrations, unusually large and wide-spaced print, good paper, neat binding, and a moderate price; and they may reasonably be expected to be very useful, from a commercial point of view, in making the scope and efficiency of British manufactures and machinery more fully known in the colonies and foreign countries, and thereby extending the range of British trade and engineering.

A STANDARD ATLAS OF ENGLAND AND WALES.

The Survey Atlas of England and Wales. A Series of 84 Plates of Maps and Plans, with Descriptive Text, illustrating the Topography, Physiography, Geology, Climate, and the Political and Commercial Features of the Country. Designed by and prepared under the direction of J. G. Bartholomew. (The Edinburgh Geographical Institute, 1903.) Price 2½ guineas.

THIS sumptuous volume, which began to be issued in parts in 1903, is a credit to all concerned with its publication. Mr. Bartholomew and the Royal Geographical Society are to be congratulated on adding a work of great beauty as well as of scientific merit to the resources of all who have to study England and Wales. These are a majority of the thoughtful members of the community, for "know thy country" is a maxim next in importance in the modern world to "know thyself." A work which concentrates in one volume the materials for a close study of its surface anatomy and human settlements and routes, as well as a general survey of its resources and activities, is a precious possession, which will increase in value as years pass, for it is the most condensed, yet clear and precise, summary of certain aspects of the material condition of England and Wales at the beginning of the twentieth century which the future historian will find within reasonable compass. What would present historians not give for similar records of the England of past centuries?

The present work may be divided into four parts:—(1) general geographical maps; (2) detailed topographical maps; (3) town plans; and (4) text and tables.

(1) The general maps are more complete than in any other atlas, although most of them have been published previously in another form. The first plate, the oro-bathymetrical map, is a new one, and contains names for the outstanding features of the land which may be regarded as at least semi-official. They were selected by Dr. Mill and Messrs. Chisholm and Mackinder at the request of the Royal Geographical Society. It is convenient to have such a set of names, and undoubtedly the greater number, even of those which are new or have had an extended significance given to them, will be generally accepted. There are, however, one or two exceptions. The term gap, which has been familiarised to us in recent years, more particularly in American writings, can hardly be applied to the broad lowland between Wales and the Pennines, though it may be used for the valleys of the Tyne and Aire, which afford narrow but easy routes across the Pennines. Norfolk Edge and East Anglian Ridge are other terms which seem to imply more pronounced topographical features than they represent. The Vale of Pickering seems unduly extended into that of York. We fail to discover any very clear rule as to what features should and should not be named. We find the Vale of York, but not the Vale of Trent or Severn; the Vale of Taunton, but not of Pewsey. While it is a pity that something more systematic and complete has not been attempted, some of the names are distinctly happy and will remain.

The geological map is unfortunately on a smaller scale than that in the companion "Atlas of Scotland," and hardly shows sufficient detail unless for the country south of London, which is shown on an inset. A smaller scale map illustrates the distribution of old, young, and coal-bearing rocks and iron centres. It is clear, but coal and iron are shown in greater detail on a map of mineral products which comes later. Maps of vegetation, lands in pasture or in crops, afford material for a long chapter in geography and economics. The next two sheets show maps of monthly and annual rainfall and temperature, driest and wettest months, the annual range of temperature, and the annual temperature not reduced for altitude. The subsequent two sheets depict the railways in black, the spheres of influence of the various companies being shown by different tints. We welcome

an attempt to illustrate the areas tributary to each railway company, which, if properly done, would be a most valuable guide to business men. The present map is hardly successful in showing more than the obvious, and in the crowded area of south Lancashire and the West Riding of Yorkshire, even when shown on a larger scale in an inset, the method adopted does not do justice to some of the lines. No attempt has been made to distinguish areas which are served by more than one railway; nor does the compiler seem to have taken configuration into account in preparing the map. No doubt the details can be worked out on the half-inch maps which come later, but what might have been a very effective and useful map is somewhat spoilt. It resembles a rough railway company diagram rather than the other maps of the atlas.

The density of population maps by Mr. Bosse, in which the uninhabited area is first marked off, are clear, and reveal a multitude of points not indicated on maps which show the density of population by counties. They form a very effective contrast to two maps showing densities of agricultural, of industrial and commercial population by counties, which, however, summarise the more obvious contrasts of density and of distribution. Administrative divisions, political and ecclesiastical, a commercial and a mineral map end the first section of the atlas.

(2) It is scarcely necessary to direct attention to the merits of Bartholomew's half-inch contoured map, which everyone uses who cycles or motors. It is beautifully printed on sixty-seven sections. The contour lines, as on the Ordnance maps, are shown for every 100 feet up to 1000 feet, and for every 250 feet above that. The areas between each consecutive 100 feet up to 400 feet are tinted in shades of lighter and lighter green, between each 200 feet to 1000 feet, and then between each 250 feet, in deepening shades of brown, a purplish tint being used for the bands between 2750 feet and 3000 feet. This is a reasonable compromise, but for students of orographical features a single colour in different shades would give a clearer picture. The great defect of our Ordnance maps is the absence of a closer contour interval, and for the inadequacy of the existing data in exhibiting the characteristics of the relief Mr. Bartholomew cannot be held responsible.

These maps are wonderfully accurate; in some places they are more up to date than the survey sheets. Only here and there have we detected minor errors. The arrangement of the sections in the atlas is confusing. The numbers zigzag in such a way that it is not possible, without turning to the sheet inside or to the key map, to discover whether they run eastwards or westwards. This difficulty might have been avoided by printing a key map beneath the number outside each sheet and shading the area of the section drawn inside.

(3) The town plans call for little comment, except that they should have been on a uniform scale.

(4) The text consists of clear descriptions of the physical features in relation to political and commercial development by Dr. Mill, with one or two slips, and of the geological features by Sir Archibald Geikie; temperature and rainfall tables for more than a hundred stations (the latter, unfortunately, only for a ten years' mean); agricultural, population, ecclesiastical, demographic, political, commercial, industrial, and railway statistics; a list of railways; the etymology of English and Welsh place-names; and an invaluable bibliography of the maps of the country from the earliest times, specially compiled by Mr. Bartholomew.

It will be seen that the atlas deserves its comprehensive title. The time and art required to produce it have been great, and Mr. Bartholomew very properly makes due acknowledgments to his skilled assistants. The execution is admirable, and the work is not merely one of great scientific importance, but also a specimen of cartography worthy of the reputation of the house of Bartholomew.

LEATHER FOR BOOKBINDING.

Report of the Committee on Leather for Bookbinding. Edited for the Society of Arts and the Worshipful Company of Leathersellers by the Right Hon. Viscount Cobham and Sir Henry Trueman Wood. Pp. 120. (London: George Bell and Sons, 1905.) Price 10*s.* 6*d.*

IN recent years there has been considerable dissatisfaction with the quality of leather used for bookbinding; although many old books have their bindings still in good condition, others more recently bound have become dilapidated. In 1899 the School of Arts and Crafts formed a committee for the investigation of the subject, which appealed later to the council of the Society of Arts requesting it to undertake a thorough examination of the whole question, and in February, 1900, the society agreed to appoint a committee for the purpose. The first meeting was held in May, 1900, and two subcommittees were elected from the members; the first, consisting of Mr. Cyril Davenport, of the British Museum Library; Dr. J. Gordon Parker, director of the London Leather Industries' Research Laboratories; Mr. A. Seymour-Jones, leather manufacturer; Mr. W. J. Leighton, bookbinder; and Mr. Douglas Cockerell, bookbinder, was to visit various libraries to ascertain the comparative duration of various leathers used at different periods and preserved under different conditions. The second subcommittee consisted of Dr. J. Gordon Parker, Prof. Henry R. Procter, professor of leather industries at Leeds University, and Mr. A. Seymour-Jones; its duty was to ascertain the cause of any deterioration noticed and to suggest methods for its prevention. Mr. M. C. Lamb, director of the leather dyeing and finishing department of Herold's Institute, was afterwards added to this committee.

The committee reported in June, 1901, and the report was printed in the *Journal* of the Society of July 5. It was considered desirable to reprint the report in a more permanent form, and with the financial assistance of the Leathersellers' Company the present volume has been produced, which contains more detailed accounts of the work of the subcommittees

than were contained in the appendices to the original report.

It was found that all the bindings examined showed evidence of decay, but the books bound during the last 80 or 100 years were in a worse condition than many of those of an earlier date; some recent binding had deteriorated in as short a period as five years. The deterioration became more general in books bound after 1830; some leather seemed to be good until 1860, after which date nearly all leather appeared to get worse.

Besides the quality of the leather, the conditions under which books are kept have a great influence on the durability of the bindings. When ventilation is good and artificial light is not used the books are in a better condition. The products of the combustion of gas do much mischief, especially on the upper shelves of a library, where the temperature is often considerably raised by the heat from the flames. Sad to relate, tobacco smoke is said to be deleterious. Daylight, and especially direct sunlight, has a bad effect on some leathers and also on the colours of the dyes.

The report discusses fully the durability of the different kinds of leathers which have been used for bookbinding and also the construction of bindings; a specification for binding heavy or valuable books and also one for ordinary library binding are given.

The second subcommittee investigated the cause of decay by many experiments. Three different kinds of skins were tanned with eleven different agents, the tanning process being modified in portions of the specimens. Small strips of the leathers were fastened on boards with one half of each strip exposed and then submitted to various actions—direct sunlight, light from a fish-tail gas-burner, light from an incandescent gas-burner and from an incandescent electric lamp, the fumes and heat of burning gas, currents of moist and dry air alternately in a closed vessel kept at a temperature of 60° to 70° F., carbonic acid gas, and sunlight, but protected from air by glass; the results of many of these experiments are shown by excellent coloured plates.

Experiments were made with purchased leathers, most of which were found to contain free sulphuric acid; this acid has been used of recent years for brightening the colour of bark-tanned calf, from which it removes the iron and tan stains, and much improves the appearance of the material. It was found that in every case the presence of sulphuric acid hastened the destruction of the leather by all the agents tried. The sulphuric acid cannot be entirely removed from the leather by washing with water; a piece of leather containing 1 per cent. of sulphuric acid was washed for five days and nights in running water, and was afterwards found to contain one-fifth of the original quantity of acid. It was found, however, that if leather containing sulphuric acid is washed with potassium or sodium lactate or acetate the effects of the sulphuric acid are neutralised.

Sulphuric acid is also introduced into leather by the pickling which is used for preserving skins that are imported from New Zealand and Australia, the process consisting of acting on the skins with a solution of salt and sulphuric acid. Mr. Seymour-Jones has shown that formic acid may be used in the place of sulphuric acid, and is quite as efficacious. Sulphuric acid is employed in the dye bath for the purpose of liberating certain colours; it has been found that in this case also formic acid may be substituted.

Mr. Seymour-Jones has made a number of determinations of the mechanical strength of skins in their original condition, and also after tanning and other processes; it was found that the breaking stress of the leather is always below that of the original skin.

Valuable sections on the preparation of leather suitable for bookbinding, on bookbinding, and on the preservation of books appear in the report. Appendix i. consists of hints to owners and keepers of libraries by the chairman, Lord Cobham. Appendix ii. is on the fading of colour from sumach-tanned leather dyed with coal-tar colours, by Mr. M. C. Lamb, and is illustrated by coloured plates.

The book is excellently printed and illustrated, and inside the cover are specimens of six varieties of leather in their undyed and dyed conditions. The report should be read by all interested in books and libraries. H. M.

OUR BOOK SHELF.

A Treatise on Ore and Stone Mining. By Sir C. Le Neve Foster. Sixth edition, revised and enlarged by Bennett H. Brough. Pp. xxx+799. (London: Charles Griffin and Co., Ltd., 1905.) Price 34s.

THIS book, when it first appeared in 1894, was the first systematic treatise on mining published in England, and was quite up to date; but later editions were not sufficiently revised, and the hand of death put an end to the gifted author's intentions of rewriting the work. The preparation of a new edition could not have been entrusted to more competent hands than those of his old colleague Mr. Bennett H. Brough. The general arrangement of the book is the same as in former editions, except that chapter xiv., "Principles of Employment of Mining Labour," has become chapter xvii.

The revision of the whole work has been very thorough; recent discoveries of important occurrences of minerals and new methods of mining and treating ores have been brought up to date, while other methods, machinery and appliances, which have been superseded during the last few years, are omitted from this edition.

Additions to the work are interspersed throughout, so that it is difficult to make selections. More prominence is given to the important iron-ore deposits of Sweden and Norway, also to those of Spain. The various kinds of steam turbines, which may, under certain conditions, be used to advantage as motors for pumps, are briefly described. A considerable addition has been made to the list of important percussive rock drills now on the market. The Water Leyner rock drill with its water-flushing apparatus, which tends to prevent miners' phthisis, is introduced to the reader, and the recent important investigations of Dr. Haldane and Mr. Thomas into the mortality of Cornish miners receive the attention they deserve.

We find no mention in chapter vii.—"Haulage"—of Koppel's hydroleum steam locomotive, which is in use at some mines in Great Britain and elsewhere for underground haulage, and deserves to be better known. A 10-horse-power locomotive costs 285*l.*, and burns on an average 1½ gallons an hour of crude petroleum, which can be bought for 3*d.* a gallon. Acetylene hand lamps (p. 544) are also used at some of the mines in Great Britain, while one mine at least has had its pass-byes illuminated for years by 30-candle-power acetylene burners supplied from a small generating plant.

We would warn the mining student not to make a pilgrimage to the Frongoch Mine, mentioned more than once, as, unfortunately, the whole of the fine electrical and dressing plant has passed under the auctioneer's hammer and been dismantled.

The amount of accurate and up-to-date information contained in this volume is enormous. No mining student at home can afford to neglect it, and it is a library in itself to mining engineers who go abroad.

The Useful Plants of the Island of Guam. By W. E. Safford. Pp. 416. (Washington: Government Printing Office, 1905.)

DURING the last few years there has been a remarkable advance in the application of scientific knowledge to the cultivation of economic products, and as a result there has arisen a demand for authoritative books providing accurate and recent information. The Department of Agriculture in the United States of America has taken the lead with its useful series of bulletins of an eminently practical nature. In addition there is need of handbooks, similar to this volume by Mr. Safford, which give a comprehensive account of the products of a country or colony. Dr. Watt's dictionary of the economic products of India is a monumental compilation dealing with an area that embraces tropical, subtropical, and mountainous regions, and describes not only indigenous products, but another fifty per cent. of introduced plants; in its present form, size and cost preclude its general use, although it is a valuable work of reference.

The island of Guam, about 100 miles in circumference, is the largest of the Ladrone or Marianne Islands, and passed into the possession of the Americans after the late war, while the rest of the islands were sold by Spain to Germany. The author had many opportunities of studying the islanders and different parts of the island, and made excellent use of this advantage, so that his information is the result of personal observation and inquiry. The introduction, forming nearly half the book, contains a general account of the history, physical conditions, vegetation, fauna, and ethnology, while in the second part is given an alphabetical list of plants with vernacular names and descriptions. Mr. Safford formed a very favourable opinion of the islanders. Agriculture is universally pursued, and even the artificers leave their trade from time to time to attend to the *rancho*. Maize is the principal food crop, rice is grown, but not in sufficient quantity to supply the demand, and taro and yams are cultivated as well as tobacco. Coffee is grown round most of the habitations, requiring little attention, and plantains and bread-fruit thrive luxuriously. Although copra provides the only article of export, the number of economic plants that are indigenous or have been introduced is exceedingly large, so that the list of plants and the information provided would be useful in many tropical countries. Of fibre-yielding plants twenty-three are recorded, including pine-apple, ramie, kapok, cocoa-nut, plantain, Manila hemp, Sida and a Pandanus, but the most valued plant is *Hibiscus tiliaceus*, from which the natives make all their cordage and cables. The island will produce plenty of citrus and other fruits, and several farinaceous and oil-yielding plants were observed. The book is lavishly supplied with excellent illustrations and the information is readily obtainable; in fact, the volume supplies a good model for future compilations of a similar nature, the main defect being a somewhat unusual nomenclature, which does not, however, cause any difficulty in the determination of the plants referred to.

The British Journal Photographic Almanac and Photographer's Daily Companion for 1906. Edited by George E. Brown. (London: Henry Greenwood and Co., 1905.) Price 1*s.* net; 1*s.* 6*d.* cloth.

THE present issue of this year-book appears under the direction of a new editor, Mr. G. E. Brown, but the contents in no way suffer from this change. As has always been the case, and still is, this work is a compendium of everything pertaining to photography, and the photographer would be at a loss if he had not the volume near at hand for ready reference. Under the new guidance, the material brought together is all that could be desired, and in order that any particular portion of it can be looked up at once there is a full "contents" and an elaborate index.

Other features of this annual consist in a capital popular account of photographic copyright as it exists to-day, a most interesting and varied "epitome of progress," being a survey, logically classified, of the year's labour in both technical and scientific photography, and articles contributed by leading writers. The directory of photographic societies, formulæ for the principal photographic processes, and other facts have all been secured and brought up to date, rendering the volume indispensable to the busy photographer.

Nature in Eastern Norfolk. By Arthur H. Patterson. Pp. vii+352. (London: Methuen and Co., 1905.) Price 6*s.*

THIS book contains some very pleasant reading, for Mr. Patterson is a born naturalist, and writes with freshness and enthusiasm. Not the least interesting chapter is the autobiographical one, in which the author tells the story of his early passion for natural history, his painful struggles to gratify it, and his later misadventures, with much relish and humour. We gather that he has at last settled down to a homely life in his beloved native town, and hope that he may long continue in it. The second chapter, general observations on the fauna, is also very good reading, and here the human species is well represented by short but vigorous sketches of old punt-gunners and bird-catchers. The rest of the book is occupied with lists of birds, mammals, fishes, &c.; these naturally do not offer much that is new in a district that has been so thoroughly worked as east Norfolk, but they are often enlivened by anecdotes or personal reminiscences. The discovery of the black rat (*Mus rattus*) as a common species in Yarmouth is extremely interesting, and still more so is the occurrence of a few specimens of *M. alexandrinus*, its southern variety. Other contributions of Mr. Patterson to the natural history of the district are to be found in these pages; most of them are already known to members of the Norfolk and Norwich Naturalists' Society.

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 British Association and our Colonies.

PROF. MILNE'S letter in NATURE of November 23 (p. 77) will be read with pleasure by all scientific people in the colonies. The benefits to be derived from a colonial meeting such as he suggests are many and various, and I have no doubt will receive full consideration should the idea be given effect to.

Here in Africa, one piece of work which the British Association is the natural body to take up is that of the magnetic survey of the whole continent. The great lack of trustworthy data for immense tracts of this continent has been often commented on. When we remember how much of the continent is in British hands, and how the British Association since its inception has steadily helped and encouraged the study of earth magnetism, the fitness of bringing such a proposal before the association is apparent. At such a conference the possibility of a simultaneous magnetic survey of Australia would naturally be considered. Could these two surveys be carried out—even if very incompletely—they, with the surveys at present in progress and with the proposed ocean surveys of the Carnegie Institution, would form an invaluable contribution to our present knowledge of earth magnetism.

Africa has many other problems—educational, exploratational, meteorological—the solution of which would be helped were they taken up at such a conference.

J. C. BEATTIE.

South African College, Cape Town, December 12, 1905.

Monotremes and Birds.

IN Semon's *Zoologische Forschungsreisen*, Lieferung xxii. (1904), Disselhorst treats of "Die maennlichen Geschlechtsorgane der monotremen und einiger Marsupialen." On p. 123 are two text figures, both copied from Sir Everard Home, *Phil. Trans.*, 1802, plate xii. One represents the male genital apparatus of *Echidna hystrix*, the other, Fig. 1B of the German work, the stretched male organ of the same animal. Now this Fig. B is, in Home's paper, correctly named "penis of the Drake." Needless to say, this Drake's organ does not in the least agree with that of Echidna, as which it is described in the German work, and our author is sorely puzzled about some of the details, *cf.* p. 131. This may well be the case. Errors and blunders have been made ere now, but the seriocomic point is that this Drake figure has, in the process of reproduction, assumed mammalian characters. In the original figure the base is surrounded by well-drawn feathers, and such are mentioned in the explanation of the plate. The thing is also correctly copied by Owen in his article Aves in Todd's "Cyclopædia," further in the "Anatomy of Vertebrates," vol. ii., Fig. 119, and Owen directs attention to an important error committed by Home in his interpretation of the urethra. But in the recent figure, wrongly attributed to Echidna, the feathers have lost their character as such, and have turned into hairy structures! Who has done this? The author or the artist, or have both combined to correct the faulty original? It is such a strikingly pretty figure that it is almost sure to be propagated, perhaps to be used as a proof of the affinity of the oviparous mammals. But a drake is a drake, for all that.

H. GADOW.

University Museum of Zoology, Cambridge, December 20.

Sounding Stones at Ch'üfu, Shantung.

LAST July I happened to pass through Ch'üfu, the birth- and burial-place of Confucius. In "seeing the sights" of the town I found three very fine examples of "sounding stones," or "stone gongs" as they are sometimes called. These particular examples do not seem to be very well known except by Chinese; none of my foreign acquaintances who have been in Ch'üfu had noticed them. Photo. No. 1 shows the tomb of the grandson of Confucius. The cover of the incense dish (on which my servant is resting his hand) is made from stone, but when struck with a stick, or even with the knuckles, it rings as though it were bronze. In fact, my man in the photograph refused to believe that it was anything but painted bronze until I myself assured him to the contrary. Photo. No. 2 shows two pillars (marked with crosses) of the balustrade in front of the principal hall of the great Confucian temple at Ch'üfu. Struck at any point with a piece of wood, they give a distinct musical note.

FIG. 1.—Grave of the grandson of Confucius. Cemetery of the K'ung family, Ch'üfu, Shantung.

Inside the temple is a large tablet, about $5 \times 3 \times \frac{1}{2}$ feet, of the same stone. In this case the note produced varies according to the point at which the stone is struck. The stone from which all these bodies is made is a greyish oolitic limestone. I was informed that it came from a quarry at Kwan Ko Shan, about seventeen miles south-east of Ch'üfu. Most of the stone from this place has no musical quality, but from time to time veins of it are found, and when found it is usually abundant. "Stone gongs" of this kind are found in all parts of the country, and some are in the possession of foreigners. So far as I can find out, they all come from this one locality. They have been known for many centuries, and it is recorded that the district from which they come paid its share of a certain special Imperial tax in "sounding stones." I should be pleased if any reader could give the cause of this very remarkable property, and if it is not understood I would gladly give what help I can towards elucidating it. During this journey I was pressed for time, and as my route lay directly east from Ch'üfu I was not able to visit

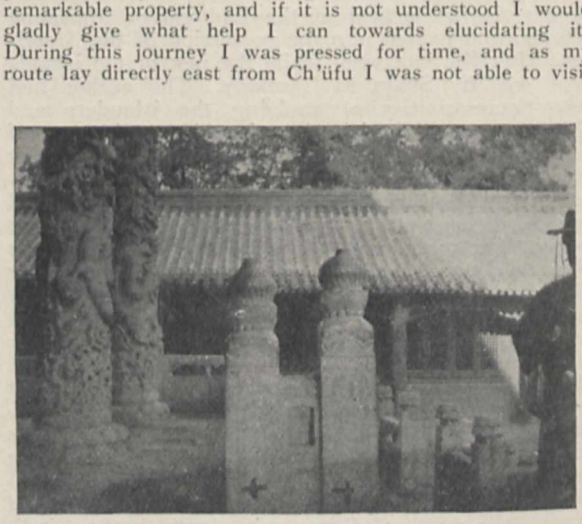

FIG. 2.—Detail of Confucian Temple, Ch'üfu. Shantung.

the quarry. Should there be any object in doing so, however, I will take the first opportunity of returning and making any observations that I may be asked to make. Such an opportunity may occur at any time, and, in fact, could be easily made to occur, as the journey would only

take four days each way. I am afraid, however, that it might prove very difficult to secure any sample of this stone for transportation to Europe. ALFRED TINGLE.

Chinanfu, Shantung, China, November 9, 1905.

Auroræ of November 15 and December 12.

SINCE my communication of December 9 (NATURE, December 28), I have learned that the aurora borealis of November 15 was observed here by several persons between 8.30 p.m. and 9.30 p.m., Halifax time. The appearances were similar to those noted in England (NATURE, November 23, pp. 79–80), and the rosy-red streamers seem to have attracted special attention.

I am also informed that an aurora was observed here last night (December 12) at 9.30 p.m. with whitish streamers, but lacking the display of colour observed November 15.

It is somewhat noteworthy that the interval November 15 to December 12 covers a period of twenty-seven days—the time required for one complete rotation of the sun.

ALEXANDER GRAHAM BELL.

Beinn Bhreagh, near Baddeck, Nova Scotia,
December 13, 1905.

The Principles of Heredity.

I HAVE every reason to be satisfied with the kind and indulgent review (December 7, p. 121) by "A. D. D." of my book "The Principles of Heredity," but there is one sentence of it on which I should like to comment, more particularly as it contains nothing of blame or praise. "A. D. D." writes, "this book . . . is an embodiment of the recognition by medical men that they depend ultimately for a precise knowledge of nature on the professional biologist—who may or may not, at the same time, be a medical man."

But really I do not think that. On the contrary, I believe it is easily capable of demonstration that the information already in the hands of all medical men is incomparably superior, both in precision and volume, to anything ever possessed, or likely to be possessed, by biologists. It has not been utilised, that is all. The blame does not rest wholly with the medical man. His strictly professional curriculum is burdened by a monstrous but necessary load of facts. His one chance of coming in contact with subjects of general interest and of acquiring habits of sustained and accurate thought lies in the purely scientific part of his curriculum. Here his teachers are biologists who, instead of inculcating wide principles of heredity and evolution, add to the load on his memory by supplying irrelevant scraps of information about jelly-fish, earthworms, cockchafers, and the like—irrelevant, for, in the form they are presented, they do not link up with the studies and interests of his future career, and therefore are forgotten as soon as may be. "A. D. D." complains that I do not sufficiently appreciate classical teaching. It may console him to know that my appreciation of a certain class of scientific teaching is just as—well, hearty.

The biologist has surpassed the medical man in the study of great problems only because his attention has been directed to the subject, and because, on the whole, his habits of thought—not information—have been more precise. Had the medical man received the training of the biologist, or the biologist possessed the information common to medical men, the progress of science would have been much more rapid, and few or none of the great biological controversies of the past would have arisen, or at least have endured the interminable time they did; for example, the disputes as to whether natural selection is the cause or the sole cause of evolution, as to whether acquired characters are transmissible, as to whether variations are due to the direct action of the environment, as to whether evolution proceeds on lines of "fluctuating" variations or of discontinuous "mutations," as to the function of sex, and so forth.

Of necessity we—that is, all men—know the human type better than we can possibly know any other. Provided we know what to look for, extreme familiarity enables us to observe the smallest variations. No shepherd knows his flock, no biologist knows animal or plant as the medical man knows his fellow man. The species has diverged into a large number of natural varieties, dwelling under immensely diverse conditions and differing vastly in every peculiarity of body and mind. All these varieties, apparently, are inter-fertile, and almost all of them, in bulk or in isolated cases, have crossed with almost every other variety. Hybrids are being reared every day, and many races are compound hybrids—*e.g.* the Caucasian-Negro-Indian inhabitants of parts of South America. Above all, the species is being stringently selected and is undergoing rapid evolution under the action of disease, an agency which furnishes the most perfect series of experiments in heredity and evolution imaginable. Every race is resistant to every disease strictly in proportion to its past experience of it. Some diseases are short and sharp, others are of long duration. Some are local, others fill the whole system with micro-organisms or bathe the germ-cells with toxins. Many diseases are new to many races; others they have afflicted for thousands of years. If ever acquirements are transmitted, however "faintly and fitfully," it should be in the case of disease. If ever variations, no matter how small, are caused by the direct action of the environment, a race long afflicted should show the trace. If Mendelian phenomena play an important part in nature, we should note them in crossed varieties of men. If evolution proceeds on lines, not of fluctuating variations, but of stable mutations "which only selection can eliminate," then races (*e.g.* British) which have become highly resistant to this or that disease (*e.g.* consumption) should not constantly produce individuals who are as susceptible as members of a race which has undergone no such evolution (*e.g.* Red Indian).

Unless heredity in man differs from heredity in other species, it is very evident that medical men have no need to go to biologists for precise information, but that there is every need that biologists should go to medical men. A vast fund of minutely accurate data, much of which is statistical, is available. To grope in the obscurity that necessarily surrounds the past and the present of wild species or amid the confusion of the unrecorded crosses of domesticated varieties while this fund is untouched may be magnificent, but it is not science.

Southsea, December 11, 1905. G. ARCHDALL REID.

DR. REID takes exception to a passage in my review of his book; in it I state my belief that his book is the embodiment of a certain opinion, but Dr. Reid writes to say that he does not hold this view at all. It is not necessary, nor would it be profitable if it were, to discuss who is right in this matter—he or I—for obviously I am guilty of misrepresenting Dr. Reid's opinion.

But that the medical man is capable of acquiring a precise knowledge of nature independently of the information already gained and the methods employed by the biologist does not seem to me to be by any means certain. Dr. Reid thinks it is, and brings forward as evidence the fact that doctors possess better data for the solution of problems of evolution than ever have been, or can be, possessed by the biologist. Now, even supposing this to be true—which I do not for a moment—it does not seem to me to prove Dr. Reid's point. Either he thinks that the possession of data is tantamount to a precise knowledge of nature, or he does not; if he does, he proves his point by introducing into his syllogism a premiss which I believe to be untrue; if he does not—and I do not believe that he does—he does not prove his point.

But be this as it may, the point that interests me is that the belief that there is no great step between the collection of data and the derivation from them of a precise knowledge of nature is a widespread and, I believe, a profoundly erroneous one; for it seems to me that the possession of data is a small advance towards such a precise knowledge, and that that which hinders the acquisition of natural knowledge is not the slowness with which facts are accumulated, but the paucity of investigators capable of dealing with them properly; and this dearth is due to the infection of the majority of biologists by a disease—a sort of sleeping sickness—which consists in a disinclination to picture to the mind's eye the things represented by the words they use.

Let us proceed to examine Dr. Reid's main thesis—that

the medical man has better material for the study of evolution than any biologist has had or can have, for the reason, says Dr. Reid, that the animal about which we know infinitely more than we do about any other is man himself. And further than this, he maintains that a knowledge of the relation of man to disease has already furnished us with solutions to such problems as that of the inheritance of use and disuse, and others which he names. Now if the reader is familiar with Prof. Ray Lankester's Romanes Lecture, he will immediately see that great caution must be exercised.

Prof. Lankester in this lecture showed that, though man was a part of nature, he had separated himself from nature, and had set up for himself a *regnum hominis*, where, to use Huxley's terms, the cosmic process was replaced by the horticultural. Man had—if we may use a picturesque expression which has no meaning—disobeyed nature's laws, and had become in Prof. Lankester's words "nature's rebel."

Moreover, it was in the very matter of disease, on which Dr. Reid bases so much, that man had become more different from the rest of nature than in any other respect.

Disease has no existence in nature apart from man; the parasite either kills his host or an equilibrium is established between the two and both continue to live together; whereas in man a state of affairs has been evolved which is entirely peculiar to him, namely, disease.

Now I maintain that these considerations should prevent us from being too willing, or even from being willing at all, to argue from the data that medical men possess concerning the human species, and particularly from the data concerning man's relation to disease, to the rest of nature.

I am sometimes asked, "Is the knowledge of heredity which you acquire from your experiments with mice likely to be applicable to man?" In my opinion the question which the pure biologist should seriously consider before he accepts the truth of Dr. Reid's contention is, "Is the knowledge of heredity acquired by observation on man likely to be applicable to mice? Is that knowledge likely to help him towards a closer acquaintance with the fundamental nature of living things?" My answer is, that it may do to a certain degree, but not so surely as will the kind of knowledge acquired by the pure biologist—a knowledge of nature outside the *regnum hominis*.

Biologists are still very anthropomorphic, and medical men still more so. To the pure biologist man is not a more interesting animal than any other; and, in fact, it might be urged with some justice that as "nature's rebel" he is less so. I am well aware that this view will find no favour with Dr. Reid. On the other hand, Dr. Reid's estimate of the value of the breeding-pen, as an instrument for acquiring a knowledge of heredity, is likely to find as little favour with the experimental breeder. Yet who can say that the one has more of truth in his opinion than the other?

Naturally each one thinks that the point of view from which, and the material with which, he works at a problem is the best, but I am willing to concede to Dr. Reid the point that, considered as material for dealing with heredity, men are nearly as good as mice, if he will allow that mice are nearly as good as men. A. D. D.

A Suggested Change in Nomenclature.

In the *Geological Magazine* for October, 1904, I gave the name Barypoda to a new order of Ungulates, including under it Arsinoitherium and its allies. It has just been pointed out to me by Mr. W. K. Gregory, of the American Museum of Natural History, that this name was previously used by Haeckel ("Generelle Morphologie," ii., p. clvii.) for certain groups of extinct marsupials. It is therefore advisable to suggest another name for the new division of the Ungulates, and I propose that Embrithopoda be employed.

In the case of a generic name, it is comparatively easy to determine with reasonable certainty whether it has been previously used or not, but with the names of higher subdivisions this is very difficult, especially when, as in the present case, the term has never passed into current use.

CHAS. W. ANDREWS.

British Museum (Natural History), London, S.W., December 29, 1905.

NOTES ON STONEHENGE.[1]

X.—Sacred Fires.

THE magnificent collection of facts bearing on this subject which has been brought together by Mr. Frazer in "The Golden Bough" renders it unnecessary for me to deal with the details of this part of my subject at any great length.

We have these records of fires:—

(1) In February, May, August and November of the original May year.

(2) In June and December on the longest and shortest days of the astronomical year (the solstices), concerning which there could not be, and has not been, any such change of date as has occurred in relation to the May year festivals.

(3) A fire at Easter, in all probability added not long before or at the introduction of Christianity. I find no traces of a fire festival at the corresponding equinox in September.

We learn from Cormac that the fires were generally double and that cattle were driven between them.

Concerning this question of fire, both Mr. Frazer and the Rev. S. Baring-Gould[2] suggest that we are justified in considering the Christian treatment of the sacred fire as a survival of pagan times. Mr. Baring-Gould writes as follows:—"When Christianity became dominant, it was necessary to dissociate the ideas of the people from the central fire as mixed up with the old gods; at the same time the central fire was an absolute need. Accordingly the Church was converted into the sacred depository of the perpetual fire."

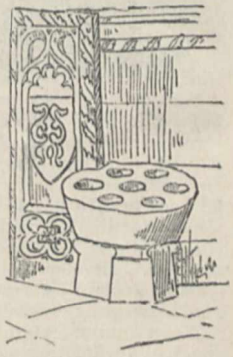

FIG. 24.—Cresset-stone, Lewannick. From Baring-Gould's "Strange Survivals."

He further points out that there still remain in some of our churches (in Cornwall, York, and Dorset) the contrivances—now called cresset-stones—used. They are blocks of stone with cups hollowed out. Some are placed in lamp-niches furnished with flues. On these he remarks (p. 122):—

"Now although these lamps and cressets had their religious signification, yet this religious signification was an afterthought. The origin of them lay in the necessity of there being in every place a central light, from which light could at any time be borrowed; and the reason why this central light was put in the church was to dissociate it from the heathen ideas attached formerly to it. As it was, the good people of the Middle Ages were not quite satisfied with the central church fire, and they had recourse in times of emergency to others—and as the Church deemed them—unholy fires. When a plague and murrain appeared among cattle, then they lighted need-fires from two pieces of dry wood, and drove the cattle between the flames, believing that this new flame was wholesome to the purging away of the disease. For kindling the need-fires the employment of flint and steel was forbidden. The fire was only efficacious when extracted in prehistoric fashion, out of wood. The lighting of these need-fires was forbidden by the Church in the eighth century. What shows that this need-fire was distinctly heathen is that in the Church new fire was obtained at Easter annually by striking flint and steel together. It was supposed that the old fire in a

[1] Continued from p. 155.

[2] "Strange Survivals," p. 120 *et seq.*

twelvemonth had got exhausted, or perhaps that all light expired with Christ, and that new fire must be obtained. Accordingly the priest solemnly struck new fire out of flint and steel. But fire from flint and steel was a novelty; and the people, Pagan at heart, had no confidence in it, and in time of adversity went back to the need-fire kindled in the time-honoured way from wood by friction, before this new-fangled way of drawing it out of stone and iron was invented."

The same authority informs us that before Christianity was introduced into Ireland by St. Patrick there was a temple at Tara "where fire burned ever, and was on no account suffered to go out."

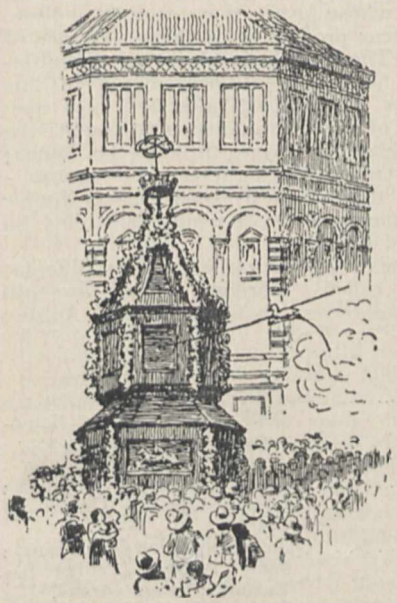

FIG. 25.—The Carro, Florence. From Baring-Gould's "Strange Survivals."

Mr. Frazer,[1] quoting Cerbied, shows that in the ancient religion of Armenia the new fire was kindled at the February festival of the May year, in honour of the fire god Mihr. "A bonfire was made in a public place and lamps kindled at it were kept burning throughout the year in each of the fire-god's temples." This festival now takes place at Candlemas, February 2.

We must assume, then, that the pagan fires were produced by the friction of dry wood, and possibly in connection with an ever-burning fire. In either case the priests officiating at the various circles must have had a place handy where the wood was kept dry or the fire kept burning, and on this ground alone we may again inquire whether such structures as Maeshowe at the Stenness circle, the Fougou at that of the Merry Maidens, and indeed chambered barrows and cairns generally, were not used for these purposes amongst others; whether indeed they were not primarily built for the living and not for the dead, and whether this will explain the finding of traces of fires and of hollowed stones in them, as well as some points in their structure. Mr. MacRitchie[2] has brought together several of these points, among them fireplaces and flues for carrying away smoke.

At both solstices it would appear that a special fire-rite was practised. This consisted of tying straw on a wheel and rolling it when lighted down a hill. There is much evidence for the wheel at the summer but less at the winter solstice; still, we learn from the old Runic *fasti* that a wheel was used to denote the festival of Christmas. With regard to the summer solstice I quote the following from Hazlitt (under John, St.):—

"Durandus, speaking of the rites of the Feast of St. John Baptist, informs us of this curious circumstance, that in some places they roll a wheel about to signify that the sun, then occupying the highest place in the Zodiac, is beginning to descend. 'Rotam quoque hoc die in quibusdam locis volvunt, ad significandum quod Sol altissimum tunc locum in Cœlo occupet, et descendere incipiat in Zodiaco.' Harl. MSS. 2345 (on vellum), Art. 100, is an Account of the rites of St. John Baptist's Eve, in which the wheel is also mentioned. In the amplified account of these ceremonies given by Naogeorgus, we read that this wheel was taken up to the top of a mountain and rolled down thence; and that, as it had previously been covered with straw twisted about it and set on fire, it appeared at a distance as if the sun had been falling from the sky. And he further observes, that the people imagine that all their ill-luck rolls away from them together with this wheel. At Norwich, says a writer in *Current Notes* for March, 1854, the rites of St. John the Baptist were anciently observed, 'when it was the custom to turn or roll a wheel about, in signification of the sun's annual course, or the sun, then occupying the highest place in the Zodiac, was about descending.'"

At Magdalen College, Oxford, the May and June years are clearly differentiated. There is a vocal service at sunrise on May morning, followed by boys blowing horns. At the summer solstice there is a sermon preached during the day in the quadrangle.

One of the most picturesque survivals of this ancient custom takes place at Florence each year at Easter. This is fully described by Baring-Gould. The moment the sacred fire is produced at the high altar a dove (in plaster) carries it along a rope about 200 yards long to a car in the square outside the west door of the cathedral and sets fire to a fuse, thus causing the explosion of fireworks.

The car with its explosives is the survival of the ancient bonfire.

It would appear that the lighting of these fires on a large scale lingered longest in Ireland and Brittany.

A correspondent of the *Gentleman's Magazine* (February, 1795) thus describes the Irish Beltane fires in 1782, "the most singular sight in Ireland":—

"Exactly at midnight, the fires began to appear, and taking the advantage of going up to the leads of the house, which had a widely extended view, I saw on a radius of thirty miles, all around, the fires burning on every eminence which the country afforded. I had a farther satisfaction in learning, from undoubted authority, that the people danced round the fires, and at the close went through these fires, and made their sons and daughters, together with their cattle, pass through the fire; and the whole was conducted with religious solemnity."

It will have been observed with reference to these fire festivals that although there were undoubtedly four, in May, August, November, and February, those in May and November were more important than the others. This no doubt arose from the fact that at different times the May and November celebrations were *New Year* festivals. With regard to the New Year in November in Celtic and later times, Rhys writes as follows ("Hibbert Lectures," p. 514):—

"The Celts were in the habit formerly of counting winters, and of giving precedence in their reckoning to night and winter over day and summer (p. 360); I should argue that the last day of the year in the Irish story of Diarmait's death meant the eve of November or All-halloween, the night before the Irish *Samhain*, and known in Welsh as *Nos Galan-gaeaf*, or the Night of the Winter Calends. But there is no occasion to rest on this alone, as we have the evidence of Cormac's Glossary that the month before the beginning of winter was the last month; so that the first day of the first month of winter was also the first day of the year."

That the November bonfire was recognised as

[1] "Golden Bough," iii. 248.
[2] "The Testimony of Tradition."

heralding the dominion of the gods and spirits of darkness; that the old ideas surrounding Horus and Set in Egypt were not forgotten; is evidenced by the fact that when the fire was extinct the whole company round it would suddenly take to their heels, shouting at the top of their voices:—

Yr hwch ddu gwta	The cropped black sow
A gipio 'r ola'!	Seize the hindmost!

A piecing together of the folklore and traditions of different districts suggests that sacrifices were made in connection with the fire festivals, in fact that the fire at one of the critical times of the May year was a sacrificial one.

I will quote two cases given by Gomme[1] for May Day and All Souls' Day respectively:—

"At the village of Holne, situated on one of the spurs of Dartmoor, is a field of about two acres, the property of the parish, and called the Ploy Field. In the centre of this field stands a granite pillar (Menhir) six or seven feet high. On May-morning, before daybreak, the young men of the village used to assemble there, and then proceed to the moor, where they selected a ram lamb, and after running it down, brought it in triumph to the Ploy Field, fastened it to the pillar, cut its throat and then roasted it whole, skin, wool, &c. At midday a struggle took place, at the risk of cut hands, for a slice, it being supposed to confer luck for the ensuing year on the fortunate devourer. As an act of gallantry the young men sometimes fought their way through the crowd to get a slice for the chosen amongst the young women, all of whom, in their best dresses, attended the Ram Feast, as it was called. Dancing, wrestling, and other games, assisted by copious libations of cider during the afternoon, prolonged the festivity till midnight."

In the parish of King's Teignton, Devonshire, "a lamb is drawn about the parish on Whitsun Monday in a cart covered with garlands of lilac, laburnum, and other flowers, when persons are requested to give something towards the animal and attendant expenses; on Tuesday it is then killed and roasted whole in the middle of the village. The lamb is then sold in slices to the poor at a cheap rate."

The popular legend concerning the origin of this custom introduces two important elements—a reference to "heathen days" and the title of "sacrifice" ascribed to the killing of the lamb (p. 31).

"At St. Peter's, Athlone, every family of a village on St. Martin's Day kills an animal of some kind or other; those who are rich kill a cow or sheep, others a goose or turkey, while those who are poor kill a hen or cock; with the blood of the animal they sprinkle the threshold and also the four corners of the house, and 'this performance is done to exclude every kind of evil spirit from the dwelling where the sacrifice is made till the return of the same day the following year'" (p. 163).

Other traditions indicate that human sacrifices were in question and that lots were drawn, or some other method of the choice of a victim was adopted. I quote from Hazlitt (i., 44) the following report of the Minister of Callender in 1794:—

"The people of this district have two customs, which are fast wearing out, not only here, but all over the Highlands, and therefore ought to be taken notice of, while they remain. Upon the first day of May, which is called Beltan, or Bàl-tein-day, all the boys in a township or hamlet meet in the moors. They cut a table in the green sod, of a round figure, by casting a trench in the ground of such a circumference as to hold the whole company. They kindle a fire, and dress a repast of eggs and milk in the consistence of a custard. They knead a cake of oatmeal, which is toasted at the embers against a stone. After the custard is eaten up, they divide the cake into so many portions, as similar as possible to one another in size and shape, as there are persons in the company. They daub one of these portions all over with charcoal, until it be perfectly black. They put all the bits of the cake into a bonnet. Everyone, blindfold, draws out a portion. He who holds the bonnet is entitled to the last bit. Whoever draws the black bit is the devoted person, who is to be sacrificed to Baal, whose favour they mean to implore, in rendering the year productive of the sustenance of man and beast. There is little doubt of these inhuman sacrifices having been once offered in this country as well as in the East, although they now pass from the act of sacrificing, and only compel the devoted person to leap three times through the flames; with which the ceremonies of the festival are closed."

I may conclude this article by referring to similar practices in Brittany, where Baring-Gould has so successfully studied them.[1]

The present remnants of the old cult in the different parishes are now called "Pardons"; they are still numerous. I give those for the May and August festivals (p. 83):—

MAY.	
Ascension Day	Bodilis, Penhars, Spezet (at the Well of S. Gouzenou), Landevennec, Plougonnec.
Sunday after Ascension Day	Trégoat, St. Divy.
Whit Sunday	Kernilis. Plouider; Edern; Coray; Spezet (Chapel of Cran).
,, Monday	Quimperlé (Pardon des Oiseaux); Pont l'Abbé (Pardon des Enfants); Ergué-Armel, La Forêt, Landudal, Ploneis, Landeleau, Carantec.
,, Thursday	Gouezec (Les Fontaines).
AUGUST.	
First Sunday in August ...	Pleyben (horse races); Plébannalec; Pouldreuzic; Plougomelin; Huelgoët; S. Nicodème in Plumeliau (M.), Cattle blessed; second day horse fair, and girls sell their tresses to hair merchants.

Judging by the "pardons," the solstitial celebrations are not so numerous as those connected with the May year. The bonfire is built up by the head of a family in which the right is hereditary. The fire has to be lighted only by a pure virgin, and the sick and feeble are carried to the spot, as the bonfire flames are held to be gifted with miraculous healing powers. When the flames are abated, stones are placed for the souls of the dead to sit there through the remainder of the night and enjoy the heat. "Every member of the community carries away a handful of ashes as a sovereign cure for sundry maladies. The whole proceeding is instinct with paganism" (p. 75).

With regard to the accompanying sacrifices, we read:—"In ancient times sacrifices were made of cocks and oxen at certain shrines—now they are still presented, but it is to the chapels of saints. S. Herbot receives cows' tails, and these may be seen heaped upon his altar in Loqeffret. At Coadret as many as seven hundred are offered on the day of the 'pardon.' At S. Nicolas-des-Eaux, it is S. Nicodemus who in his chapel receives gifts of whole oxen, and much the same takes place at Carnac."

NORMAN LOCKYER.

[1] "Ethnology in Folklore," pp. 32 and 163.

[1] "A Book of Brittany."

SCIENTIFIC EXPLORATION IN CENTRAL ASIA.[1]

IT is with a lingering feeling of regret that we recognise how different, of necessity, are the explorations of the present day from those of fifty years ago. No longer is it possible, except in rare instances, for a traveller to return with tales of new discoveries of lakes, sources of rivers, mighty peaks, and of the strange peoples that dwell there. Much work still remains, but it is of a more scientific nature, and therefore will probably provide matter which when published may be less entertaining and less widely read. When a traveller makes a speciality of one particular branch of science, as Dr. Gottfried Merzbacher does in his volume on "The Central Tian-Shan Mountains," to the almost entire exclusion of all others, it follows that he can only appeal to a limited number of readers; to those, in fact, who are interested in the study of geology and glaciers. We would, however, make this reservation, that the photographs which adorn this book are exceptionally beautiful representations of snow scenery, and will more than satisfy the ordinary reader as well as the man of science, and that the map is of great general value.

For two seasons, 1902–3, did Dr. Merzbacher and his companions labour in the central Tian-Shan Mountains which lie north-east of Kashgar. Russian explorers have visited this district many times, but the main backbone of the range has never been closely explored, and Dr. Merzbacher was able to discover and correct many errors in existing maps. We would here point out the growing necessity for the closer interchange of information between the various scientific societies of different countries. Dr. Merzbacher met a Russian expedition which to his delight was not intending to work over quite the same tract of country, while Dr. Friedrichsen and Signor Giulio Brocherel have already published the results of their explorations of the same range, which were being undertaken almost simultaneously with those of Dr. Merzbacher and his companions. Healthy rivalry is to be encouraged, but such overlapping of work as this is regrettable.

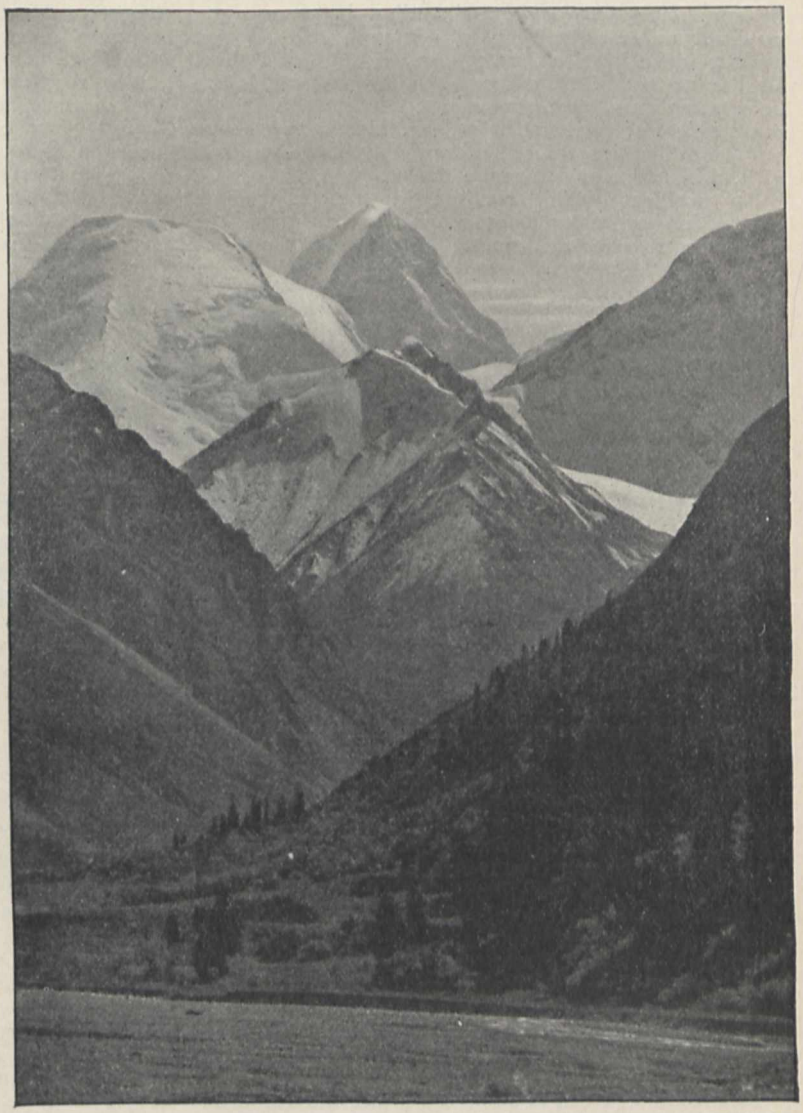

FIG. 1.—Telephotographic View of Khan-Tengri (about 23,600 feet), taken rom North, from the Middle Course of the Bayumkol Valley. Distance about 24 miles. From "The Central Tian-Shan Mountains, 1902–1903."

In this volume, which is of the nature of a preliminary report, Dr. Merzbacher has embodied observations on the present and past glacier conditions of the Tian-Shan Mountains, and on peculiarities in the physical features of its valley formations, subjects to which, throughout the expedition, his attention was specially directed. A more detailed report, however, is to follow when his rich collections have been scientifically examined and arranged. We trust that the botanical, zoological, and climatological observations, which have been almost entirely omitted from this volume, will be included in the more detailed report. We cannot help feeling that a preliminary volume, such as this is intended to be, should have included some reference to these other subjects, while some of the geological and glacial notes might have been left to the more detailed report.

The care with which Dr. Merzbacher explored is worthy of the highest praise, leaving little or nothing for any future travellers in this region to accomplish. He made his winter quarters at Kashgar, but was not content to wait for more clement weather, and made many useful excursions during the winter months, which happened to be unusually mild. It would be out of place to attempt here a description, however short, of his journeyings, and indeed, without a map, it would be nigh impossible to follow any such description. Each glacier, each valley, each ridge is in turn visited, surveyed, and described. The position of the great peak of Khan-Tengri

[1] "The Central Tian-Shan Mountains, 1902–1903." By Dr. Gottfried Merzbacher. Pp. ix+285. (London: John Murray.) Price 12s. net.

(23,622 feet) was correctly fixed, and the discovery was made that this, the culminating eminence of the whole Tian-Shan, does not stand in the main watershed, and is not a nucleus of converging ranges, but is situated on a secondary spur which projects from the main range far to the south-west. The true "nucleus" is the so-called "Marble Wall," which in lieu of a better name Dr. Merzbacher has christened after the president of the Imperial Russian Geographical Society Mount Nicholas Mikhailovich! The Inylchek glacier was found to have a total length of from forty-three to forty-six miles, in place of six to eight miles as previously supposed, and another equally large glacier was discovered but not visited. In the matter of climbing Khan-Tengri, which has been sometimes wrongly assumed to have been the main object of this expedition, Dr. Merzbacher points out the difficulties, which will probably have the result of exciting someone to make the attempt.

An accident which resulted in the unfortunate destruction of many photographic plates gave the energetic traveller an excuse for revisiting some of the ground already traversed, and enabling him, owing to the finer weather, to take still better photographs. Dr. Merzbacher's visit to the alpine lakes, such a rare phenomenon in the central Tian-Shan, and his notes thereon are of great interest, but as winter was closing in work became more difficult, and the expedition finally reached Tashkent *viâ* Kulja.

Regarding this volume as a preliminary report Dr. Merzbacher deprecates drawing conclusions from the facts noted until his rich materials have been examined by competent experts. He however mentions one point on which his scientific conviction is settled once and for all, namely, that for the Tian-Shan also an Ice age has to be accepted.

Photography was used on this expedition to an unprecedented extent, many beautiful views being due to the telephotographic process, which was used with excellent results. In addition to botanical and zoological collections climatic observations were taken twice daily, while the map was compiled with great care, and is also well drawn and beautifully reproduced. It is a pity that the same symbol should have been used to denote permanent villages and the pasturages, which are only visited at certain seasons by the Kirghiz herdsmen.

This volume, which is published under the authority of the Royal Geographical Society, is a worthy record of scientific work carried out under great difficulties. The author is to be warmly congratulated.

A LARGE-HEADED DINOSAUR.

THE mounted skeleton of *Triceratops prorsus*, of which a note by Mr. Charles W. Gilmore, preparator to the department of geology in the United States National Museum, Washington, has recently been published [1] with two plates, is interesting as displaying another Dinosaur of a distinct and very remarkable type, differing entirely from the numerous series of bipedal forms with which we are now familiar from the reconstructed skeleton of the iguanodon and its allies, and also from the ponderous quadrupedal, long-necked, small-headed Diplodocus, Brontosaurus, and Cetiosaurus types of gigantic herbivorous reptiles. Compared with these latter, Triceratops was a quadrupedal reptile of quite moderate size, the skeleton, according to the late Prof. Marsh, being not more than 25 feet in length and 10 feet in height. The present reconstruction by Mr. Gilmore still further reduces its length by the omission of six of the presacral vertebræ (introduced by Prof. Marsh), so that, as now restored, its total length is only 19 feet 8 inches.

The striking feature, which remains unchanged, is the skull, which is fully 6 feet long, and is consequently just one-third of the entire length of the skeleton as now set up.

Two powerful horn-cores of the bovine type, 2½ feet in length, rise from the frontal bones of the skull, at the base of which are the round bony orbits. The snout is narrow and pointed, and carries a third smaller horn upon the nasal bone. Behind the pair of frontal horns is an immense frill of bone spreading back over the occipital region and covering the first six cervical vertebræ; it was 2 feet 6 inches long and 3 feet broad, resembling an immense Elizabethan ruff, ornamented with about twenty-four pointed bosses of bone along its border. The rostrum and predentary bones were armed with pointed horny beaks, the teeth being confined to the maxillary and dentary bones, forming a single series in each jaw. They are remarkable as having two distinct fangs, placed transversely in the jaw, with distinct sockets, and are displaced vertically; the successional teeth cut their way between the alveolar margin and the adjacent root of the old tooth, or between the two roots. Prof. Marsh had published a restoration of this dinosaur in 1891 (see *Geol. Mag.*, plate vii.), the chief difference between which and the present skeleton set up by Mr. Gilmore being the reduction in the number of the presacral vertebræ, already referred to, and the placing of the limbs, especially the forelimbs (the humerus and the radius and ulna), in a

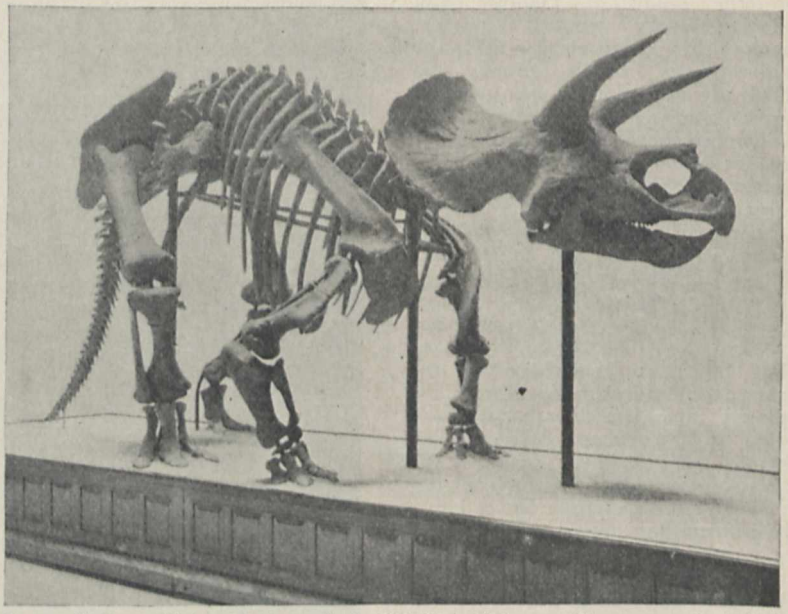

FIG. 1.—Skeleton of *Triceratops prorsus* in the U.S. National Museum. Three-quarters front view.

[1] *Proc. United States National Museum*, Washington, vol. xxix., pp. 433–435, with plates i. and ii., 1905.

more flexed and diverging position to enable the head of the animal in browsing to approach nearer to the ground. The bony cores on the skull were sheathed in horn as well as the beaks, and there is evidence of a dermal armature of bosses and spines which once covered the dorsal and lateral region of the creature's body. Mr. Charles R. Knight has given a spirited restoration of this animal in the *Century Magazine* (1897, p. 18). A life-size *papier-maché* reproduction of Triceratops has been made in America by Mr. Lucas, and it is to be hoped a copy may shortly be secured for the Natural History Museum in Cromwell Road. H. W.

NOTES.

THE King has conferred the honour of Knighthood upon Prof. A. Pedler, C.I.E., F.R.S., Director of Public Instruction, Bengal, and Vice-Chancellor of the Calcutta University.

WE are requested to announce that the endowment fund now being raised for the family of the late Prof. G. B. Howes, F.R.S., will be closed shortly, and all intending contributors are asked to send their contributions without delay to the treasurer, Mr. Frank Crisp, at 17 Throgmorton Avenue, London, E.C.

AT a meeting of the Academy of Natural Sciences of Philadelphia on December 5, 1905, Dr. Dixon announced that Mr. D. M. Barringer and Mr. B. C. Tilghman, members of the academy, had notified him of their discovery that the crater of Coon Mountain, or Coon Butte, in northern Arizona, twelve miles south-east of Cañon Diablo station on the Atchison, Topeka and Santa Fé Railway, is an impact crater, and not a crater produced by a steam explosion, as has been supposed since the examination made of it by members of the United States Geological Survey. It appears from their work that the large crater and elevation known as Coon Mountain is the result of a collision with the earth of a very large meteorite or possibly a small asteroid, fragments of which are well known to the scientific world by the name of the Cañon Diablo siderites. The investigations show (1) that the formation of the crater and the deposition of the meteoritic material were simultaneous; (2) that meteoritic material has been found 500 feet below the surface of the centre of the crater; (3) that sandstone supposed to be in place exists less than 1000 feet below the surface of the centre of the crater. The authors have presented to the academy for publication two comprehensive papers in which they set forth in full their reasons for the above statements.

A COPY of the programme of the excursions arranged in connection with the International Geological Congress, to be held in Mexico during next September, has just reached us. Excursions will take place before, during, and after the congress. Before the business meetings actually begin, four excursions are provided for visitors. The first excursion, which will last four days and be confined to 250 persons, is to be to the east from Mexico through Jalapa to Vera Cruz, returning to Mexico through Esperanza. The second excursion to the south is to extend to eight days, and is limited to 40 persons. Arriving at Esperanza, included in the first trip, the party will proceed to Tehuacan and thence to Oaxaca. Puebla will be taken on the return journey. The third excursion, confined to 30 members, will include visits to the volcanoes of Toluca, San Andrés, and Jorullo, and will last fourteen days, nine of which will be on horseback. The last of these trips is to the geyser district of Ixtlán and to the volcano, Colima. During the progress of the congress short journeys will be made to Pachuca, to Cuernavaca, and other places near Mexico. At the close of the conferences an excursion to the north, of twenty days, will take place. Salamanca, Guanajuato, Zacatecas, Mapimí, Conejos, Ciudad, Parras, and other localities will be visited. Another excursion after the meeting will be to the isthmus of Tehuantepec. The following subjects will be discussed at the congress:—(1) Climatic conditions during the geological epochs, when Messrs. G. Boehm, T. C. Chamberlin, W. B. Clark, W. H. Dall, W. M. Davis, A. Heilprin, V. Uhlig, and S. W. Williston will take part. (2) The relations between tectonics and eruptive masses: Messrs. A. Bergeat, A. Dannenberg, G. K. Gilbert, J. P. Iddings, A. Karpinski, A. Lacroix, and E. Naumann will speak. (3) The genesis of metalliferous veins: Messrs. B. von Inkey, F. Klockmann, W. Lindgren, W. B. Phillips, J. E. Spurr, and W. H. Weed will participate. (4) The classification and nomenclature of rocks: Messrs. Wh. Cross, J. P. Iddings, A. Karpinski, A. Lacroix, A. Osann, W. B. Phillips, H. S. Washington, and F. Zirkel will take part in the discussion. Communications may be addressed to the general secretary, M. Ezequiel Ordóñez, 5*a* del Ciprés, No. 2728, Mexico, D. F.

THE stone implements of the Zambesi valley near Victoria Falls, noted by Mr. Lamplugh in his report on the district (see NATURE, p. 112), and more fully described by Colonel Feilden in a letter recently printed in NATURE (p. 77), possess much interest in view of their possibly high antiquity. At a meeting of the Geological Society of South Africa on October 30, 1905, Mr. J. P. Johnson, of Johannesburg, in giving an account of a further collection of these implements which he had made during a recent visit to the falls, stated that some of the specimens appear to show the transitional stage between the Eolithic and Palæolithic cultures. In the same paper the occurrence of implements of the "pygmy" type near Bulawayo is recorded.

IN the second part of the *Bergen's Museums Aarbog* for 1905, Mr. P. Bjerkan describes the ascidians collected by the Norwegian fishery-steamer *Michael Sars* from 1900 to 1904, while Mr. H. Brock does the same for the hydroid polyps obtained during the last two years. Three ascidians regarded as new are named by the former author, one of these representing a new genus; but all the hydroids appear to be identified with previously known forms. The organisation of Cephalodiscus has been recently fully investigated by Dr. H. Schepotieff, who records the results of his studies in a third article; while Mr. O. Bidenkap supplies a list of Arctic bryozoans.

To the October issue of the *Proceedings of the Philadelphia Academy of Sciences* Dr. J. W. Haishberger contributes two interesting papers on the flora of the Bermudas. In the first of these the general character of the flora, which is evidently of comparatively recent introduction, is discussed, and the different zones described. The second paper, on the other hand, is devoted to an explanation of the origin of the curious "hour-glass-conformation" of the stem of the Bermuda palmetto (*Sabal blackburniana*), long ago described in a letter from Mr. O. A. Reade to Sir Joseph Hooker. The explanation, according to the author, is simplicity itself, the constrictions being caused by unfavourable seasons of excessive drought.

IN a recent issue (vol. xxi., art. 14) of the Bulletin of the American Museum, Prof. H. F. Osborn describes two new generic types of carnivorous dinosaurs from the

Laramie Cretaceous, namely, *Tyrannosaurus rex* and *Dynamosaurus imperiosus*. The former appears to have been unprovided with armour, and is estimated to have measured 39 feet in length; it walked on the hind-limbs only, with the top of the skull raised about 19 feet from the ground. On the other hand, Dynamosaurus was an armoured type with about a dozen lower teeth, and a number of curious prominences on the inner margin of the jaw. In this comparatively small number of teeth it seems to differ from Leidy's Dinodon, in which some of the teeth were serrated. A third type, *Albertosaurus sarcophagus*, is based on a skull from Albert province, Canada. It is apparently more specialised than Dinodon in the reduction of the truncated anterior teeth, and more primitive than Dynamosaurus in the possession of a larger number of teeth, which are of a less specialised type.

We have received four numbers (inclusive of one devoted to the record of last year's meetings) of the fourteenth volume of the *Transactions of the Academy of St. Louis*. In the bulkiest of these, comprising no less than 248 pages, Mr. T. L. Casey revises the American representatives of that section of the staphylinid or short-elytraed beetles known as the Pœderini, the memoir being, of course, interesting only to specialists. In a second paper Mr. S. Weller describes, under the name of Paraphorhynchus, a new genus of rhynchonella-like brachiopods from the Kinderhook formation of the Mississippi. In a third paper the fresh-water molluscan fauna of McGregor, Iowa, forms the subject. Mr. F. C. Baker communicates some interesting information with regard to the pearl-fishery of that district. The unios are fished up by means of a dredge armed with four-pronged "crowfoot" hooks, and it is believed that malformed specimens are more likely to contain pearls than those with normal shells. These "crippled" mussels, or "clams," are believed by the writer to owe their injuries to the action of the dredge itself.

The last published number of *Biometrika* contains an important paper by Mr. A. O. Powys on fertility, duration of life and reproductive selection in man, with their mutual relations. Several of his results, which are derived from the statistical data of New South Wales, are of high interest. He finds that women with families of five or six children have a better expectation of life after forty-five than mothers of either a larger or smaller number of offspring. The married have a similar advantage over the single. Another conclusion drawn by Mr. Powys from his figures is that "up to the present there is but little Malthusian restraint upon the population in New South Wales—what little there may be apparently being confined to the professional, domestic and commercial classes." He confirms Prof. Karl Pearson's view that society is at present being recruited from below—mainly from the artisan class. A useful craniological contribution to the study of inter-racial correlation in man is furnished by E. Tschepourkowsky, of Moscow, and Mr. E. H. J. Schuster publishes the first instalment of a catalogue of the fine collection of skulls in the Oxford Museum, on the basis of a manuscript catalogue prepared some years ago by Dr. Hatchett Jackson. Dr. Brownlee puts the facts of the immunity against small-pox conferred by vaccination and re-vaccination on a firm statistical basis, and Mr. John Blakeman supplies probable error tests of the significance or otherwise of the difference between correlation ratio and coefficient, and consequently of the existence or non-existence in a given population of true linear regression. Mr. Latter deals with the measurements of 1572 specimens of cuckoos' eggs. These, he considers, tend to confirm Prof. Newton's suggestion that there are certain subraces of cuckoos which "in the main confine their attentions, generation after generation, each to its own particular variety of foster-parent." In the "Miscellanea," Mr. W. Palin Elderton proposes new methods for the calculation and adjustment of moments.

Mr. J. H. Hart, the superintendent of the Royal Botanic Gardens, Trinidad, records the discovery of a water-plant, probably a species of Nitella, in the Pitch Lake La Brea, which produces peculiar pear-shaped organs on the stems. These are hollow, and have large openings into the interior, fringed with simple or branched hairs, and within some of them mosquito larvæ were observed, apparently caught and killed by the plant. The suggestion, therefore, is made that the plant might be useful for mosquito destruction.

The use of copper sulphate in the purification of water supplies has from time to time been referred to in these columns. Dr. Howard Jones, the medical officer of health for Newport, Mon., reports the successful employment of the method at Newport. Copper sulphate, to the extent of 1 lb. per million gallons, proved efficient in removing an objectionable fishy odour and rendering the water of the reservoirs bright and clear (*Water*, December 15, 1905).

At a meeting of the Royal Statistical Society on December 19, 1905, Drs. Newsholme and Stevenson read an important paper on the decline of human fertility in the United Kingdom and other countries as shown by corrected birth-rates. They pointed out that corrected birth-rates measure the tendency of communities to increase by natural means, *i.e.* by the excess of births over deaths, or, in other words, their fertility, just as corrected death-rates measure the tendency to decrease. The ordinary "crude" birth-rate is deceptive, since it fails to make allowance for the fact that some populations include a much larger proportion than others of wives at reproductive ages, and for the further fact that the potential fertility of women steadily decreases during the reproductive period until its end is reached. The necessity for correction was illustrated by numerous examples. Thus the crude birth-rate of Ireland in 1903, 23·1, is little higher than that of France in 1902, which was 21·7; but the French birth-rate is practically unaltered by correction, whereas that of Ireland is increased to no less than 36·1. This remarkable result is due to the fact that, although both countries have approximately the same proportion of women aged fifteen to forty-five in their populations, 52·5 per cent. of these in France are married as against 32·5 per cent. in Ireland. Of the countries studied, Ireland alone shows an increase of fertility (3 per cent.) during the last twenty-two years. The conclusion arrived at is that the decline in the birth-rate is associated with a general raising of the standard of comfort, and is an expression of the determination of the people to secure this greater comfort; and the authors anticipate as a result a deterioration of the moral, if not also of the physical, nature of mankind.

Ciel et Terre for November 15, 1905, contains a useful summary of an elaborate discussion by M. A. Angot on the temperature of France and adjoining countries. The original paper appeared in a recent number of *Annales de Géographie*; it deals chiefly with the temperature of France, to which the following remarks entirely refer. As regards the annual means, the isotherms in the north of the country show a decided inclination from north-west to south-east; this is due to the fact that, generally speak-

ing, the land is colder than the sea above lat. 45°, and warmer to the south of that latitude. The lowest mean value is found between Lille and Dunkirk, being about 49° F.; the maximum is on the coast of Nice, and is slightly above 59°. Except on part of the coast of Brittany, the whole of France lies in the zone of moderate climates, in which the annual amplitude is between 50° and 68°. The lowest minima are found in the east; in the winter of 1879–80, temperatures of −22° were recorded. Contrary to current opinion, the highest minima are not on the coast of Nice, where occasionally the cold is very severe, but on the south-west of Brittany and at Ushant, where frost is extremely rare. In the latter regions the absolute maxima are not so high as in other parts. At Ushant a reading of 86° has not been recorded. The highest maxima are found near the Mediterranean, between Carcassonne and Avignon. At Montpellier, a temperature of 109° was recorded on July 19, 1904; this is the highest reading known in France. The details of the discussion are being published in the *Annales* of the French Central Meteorological Office.

IN the *Engineering Magazine* for December, 1905, Mr. E. Guarini gives some striking illustrations of the electric railway at Gruyères. The description is typical of much of the work now being done in the construction of electric railways in Switzerland, where the abundant water-power is especially favourable to the development of such enterprises.

IN the *Engineering and Mining Journal* Mr. F. L. Hoffman gives details of the fatal accidents in coal mining in the United States in 1904. The fatal accident rate was 3·38 per thousand workmen employed, as against an average of 3·03 per thousand for the decade 1895–1904. The relative mortality due to fatal accidents continues to be unreasonably high, and the problem of the prevention of such accidents remains the most serious and perplexing in coal-mining operations.

THE paper recently read by Mr. E. M. Speakman on the determination of the principal dimensions of the steam turbine before the Institution of Engineers and Shipbuilders in Scotland, gave rise to a discussion of great interest in which important information was given regarding the application of the steam turbine to marine work. It was pointed out that the trials of the Cunard steamship *Carmania*, the largest turbine steamer yet built, had fulfilled in every way the highest expectations of all connected with the ship.

AT the last meeting of the Institution of Mechanical Engineers a paper on the behaviour of materials of construction under pure shear was read by Mr. E. G. Izod. The results obtained seem to point to the fact that there is no common law connecting the ultimate shearing stress with the ultimate tensile stress. With crystalline materials, such as cast iron or those with very little or no elongation, the former exceeds the latter by as much as 20 per cent. or 25 per cent., while from fibrous material or, more properly speaking, those with a fairly high measure of ductility, the ultimate shear stress may be anything from 0 per cent. to 50 per cent. less than the ultimate tensile stress.

THE second part of the report of the Ontario Bureau of Mines for 1905 is devoted to an important monograph on the cobalt-nickel arsenides and silver deposits of Temiskaming by Mr. W. G. Miller. It covers sixty-six pages, and is illustrated by twenty-eight reproductions of photographs and two geological maps. The deposits were discovered in October, 1903, during the construction of the Temiskaming and Northern Ontario Railway. They occupy narrow, practically vertical fissures cutting through a series of unusually slightly inclined metamorphosed fragmental rocks of Lower Huronian age. A few veins have also been found in the adjacent diabase. The chief ores are native silver, smaltite, niccolite, and chloanthite, with which are associated argentite, pyrargyrite, dyscrasite, erythrite, and other comparatively rare minerals. None of the veins are wide, the maximum being about 18 inches. Some that have been traced 100 feet or more average 1 inch in width. The production during the quarter ended June 30 was 537 tons, the average metallic contents being:—silver, 4·158 per cent.; cobalt, 6·89 per cent.; nickel, 3·09 per cent.; and arsenic, 30·91 per cent. An interesting mineral occurrence is a white clay-like material in the weathered parts of the veins. The white colour of this mineral is due to the intermixture of the green nickel arsenate, annabergite, with the pink cobalt bloom, the mineral showing on analysis 29·30 per cent. of nickel oxide, 6·43 per cent. of cobalt oxide, and 38·31 per cent. of arsenic pentoxide. Hitherto New Caledonia has had practically a monopoly of the world's production of cobalt. Worked primarily for silver with their high values in that metal, the Ontario deposits, with nickel and arsenic as by-products, should prove a strong competitor, even if they should not control absolutely the cobalt market.

MESSRS. F. VIEWEG AND SON, Brunswick, have just published the ninth edition of Prof. A. Bernthsen's "Kurzes Lehrbuch der organischen Chemie." The work appeared originally in 1887; and in the preparation of the present edition Dr. E. Mohr is associated with the author.

STUDENTS and others interested in microscopy will be glad to have their attention directed to new lists of microscopic slides and of second-hand instruments and accessories just issued by Messrs. Clarke and Page, Leadenhall Street, E.C. Special mention should be made of the marine and botanical slides, which are fine examples of cutting, staining, and mounting. A series of objectives corrected for photomicrography is also of noteworthy interest.

A LIST of meteorological instruments for observatories and climatological stations has been received from Messrs. Pastorelli and Rapkin, Ltd., Hatton Garden, E.C. Instruments of various forms for the accurate determination of pressure, temperature, rainfall, and other meteorological elements are described and illustrated in the list, which may be consulted with advantage by anyone desiring to equip a station with serviceable apparatus, or to supplement instruments already in use.

MESSRS. EASON AND SON, LTD., of Dublin, have sent us four of their time-saving indexed diaries for 1906. The "Every Hour" diary provides a convenient record of appointments, special business and events, for any hour of any day during the year. The "Cabinet Scribbling" diary is furnished with a double index for rapid reference, the first arranged as a record for such items as addresses and current literature, the second being to the first of each month.

A COPY of "Hazell's Annual" for 1906 has been received. This twenty-first issue maintains the high reputation of its predecessors. To keep in touch with the important foreign events of the year, numerous foreign biographies have been added, and the text of many treaties included. Some sixteen pages are devoted to scientific matters, most of them being given to scientific progress during 1905.

Prominence is also given to higher educational matters, and the man of science will find much in this section to interest him.

MESSRS. CHARLES GRIFFIN AND CO., LTD., have published the twenty-second annual issue, that for 1905, of the "Official Year-book of the Scientific and Learned Societies of Great Britain and Ireland." This useful work of reference is already well known as a trustworthy guide to the scientific societies and their work. Though the volume is very comprehensive, we miss a reference to the Geographical Association and to the Public Schools Science Masters' Association. The editor might consider the advisability of including associations dealing with educational science.

A NEW vernier rule and scale designed by Mr. S. Irwin Crookes has been received from the maker—Mr. W. H. Harling, 47 Finsbury Pavement, E.C. The rule is divided on one face into inches and eighths of an inch and centimetres and millimetres; the other face has on the edges divisions and numbers representing degrees from 0 to 150, and a barometer scale reading from 20 to 32. A metal vernier slides in a slot cut through the middle of the length of the rule, and it is divided in four different ways to read fractions of the four scales on the rule. The device should be valuable in making students familiar with the use of the vernier on many precise scientific instruments.

THE second annual issue of the "Science Year Book" (5*s*. net), edited by Major B. F. S. Baden-Powell, has been published by Messrs. King, Sell and Olding, Ltd. Several new features have been introduced, and every care appears to have been taken to make the volume serviceable to men of science and others interested in natural knowledge. The year book includes a diary containing at the head of every daily page the astronomical and meteorological particulars of the day likely to be of interest, and blank spaces for recording results of observations. Other characteristics are tables of useful data, an astronomical ephemeris, maps of the constellations, charts of planetary positions during 1906, and various statistics and notes referring to matters not usually included in ordinary calendars and almanacs. There are also short summaries of progress in science during last year, an eclectic bibliographical directory, and a list of scientific books published last year. The year book is thus a convenient and helpful companion for the study, laboratory, or observatory.

OUR ASTRONOMICAL COLUMN.

ASTRONOMICAL OCCURRENCES IN JANUARY:—

Jan. 4. 4h. 12m. to 5h. 10m. Moon occults ξ^2 Ceti (mag. 4·3).
,, 4. 15h. Mercury at greatest elongation, 23° 0′ W.
,, 5. 5h. Venus in conjunction with Uranus, Venus 0° 6′ N.
,, 5. 14h. 45m. to 15h. 16m. Moon occults *f* Tauri (mag. 4·3).
,, 6. 14h. 52m. to 15h. 40m. Moon occults γ Tauri (mag. 3·9).
,, 14. 11h. 1m. to 11h. 58m. Moon occults σ Leonis (mag. 4·1).
,, 15. Venus. Illuminated portion of disc =0·993. Of Mars =0·923.
,, 15. 11h. 2m. Minimum of Algol (β Persei).
,, 18. 7h. 51m. Minimum of Algol (β Persei).
,, 26. 8h. Saturn in conjunction with Moon. Saturn 0° 31′ S.
,, 28. 6h. 17m. to 8h. 14m. Transit of Jupiter's Sat. III.

A FOURTH NEW COMET (1905*e*).—A telegram from the Kiel Centralstelle announces the discovery of another new comet by the Flagstaff observers. This object was discovered, presumably, from the examination of a photograph, by Mr. Lowell, who gives its position on November 29, 1905, at 9h. 27m. (Flagstaff M.T.), as follows:—

R.A. = 22h. 32·2m., dec. = −8° 42′.

The apparent motion of the comet was either in a north-east or a south-west direction, and the photograph showed that the body was accompanied by two tails.

The above position is in the constellation Aquarius, about half-way between ϕ Aquarii and ι Ceti.

NEW ELEMENTS AND EPHEMERIS FOR COMET 1905*c*.—A new set of elements and a daily ephemeris for comet 1905*c* (Giacobini) are given by Herr E. Strömgren in No. 4062 of the *Astronomische Nachrichten*.

These elements, and an extract from the ephemeris, are given below.

T = 1906 Jan. 22·666 (*M.T. Berlin*).

$\infty = 198\ 21'\cdot67$
$\Omega = 91\ 55'\cdot27$ } 1905·0
$i = 43\ 37'\cdot08$
$\log q = 9\cdot34978$

Ephemeris (12*h*. *M.T. Berlin*).

1906	α (true) h. m. s.	δ (true) ° ′	log γ	log Δ	Brightness
Jan. 5	17 23 54	− 1 35·7	9·7701	0·0425	7·97
,, 7	17 39 28	− 3 53·5	9·7313	0·0425	9·53
,, 9	17 55 31	− 6 15·9	9·6881	0·0441	11·53
,, 11	18 12 10	− 8 42·5	9·6398	0·0473	14·20
,, 13	18 29 33	− 11 12·8	9·5856	0·0520	17·83

The above positions are plotted on the accompanying chart, which shows approximately the apparent positions of the comet among the stars on the dates indicated.

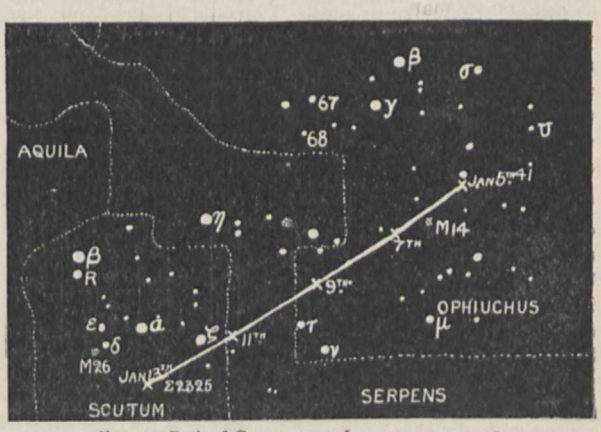

FIG. 1.—Path of Comet 1905*c*, January 5–13, 1906.

THE EXPECTED RETURN OF COMET 1892 V.—In *Circular* No. 84 from the Kiel Centralstelle, M. J. Coniel gives several provisional search-ephemerides, showing positions up to January 6·5, for comet 1892 V.

This comet was discovered by Holmes on November 6, 1892, and was observed during its apparition in 1899, when it passed through its perihelion on April 28. Its period is given by Zwiers as 6·874 years.

MICROMETER MEASURES OF DOUBLE STARS.—The results of a series of micrometer measures of eighty-three double stars, taken from the Struve, Burnham, and Hussey catalogues, are published in No. 4054 of the *Astronomische Nachrichten* by Herr H. E. Lau. The observations were made during March, 1905, with the Urania-Sternwarte (Copenhagen) refractor, of 246 mm. aperture and 4·1 metres focal length, fitted with a Cooke position micrometer.

For each double, the time of observation, the position-angle, the distance, the magnitudes of the components and the power used are given, whilst short comparisons with other measures and notes regarding the probable character and motion are generally added.

FRENCH ASTRONOMICAL "ANNUAIRES."—We have received two French "Annuaires" which are of particular interest to astronomical workers, the one being the "Annuaire du Bureau des Longitudes" (price 1.50 francs), the other the "Annuaire astronomique et météorologique" (price 1.50 francs), which is published by M. Flammarion.

The former volume contains 352 pages devoted to astronomical matters, in addition to which there are three appendices (188 pages) dealing with eclipse observations. In the first of these M. Bigourdan gives a large number of summarised instructions concerning the observations which may be made during eclipses, pointing out the most suitable observations to be undertaken with the instruments readily available. In the second the same writer gives an extremely interesting summary of the observations made in all parts of the shadow-track during the recent eclipse, whilst the third appendix is devoted to a short account, by Prof. Janssen, of his own observations made in Spain on August 30.

M. Flammarion's "Annuaire" will be found to be especially suitable for amateur observers, some interesting phenomenon being given for every day in the year. It contains practically all the data to which the amateur has any need to refer, and the *résumé* of the more important astronomical advances during the past year should prove both interesting and useful.

PRIZES AWARDED AND PROPOSED BY THE PARIS ACADEMY OF SCIENCES.

AT the annual meeting of the academy of December 18, 1905, the president delivered his annual address, and announced the list of prizes awarded in 1905 as follows:—

The Francœur prize is awarded to M. Stouff, for the whole of his mathematical works.

A Montyon prize to M. Mesnager, for his theoretical and experimental work on the theory of elasticity and the resistance of materials. The Poncelet prize to M. Lallemand, for his work on the figure of the earth and for his improvements in geodesic instruments.

The extraordinary prize of 6000 francs has been divided, Colonel Gossot and M. Liouville receiving 4000 francs, for their work on ballistics; M. Carré 1000 francs, for improvements in the navigation of submarines; and M. Merlu 1000 francs, for improvements in the furnaces of marine boilers. The Plumey prize is divided between M. Maurice (2500 francs), for a device for the recuperation of heat in boilers, and M. de Maupeou d'Ableiges (1000 francs), for his investigations of the theory of impact.

The Pierre Guzman prize is not awarded, but M. Perrotin receives 2000 francs from this foundation for the whole of his astronomical work. The Lalande prize is awarded to Prof. W. H. Pickering, for his astronomical work, and especially for his brilliant researches on the satellites of Saturn; the Valz prize to M. Giacobini, for his work on comets; and the G. de Pontecoulant prize to Prof. J. C. Kapteyn, for the whole of his astronomical researches. Of the two memoirs on the theory of comets presented for the Damoiseau prize, that of M. Fayet is adjudged the better, M. Fabry, the author of the second memoir, receiving a prize from the funds of the Guzman prize.

The Gay prize is given to Dr. Cureau, for his accurate geodesic measurements in Africa. The Tchihatchef prize to the late M. Massenet, for geodesic work in Cochin China.

M. Jumau receives the Hébert prize for his book on electric accumulators; M. Georges Urbain the Hughes prize, for his researches on the rare earths; M. Henri Abraham the Gaston Planté prize, for his researches and books; and M. Gouy the La Caze prize, for the whole of his original work.

The Jecker prize is awarded to MM. Sabatier and Senderens, for their researches on the catalytic action of metals; Montyon prizes (unhealthy trades) to M. Donard, for his method of treating slaughter-house refuse, and to M. Carles, for his method of utilising wine residues; the La Caze prize to M. Albert Colson, for the whole of his researches; the Bordin prize to M. Paul Lebeau, for his researches on silicides. The Cahours prize is divided between M. Binet du Jassoneix and M. Kling.

M. G. Friedel receives the Delesse prize for his work in mineralogy; M. Gustave Dollfus the Fontannes prize, for his researches on Tertiary fossils; and M. Marcellin Boule the Alhumbert prize, for his work on the determination of the period of the latest volcanic eruptions in central France.

The grand prize of the physical sciences is awarded to M. Dangeard, for his researches on the development of the egg in the Ascomycetes and Basidiomycetes; the Desmazières prize to M. Ferdinand Renauld, for his memoir on the flora of Madagascar; the Thore prize to M. de Itsvanffi, for his memoirs on the fungi attacking the European vine, the Montagne prize being divided between M. Lutz (1000 francs) and M. Gallaud (500 francs).

In anatomy and zoology, M. C. Gravier receives the Savigny prize.

A Montyon prize is divided between M. L. C. Maillard (the indoxylic colouring matters of human urine), M. Albert Malherbe (researches on sarcoma), and M. Albert Le Play (experimental researches on intestinal poisons). Mentions are accorded to MM. H. Guilleminot, J. Beolt, and Edmond Loison. The Barbier prize is divided between M. J. Dechery and G. Rosenthal, M. Scrini receiving a mention. The interest on the funds of the Bréant prize is divided between M. Vincent, M. Martel, and Dr. Remlinger. The Godard prize is accorded to Dr. A. Hogge; the Baron Larrey prize to M. H. Nimier, with very honourable mention to M. Marix; the Bellion prize to Dr. Pressat (malaria and mosquitoes) and MM. Alquier and Drouineau (glycogen and rational nutrition with sugar); the Mège prize to M. Beni-Barde, for his book on hydrotherapeutics; the Serres prize to M. F. Henneguy. The Dusgate prize is not awarded, but M. Onimus receives a very honourable mention.

In physiology the Montyon prize is shared by M. J. Lefèvre and M. J. Laurent. The Philipeaux prize is awarded to M. Victor Henri for his quantitative researches on diastases, M. L. Butte being accorded a mention for his researches on the glycogenic functions of the liver. The Lallemand prize is divided between M. and Mme. Lapicque and M. Jules Voisin, M. Crouzon receiving a very honourable mention. The question set for the Pourat prize was the origin of muscular glycogen. The only paper received on this subject was by M. Maignon, to whom the prize is awarded.

A Montyon prize for statistics is awarded to M. Edmond Gain, with a very honourable mention to M. Jules Fleury.

The Binoux prize is awarded to M. Paul Tannery.

M. Adolph Lieben receives the Lavoisier medal; MM. Senderens, Donard, Lebeau, Jumau, Urbain, Abraham, Gouy, Canovetti, and Leduc the Berthelot medal. The Trémont prize is awarded to M. Ch. Frémont, for his researches in the domain of mechanics; the Gegner prize to M. J. H. Fabre; the Lannelongue prize to Mme. Beclard and Mme. Cusco; the Wilde prize to M. Canovetti and M. Leduc (in equal parts); the Saintour prize to M. Édouard Piette and M. Marchis; the Petit D'Ormoy prize to M. Émile Borel (mathematical sciences) and M. Julien Costantin (natural sciences); the prize founded by Mme. la Marquise de Laplace to M. Fortier; and the Félix Rivot prize to MM. Fortier, Rodhain, Frontard, and Lefranc.

The subjects proposed by the academy for prizes for 1907 are as follows:—

The Francœur prize (1000 francs), for work or discoveries useful to the progress of the science of pure or applied mathematics; the Bordin prize (3000 francs), for the solution of a problem in the theory of algebraic surfaces; the Vaillant prize (4000 francs), for the integration of the equation

$$\frac{\partial^4 u}{\partial x^4}+2\frac{\partial^4 u}{\partial x^2 \partial y^2}+\frac{\partial^4 u}{\partial y^4}=f(x, y)$$

under specified conditions; and the Poncelet prize (2000 francs), under conditions similar to those of the Francœur prize.

A Montyon prize (700 francs), for the invention or improvement of instruments useful to the progress of agriculture, the mechanical arts or sciences.

The extraordinary prize of 6000 francs, for an invention or discovery tending to increase the efficacy of the French naval forces; the Plumey prize (4000 francs), for improvements in the steam engine or any invention contributing to the progress of steam navigation.

The Lalande prize (540 francs), the Valz prize (460 francs), and the G. de Pontécoulant prize (700 francs), for the most interesting observation, memoir, or work in astronomy published during the year.

The Gay prize (1500 francs), for a study of the natural conditions in the Polar regions; the Tchihatchef prize (3000 francs), for exploration in the lesser known portions of Asia.

The Hébert prize (1000 francs), for a treatise or discovery in the practical use of electricity; the Hughes prize (2500 francs), for a discovery contributing to the progress of physics; the Gaston Planté prize (3000 francs), for a French author of a discovery, invention, or important work in electricity; the La Caze prize (10,000 francs), for works or memoirs contributing to the progress of physics; the Kastner-Boursault prize (2000 francs), for the best work on the applications of electricity in the arts, industry, or commerce.

The Jecker prize (10,000 francs), for works useful to the progress of organic chemistry; the Cahours prize (3000 francs), for the encouragement of young chemists; the Montyon prize (2500 francs and 1500 francs), for the discovery of a process rendering a trade or manufacture less unhealthy.

The grand prize of the physical sciences (3000 francs), for a study of underground water from the hygienic point of view; the Delesse prize (1400 francs), for work in geological or mineralogical science.

The Desmazières prize (1600 francs), for the best work during the year on cryptogams; the Montagne prize (1500 francs), to the French author of the best work on the anatomy, physiology, development, or description of the lower cryptogams; the Thore prize (200 francs), for the best work on the cellular cryptogams of Europe; the de Coincy prize (900 francs); the de la Fons-Mélicocq prize (900 francs), for the best botanical work on the north of France.

The Savigny prize (1300 francs), for the assistance of young travelling zoologists specially occupied with the study of the Egyptian and Syrian invertebrates.

A Montyon prize (2500 francs, mentions 1500 francs), for discoveries useful in the art of healing; the Barbier prize (2000 francs), to the author of a valuable discovery in surgical, medical, pharmaceutical, or botanical science; the Bréant prize (100,000 francs), for the discovery of a radical cure for Asiatic cholera or for pointing out the causes of cholera in such a manner that could lead to its total suppression. Failing these, the interest will be awarded annually for the proof of the existence in the air of substances playing a part in the production or propagation of epidemic disease. The Godard prize (1000 francs), for the best memoir on the anatomy, physiology, or pathology of the genito-urinary organs; the Baron Larrey prize (750 francs), for a memoir on military medicine, surgery or hygiene; the Bellion prize (1400 francs), for discoveries profitable to the health of man; the Mège prize (10,000 francs); the Chaussier prize (10,000 francs), for a memoir on legal or practical medicine.

A Montyon prize (750 francs) and the Philipeaux prize (900 francs), for work in experimental physiology; the Lallemand prize (1800 francs), for work on the nervous system; the Pourat prize (1000 francs), for a memoir on the utilisation of pentanes in animal organisms; the La Caze prize (10,000 francs), for a work on physiology.

The Montyon prize (500 francs), for a memoir on French statistics.

The Arago, Lavoisier, and Berthelot medals. The Trémont prize (1100 francs); Gegner prize (3800 francs); the Lannelongue prize (2000 francs); Wilde prize (4000 francs), for memoirs in the subjects of astronomy, physics, chemistry, geology, or experimental mechanics; the Saintour prize (3000 francs); the Petit d'Ormoy prize (two of 10,000 francs), one for pure and applied mathematics, the other for one of the natural sciences; the Leconte prize (50,000 francs); the Pierson-Perrin prize (5000 francs); the prize founded by Mme. la Marquise de Laplace; the Félix Rivot prize (2500 francs).

December 31, 1906, will be the last day for sending in memoirs for the above prizes. The prizes bearing the names of Tchihatchef, La Caze, Delesse, Wilde, and Leconte are awarded without preference of nationality.

VOLCANIC ROCKS FROM NEW ZEALAND.[1]

THE district dealt with in this memoir is part of the principal gold-field of New Zealand. The igneous rocks here, which are the source of the gold, are of Tertiary age, though an older series, of Palæozoic age, occurs in the same district. There had been no previous petrographical study of the rocks, of a kind at once comprehensive and detailed, when a specially made collection of 500 specimens was placed in the hands of Prof. Sollas for description, and the report now before us consequently contains much valuable material. Mr. McKay tells us that the principal object of invoking the aid of this well known petrologist was to place the nomenclature of the rocks on a more satisfactory footing. Whatever the object, we are glad to welcome the result, and we also accept gratefully the lavish illustration which attests the liberality of the New Zealand Government. There are upward of 100 plates, reproduced by "process" from photographs, most

FIG. 1.—Hyalopilitic Hypersthene-Andesite; thin slice photographed in polarised light, magnification about 20 diameters.

of them representing thin slices of rocks photographed from the microscope. A figure measuring 7 inches by 5 inches affords a much better conception of the micro-structure of a rock than can be gained from the illustrations in most petrographical memoirs.

The introductory section by Mr. McKay gives a historical account of the district, with bibliographical references, and also sets forth the bearings of Prof. Sollas's results upon the general geology of the district. The Tertiary volcanic rocks are all andesites, dacites, and rhyolites. We may note here a striking contrast with the southern part of New Zealand, where, in the neighbourhood of Dunedin, is found a great variety of phonolites, tinguaites, trachytes, and other types rich in alkalies. The sequence in the Cape Colville district is also of interest. The

[1] "The Rocks of Cape Colville Peninsula, Auckland, New Zealand." By Prof. Sollas, F.R.S. With an Introduction and Descriptive Notes by Alexander McKay, Government Geologist, N.Z. Vol. i. Pp. viii+289; with many plates. (Wellington, 1905.)

Eocene volcanic rocks were mostly andesitic flows and breccias; the Miocene wholly andesitic or dacitic, stratified tuffs with coal; the Pliocene a succession of rhyolitic flows and breccias.

The description by one geologist of specimens collected by another at the Antipodes is a division of labour which has drawbacks as well as advantages. Prof. Sollas, however, has faced the difficulty successfully, and the large amount of labour which he has expended on this study has produced results which have a value by no means confined to New Zealand geology. Arising from the detailed examination of the rocks, there are a number of more general questions of petrographical interest on which the author is able to throw light. One point is the recognition in the ground-mass of the so-called "pilotaxitic" andesites of an interstitial mosaic of quartz, which plays the same part as the glassy base in the "hyalopilitic" type. Another point is the discovery of a certain isotropic hydrated decomposition-product, which partly or wholly replaces the felspar crystals in some of the rhyolites. This was taken by Rutley for glass, and regarded as evidence of the re-fusion of the rock. Our author finds no evidence of devitrification in the glassy rhyolites of this district, but there may be considerable chemical alteration. The Palæozoic dyke-rocks are also described and discussed. They range from quartz-diorite, through "dacite-porphyrite," to dacite, the second being given as a new name to a type of intermediate characters which agrees generally with propylite as defined by Zirkel. We may remark that the term "dacite-porphyry" has been used by American petrologists for a rock not essentially different (see, *e.g.*, Iddings in *Bull.* 150 *U.S. Geol. Sur.* [1898], p. 233).

The report under notice is marked "vol. i.," and we may expect that the geological and petrological study of the Cape Colville district will yield further results of interest. One question which remains to be elucidated is that of the mode of occurrence and origin of the gold. Comparison with the well known Comstock district of Nevada suggests that careful chemical assays of the rocks, both fresh and decomposed, would give significant information on this point. A. H.

INSECTS AS CARRIERS OF DISEASE.[1]

"Infinite torment of flies."—*Tennyson.*

THE last few years are marked in the annals of medicine by a great increase in our knowledge of certain parasitic diseases, and, above all, in our knowledge of the agency by which the parasites causing the diseases are conveyed.

Chief among these agencies, in carrying the disease-causing organisms from infected to uninfected animals, are the insects, and, amongst the insects, above all the flies. Flies, *e.g.* the common house-fly (*Musca domestica*), can carry about with them the bacillus of anthrax. Flies, ants, and other even more objectionable insects, are not only capable of disseminating the plague-bacillus from man to man, and possibly from rat to man, but they themselves fall victims to the disease, and perish in great numbers. They are active agents in the spread of cholera, and the history of the late war in this country definitely shows that flies play a large part in carrying the bacilli of enteric fever from sources of infection to the food of man, thus spreading the disease.

The diseases already mentioned are caused by bacteria. But flies also play a part in the conveyance of a large number of organisms which are not bacteria, but which, nevertheless, cause disease.

In considering the part played by flies in disseminating diseases not caused by bacteria, we can neglect all but a very few families, those flies which suck blood having alone any interest in this connection.

From the point of view of the physician, by far the most important of these families is the Culicidæ, with more than 300 described species and 5 subfamilies, of which two, the Culicina and the Anophelina, interest us in relation to disease. The gnats or mosquitoes are amongst the most graceful and most beautiful insects that we know; but they have been judged by their works and undoubtedly are unpopular, and we shall see that this unpopularity is well deserved. Gnats belong both to the genus Culex and to the genus Anopheles. The genus Culex, from which the order takes its name, includes not only our commonest gnat, often seen in swarms on summer evenings, but some hundred and thirty other species. Members of this genus convey from man to man the *Filaria nocturna*, one of the causes of the widely-spread disease filariasis. In patients suffering from this disease, minute embryonic round-worms swarm in the blood-vessels of the skin during the hours of darkness. Between six and seven in the evening they begin to appear in the superficial blood-vessels, and they increase in number until midnight, when they may occur in such numbers that five or six hundred may be counted in a single drop of blood. After midnight, the swarms begin to lessen, and, by breakfast time, about eight or nine in the morning, except for a few strayed revellers, they have disappeared from the superficial circulations, and are hidden away in the larger blood-vessels and in the lungs.

In spite of their incredible number, some authorities place it at thirty to forty millions in one man, these minute larval organisms, shaped something like a needle pointed at each end, seem to cause little harm. It might be thought that they would traverse the walls of the blood-vessels, and cause trouble in the surrounding tissues; but this is prevented by a curious device. It is well known that, like insects, round-worms from time to time cast their skins, and the young larvæ in the blood cast theirs, but do not escape from the inside of this winding-sheet; and thus, though they actively wriggle and coil and uncoil their bodies, their progress is as small, and their struggles as little effective, as are those of a man in a strait-waistcoat.

One reason of the normal appearance of the creatures in the blood at night is undoubtedly connected with the habits of its second host, the gnat or mosquito. Two species are accused of carrying the Filaria from man to man—*Culex fatigans* and *Anopheles nigerrimus*. Sucked up with the blood, the round-worms pass into the stomach of the insect. Here they appear to become violently excited, and rush from one end to the other of their enveloping sheath, until they succeed in breaking through it. When free, they pierce the walls of the stomach of the mosquito, and come to rest in the great thoracic muscles. Here the Filarias rest for some two or three weeks, growing considerably and developing a mouth and an alimentary canal, thence, when they are sufficiently developed, they make their way to the proboscis of the mosquito. Here they lie in couples. Exactly how they effect their exit from the mosquito and their entrance into man has not yet been accurately observed; but presumably it is during the process of biting. Once inside man, they work their way to the lymphatics, and very soon the female begins to pour into the lymph a stream of young embryos, which reach the blood-vessels through the thoracic duct. It is, however, the adults which are the source of all the trouble. They are of considerable size, three or four inches in length; and their presence, by blocking the channels of the lymphatics, gives rise to a wide range of disease, of which elephantiasis is the most pronounced form.

We now pass to the second of the diseases carried by gnats, that of Malaria.

The parasite which causes malaria is a much more lowly organised animal than the Filaria. It is named Hæmamœba, and it too is conveyed by an insect, and, so far as we know, by one genus of mosquito only, the Anopheles. Hence from the point of view of malaria it is important to know whether a district is infected with Culex or Anopheles. The former is rather humpbacked and keeps its body parallel with the surface it is biting, and its larva hangs at an angle below the surface of the water by means of a respiratory tube. Anopheles, on the other hand, carries its body at a sharp angle with the surface upon which it rests, and its larva lies flat below the surface-film and parallel with it. The malarial parasite lives in the blood-cells of man, but at a certain period it breaks up into spores which escape into the fluid of the blood, and it is at this moment that the sufferer feels the access of fever. Their presence and growth within the blood-cells

[1] From an Address delivered before the British Association at Pretoria, by A. E. Shipley, F.R.S.

result in the destruction of the latter, a very serious thing to the patient if the organisms be at all numerous. If the spores be sucked up by an Anopheles, they undergo a complex change, and ultimately reproduce an incredible number of minute spores or sporozoites, each capable of infecting man again if it can but win entrance into his body.

In normal circumstances, for each Filaria larva which enters a mosquito one Filaria issues forth, longer, it is true, and more highly developed, but not much changed. The malaria-parasite undergoes, in its passage through the body of the Anopheles, many and varied phases of its life-history. As the Frenchman said of the pork, which goes into one end of the machine in the Chicago meat-factories as live pig, and comes out at the other in the form of sausages, "il est diablement changé en route."

Whoever has watched under a lens the process of "biting," as carried on by a mosquito, must have observed the fleshy proboscis (labium) terminating in a couple of lobes. The labium is grooved like a gutter, and in the groove lie five piercing stylets, and a second groove or labrum. It is along this labrum that the blood is sucked. Between the paired lobes of the labium, and guided by them (as a billiard cue may be guided by two fingers), a bundle of five extremely fine stylets sinks slowly through the epidermis, cutting into the skin as easily as a paper-knife into a soft cheese. Four of these stylets are toothed, but the single median one is shaped like a two-edged sword. Along its centre, where it is thickest, runs an extremely minute groove, only visible under a high power of the microscope. Down this groove flows the saliva, charged with the spores or germs of the malaria-causing parasite. Through this minute groove has flowed the fluid which, it is no exaggeration to say, has changed the face of continents and profoundly affected the fate of nations.

It is an interesting fact that, amongst the Culicidæ, it is the female alone that bites, and she is undoubtedly greedy. If undisturbed, she simply gorges herself until every joint of her chitinous armour is stretched to the cracking point. At times even, like Baron Munchausen's horse after his adventure with the Portcullis, what she takes in at one end runs out at the other. But she never ceases sucking. The great majority of individuals, however, can never taste blood, and subsist mainly on vegetable juices.

Anopheles is often conveyed great distances by the wind, or in railway trains or ships; but of itself it does not fly far, about five or six hundred yards—some authorities place it much lower—is its limit. Both Anopheles and Culex lay their eggs, as is well known, in standing water, and here three out of the four stages in their life-history—the egg, the larva, and the pupa—are passed through. The larva and the pupa hang on to the surface-film of the water by means of certain suspensory hairs, and by their breathing apparatus. Anything which prevents the breathing tubes reaching the air ensures the death of the larva and pupa. Hence the use of paraffin on the pools or breeding places. It, or any other oily fluid, spreads as a thin layer over the surface of the pools and puddles, and clogs the respiratory pores, and the larvæ or pupæ soon die of suffocation.

Thus a considerable degree of success has attended the efforts of the sanitary authorities, largely at the instigation of Major Ross, all over the world, to diminish the mosquito-plague. It is, of course, equally important to try and destroy the parasite in man by means of quinine. This is, however, a matter of very great difficulty. In Africa and in the East nearly all native children are infected with malaria, though they suffer little, and gradually acquire a high degree of immunity. Still, they are always a source of infection; and Europeans living in malarious districts should always place their dwellings to the windward of the native settlements.

Another elegant little gnat, *Stegomyia fasciata*, closely allied to Culex, with which, until recently, it was placed, is the cause of the spread of that most fatal of epidemic diseases, the yellow fever. Like the Culex, but unlike the Anopheles, Stegomyia has a humpbacked outline, and its larva has a long respiratory tube at an angle to its body, from which it hangs suspended from the surface-film of its watery home. It is a very widely distributed creature; it girdles the earth between the tropics, and is said to live well on shipboard. It breeds in almost any standing fresh water, provided it be not brackish. The female is said to be most active during the warmer hours of the day, from noon until three or so, and in some of the West Indies it is known as the "day-mosquito."

The organism which causes yellow fever has yet to be found. It seems that it is not a bacterium, and that it lives in the blood of man. It evidently passes through a definite series of changes in the mosquito, for freshly infected mosquitoes do not at once convey the disease. After biting an infected person it takes twelve days for the unknown organism to develop in the Stegomyia, before it is ready for a change of host. The mosquitoes are then capable of inoculating man with the disease for nearly two months. The period during which a man may infect the mosquito, should it bite him, is far shorter, and extends only over the first three days of the illness.

Very careful search has hitherto failed to reveal the presence of the parasite of yellow fever. By its works alone can it be judged. It seems that, like the germ of rinderpest and of foot-and-mouth disease, it is ultra-microscopic; and our highest lenses fail to resolve it.

King Solomon sent to Tarshish for gold and silver, ivory, and apes and peacocks, and, at the present day, people mostly go to Africa for gold, diamonds, ivory, and game. These are the baits that draw them in. Of the great obstacles, however, which have for generations succeeded in keeping that great continent, except at the fringes, comparatively free from immigrants, three, and these by no means the least important, are insignificant members of the order Diptera. We have considered the case of Culex and Anopheles; the third fly we have now to do with is the tsetse fly (Glossina), which communicates fatal diseases to man and to cattle and domesticated animals of all kinds.

The members of the genus Glossina are unattractive insects, a little larger than our common house-fly, with a sober brownish or brownish-grey coloration. When at rest the two wings are completely superimposed, like the blades of a shut pair of scissors; and this feature readily serves to distinguish the genus from that of all other blood-sucking flies, and is of great use in discriminating between the tsetse and the somewhat nearly allied Stomoxys and Hæmatopota.

The tsetse flies rapidly and directly to the object it seeks, and must have a keen sense of smell, or sight, or both, making straight for its prey, and being most persistent in its attacks. The buzzing which it produces when flying is peculiar, and easily recognised again when once heard. After feeding, the fly emits a higher note, a fact recalling the observation of Dr. Nuttall and the present writer on the note of Anopheles, in which animal we observed that "the larger the meal the higher the note." The tsetse does not settle lightly and imperceptibly on the sufferer as the Culicidæ do, nor does it alight slowly and circumspectly after the manner of the horse-flies, but it comes down with a bump, square on its legs. Like the mosquito, the tsetse is greedy, and sucks voraciously. The abdomen becomes almost spherical, and of a crimson red, and in the course of a few seconds the fly has exchanged the meagre proportions of a Don Quixote for the ampler circumference of a Sancho Panza. Unlike so many of the blood-sucking Diptera, in which the habit is confined to the females, both sexes of Glossina attack warm-blooded creatures.

The fly always seems to choose a very inaccessible portion of the body to operate on, between the shoulders in man, or on the back and belly in cattle and horses, even inside the nostrils in the latter, or on the forehead in dogs. According to Lieut.-Colonel D. Bruce, R.A.M.C., to whom we owe so much of our knowledge of this fly and its evil work, the female does not lay eggs, but is viviparous, and produces a large active yellow larva, which immediately crawls away to some secluded crevice, and straightway turns into a hard, black pupa, from which the imago emerges in some six weeks. Thus two stages, the egg and the larva, both peculiarly liable to destruction, are practically skipped in the tsetse, at any rate in some species.

The genera of the Culicidæ which we have considered are found practically all over the world, but the genus

Glossina is fortunately confined to Africa. From the admirable map of the geographical distribution of the fly compiled by Mr. Austen, we gather that its northern limit corresponds with a line drawn from the Gambia, through Lake Chad to Somaliland, somewhere about the thirteenth parallel of north latitude. Its southern limit is about on a level with the northern limit of Zululand. The tsetse, of course, is not found everywhere within this area; and, though it has probably escaped observation in many districts, it seems clear that it is very sporadically distributed.

Even where the tsetse is found, it is not uniformly distributed, but occurs in certain localities only. These form the much dreaded "fly-belts." The normal prey of the fly is undoubtedly the big game of Africa. But they are not the only factor in its distribution. The nature of the land also plays a part. There are the usual discrepancies in the accounts of travellers, especially of African travellers, as to the exact localities the Glossina affects; but most writers agree that the tsetse is not found in the open veldt. It must have cover. Warm, moist, steamy hollows, containing water and clothed with forest growth, are the haunts chosen.

The tsetse fly belongs to the family Muscidæ, the true flies, a very large family, which also includes our house-fly, blue-bottle fly, &c. These flies, unlike Anopheles and Culex, are day-flies, and begin to disappear at or about sunset, a fact noted centuries ago by Dante:—

> "Nel tempo che colui, che il mondo schiara,
> La faccia sua a noi tien meno ascosa,
> Come la mosca cede alla zanzara."[1]

The practical disappearance as the temperature drops has enabled the South African traveller to traverse the fly-belts with impunity during the cooler hours of the night. At nightfall the tsetse seems to retire to rest amongst the shrubs and undergrowth; but, if the weather be warm, it may sit up late; and some experienced travellers refrain from entering a fly-belt, especially on a summer's night, until the temperature has considerably fallen.

The sickness and death of the cattle bitten by the tsetse were formerly attributed to some specific poison secreted by the fly, and injected during the process of biting. It is now, largely owing to the researches of Colonel Bruce, known to be due to the inoculation of the beasts with a minute parasitic organism conveyed from host to host by the fly. The disease is known as "nagana," and the organism that causes it is a species of Trypanosoma, a flagellate protozoon or unicellular organism, which moves by means of the lashing of a minute, whip-like process. Since Bruce's researches, a number of Trypanosomas have been found causing disease in various parts of the world; thus *T. evansii* causes the surra disease of cattle, horses, and camels in India; *T. equinum* produces the "mal de caderas" of the horse ranches of South America; and *T. equiperdum* is responsible for the North African disease called by the French the dourine; *T. theileri* causes the gall-sickness, and there are others. The particular species of Trypanosoma which causes nagana is *Trypanosoma brucei*, and it does not attack man; goats and donkeys seem also immune; but, with these exceptions, all domesticated animals suffer, and in a great percentage of cases the disease terminates in death. Just as the native children in Africa form the source of the supply of the malarial parasite without appearing to suffer much, so do the big game of the country abound in Trypanosoma without appearing to be any the worse. They are in Lankester's phrase "tolerant" of the parasite, and a harmony between them and the parasite has been established, so that both live together without hurting one another. It is from the big game that the disease has spread. In their bodies the harmful effect of the parasite has, through countless generations, become attenuated; but it leaps into full activity again as soon as the Trypanosoma wins its way into the body of any introduced cattle, horse, or domesticated animal.

The report of Colonel Bruce, which has just been issued, shows that the sleeping sickness which devastates Central Africa, from the west coast to the east, is also conveyed by a species of tsetse fly. Writing more than a hundred years ago of Sierra Leone, Winterbottom mentions the disease. "The Africans," he says, "are very subject to a species of lethargy which they are very much afraid of, as it proves fatal in every instance." Early last century it was recorded in Brazil and the West Indies; and Lankester has suggested that the deaths which our slave-owning ancestors used to attribute to a severe form of home-sickness, or even to a broken heart, were in reality caused by sleeping sickness. In one year the deaths in the region of Busoga reached a total of 20,000; and it is calculated that although the disease was only noticed in Uganda for the first time in 1901, by the middle of 1904 100,000 people had been killed by it. The disease is caused by the presence of a second species of Trypanosoma in the blood and in the cerebro-spinal fluid. The existence of this parasite has now been proved in all the cases recently investigated. Apparently the Trypanosoma can live in the blood without doing much harm, and only when it reaches the cerebro-spinal canal does it set up the sleeping-sickness. It is also found in great numbers in the lymphatic glands, especially those of the neck, which in patients infected by the parasite are usually swollen and tender. From the similarity of the parasite to that causing the cattle disease of South Africa, the idea at once arose that the Trypanosoma was conveyed from man to man by a biting insect. Along the lake shores a species of tsetse (*G. palpalis*) abounds; and it was noticed that if the fly, having fed off a sleeping-sickness patient, bit a monkey, the monkey became infected. Further, flies which were captured in a sleeping-sickness district were also capable of conveying the disease to healthy monkeys. The proof that sleeping sickness is due to a Trypanosoma known as *T. gambiense* present in the cerebro-spinal fluid of the patient, due to the brilliant research of Colonel Bruce and his colleagues, Captain Grieg and Dr. Nabarro, and that it is conveyed from man to man by *Glossina palpalis*, seems now complete.

Finally, we come to a last class of diseases which is of the utmost interest to the agriculturist and settler, and yet at present is but little understood. These diseases are caused by various species of a protozoon named Piroplasma, and the diseases may collectively be spoken of as piroplasmosis. When they are present in cattle they are spoken of in various parts of the world as Texas fever, tick-fever, blackwater, and redwater. Heartwater in sheep is a form of piroplasmosis. Horses also suffer, and the malignant jaundice or bilious fever which makes it impossible to keep dogs in certain parts of this country is also caused by a Piroplasma. Finally, under the name of Rocky Mountain fever, spotted- or tick-fever, the disease attacks man throughout the west half of the United States.

The organisms which cause the disease live for the most part in the red blood corpuscles, but they are sometimes to be found in the plasma or liquid of the blood. Unfortunately we know comparatively little about the life-history of the Piroplasma or of the various stages it passes through, but we do know how it is transmitted from animal to animal and from man to man.

We have seen that the carrier or "go-between" in the case of the malaria is the mosquito, and in the case of the sleeping sickness is the tsetse fly. Piroplasma, however, is not conveyed from host to host by any insect, but by mites or ticks, members of the large group of Acarines, which include beside the mites the spiders, scorpions, harvestmen, and many others.

The ticks differ from the insect bearers of disease, inasmuch as the tick that attacks an ox or a dog does not itself convey the disease, but it lays eggs—for I regret to say here, as with the Anopheles, it is the female only that bites—and from these eggs arises the generation which is infective, and which is capable of spreading the disease. The tick which conveys the Piroplasma from dog to dog is called *Haemophysalis leachi*. The brilliant researches of Mr. Lounsbury have shown that even the young are not immediately capable of giving rise to the disease. The female tick gorges herself with blood, drops to the ground, and begins laying eggs. From these eggs small six-legged larvæ emerge. These larvæ, if they get a chance, attach themselves to a dog, gorge themselves, and after a couple of days fall off. If their mother was infected they nevertheless do not convey the parasite. After lying for a time upon the ground the larval tick casts its skin and becomes

[1] *Inf.* xxvi. 26–28.

a nymph, a stage roughly corresponding with chrysalis of a butterfly. This nymph, if it has luck, again attaches itself to the dog and has a meal, but it also fails to infect the dog. After a varying time it also drops to the ground, undergoes a metamorphosis, and gives rise to the eight-legged adult tick. Here at last we reach the infective stage; the adult tick is alone capable of giving the disease to the animal upon which she feeds, and then only when she is descended from a tick which has bitten an infested host. Think what a life-history this parasite has! Living in the blood-corpuscles of a dog, sucked up by an adult tick, passed through her body until it reaches an egg, laid with that egg, being present while the egg segments and slowly develops into the larva; living quiescent during the larval stage and the nymph stage, surviving the metamorphosis, and only leaping into activity when the adult stage is reached. This most remarkable story probably indicates that the Piroplasma undergoes a series of changes comparable to those of the malaria organism when it is inside the mosquito; what these stages are we do not at present know, but Dr. Nuttall and Mr. Smedley at Cambridge, and many other observers elsewhere, are at work on the problem, and soon we shall have more light.

With regard to bovine piroplasmosis, Koch and others have distinguished redwater fever, which is conveyed by *Rhipicephalus annulatus*, and in Europe probably by *Ixodes reduvius* from the Rhodesian fever which is conveyed by *Rhipicephalus appendiculatus*, and I regret to say by a species dedicated to myself, *Rhipicephalus shipleyi*.[1]

The heartwater disease of sheep and goats is similarly conveyed by *Amblyomma hebraeum*, the Bont tick, and many farmers accuse *Ixodes pilosus* of causing the well known paralysis from which sheep suffer in the early autumn; and there are many others, diseases such as the chicken disease of Brazil, which is so fatal to poultry yards, and which is conveyed by the *Argas persicus*.

I will not weary you with more diseases. I think I have said enough to show that within the last few years a flood of light has been thrown upon diseases, not only of man and his domestic animals, but upon such insignificant creatures as the mosquito and the tick. I have tried to show how these diseases interact, and how both hosts are absolutely essential to the disease. We can now to a great extent control these troubles; the old idea that there is something unhealthy in the climate of the tropics is giving way to the idea that the unhealthiness is due to definite organisms conveyed into man by definite biting insects. We have at last, I think, an explanation of why Beelzebub was called the Lord of Flies.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

OXFORD.—Prof. Osler has been nominated by the Vice-Chancellor and Proctors as a delegate of the University Press.

A decree has been approved by Convocation providing that the stipend of the Sibthorpian professor of rural economy shall be 600*l*. a year, independently of the income from the Sibthorpian estate, in the years 1906 and 1907. This is necessary if an election is to be made before 1908, as the full endowment will not be provided by St. John's College until that year. St. John's is to nominate a member of the board of electors to the chair.

The following elections have been made to scholarships and exhibitions in natural science:—Balliol College, to a Brakenbury scholarship, J. S. Huxley (Eton College), to a scholarship, C. Whitley (Bromsgrove School); Lincoln College, to a scholarship, P. Pickford (Exeter School), to an exhibition, E. Hancock (Exeter School); Magdalen College, to a demyship, D. L. Hammick (Whitgift Grammar School, Croydon), to an exhibition, J. F. Venables (Magdalen College School, Oxford); Christ Church, to a scholarship, J. T. Lattey (Dulwich College), to an exhibition, W. A. Akers (Aldenham School); Trinity College, to a Millard scholarship, H. G. J. Moseley (Eton College).

A COURSE of lectures upon modern research in the psychology of memory, accompanied by the exhibition of apparatus, will be given by Dr. C. S. Myers in the physiological theatre of King's College, London, on January 12 and the following seven Fridays at 6 p.m. The course is free to internal students of the university and to all teachers. The general course in experimental psychology, accompanied by laboratory work, will be held on Saturdays, beginning on January 13. Particulars may be obtained from the secretary of the college.

THE *London University Gazette* announces that a course of nine or ten lectures on the origin of Gymnosperms will be given during the Lent term by Prof. F. W. Oliver, F.R.S., at University College on Mondays, commencing on January 22. There is no fee for the lectures. Further details and cards of admission may be obtained on application to the academic registrar at the university. Two courses of lectures have been arranged for the Lent term in the physiological laboratory of the university, viz. eight lectures on tissue-respiration by Mr. J. Barcroft on Tuesdays, beginning on January 16, and eight lectures on respiration by Dr. M. S. Pembrey on Fridays, beginning on January 19.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, November 23, 1905.—"Some Observations on *Welwitschia mirabilis*, Hooker, f. By Prof. H. H. W. **Pearson.** Communicated by A. C. Seward, F.R.S.

Evidence is adduced in support of the view that Welwitschia is partially, if not entirely, insect-pollinated, and that the processes of fertilisation and maturation of the seed seem to be effected much more rapidly than in other Gymnosperms.

The author supports Strasburger's view that the male flowers are reduced forms of an originally hermaphrodite structure. The nature of the prothallial tubes is discussed, and the conclusion is that the true interpretation of the extraordinary behaviour of the fertile end of the Welwitschia prothallus will be founded upon a comparison with the corresponding portion of the embryo-sac of *Gnetum gnemon*.

December 14, 1905.—"The Araucarieæ, Recent and Extinct." By A. C. **Seward,** F.R.S., and Sibille O. **Ford.**

The work was undertaken primarily with a view to ascertain whether the genera Agathis and Araucaria exhibit any of those features which are often associated with survivals from the past; the aim was to obtain an answer to the question: Do the existing Araucarieæ afford evidence of primitive characters or do they throw light on the phylogeny of the araucarian phylum?

A comparison is made between the Araucarieæ and Lycopodiales; arguments are advanced in favour of the view that this group of Gymnosperms, unlike the Cycadales, was probably derived from lycopodiaceous ancestors. Attention is directed to the various characters in which the Araucarieæ differ from other members of the Coniferales, and the advisability is suggested of giving more definite expression to their somewhat isolated position by substituting the designation Araucariales for Araucarieæ.

The authors contend that the general consent which has deservedly been given to the view that the Cycadales and Filicales are intimately connected by descent may have the effect of inducing an attitude too prone to overestimate the value of the arguments advanced in support of an extension of the idea of a filicinean ancestry to other sections of the Gymnosperms.

"On the Microsporangia of the Pteridosperms." By R. **Kidston,** F.R.S.

The conclusion arrived at is that the Cycadofilices, which long antedated the advent of true ferns, cannot have been derived from them, but are themselves the oldest type of fern-like plant at present known. In regard to the true ferns, it seems probable that they may have been derived from the Botryopterideæ.

"The Mammalian Cerebral Cortex, with Special Reference to its Comparative Histology. I., Order Insectivora." By Dr. G. A. **Watson.** Communicated by Dr. F. W. Mott, F.R.S.

[1] This happily turns out to be a synonym.

This paper is one of a series in which it is hoped to deal with the cerebral cortex of the various orders of mammals so far as material is available, the primary object of the research being to endeavour to shed some further light upon the significance of the mammalian neopallial lamination. In this natural order the brains of the mole (*Talpa europea*), shrew (*Sorex vulgaris*), and hedgehog (*Erinaceus europeus*) have been exhaustively studied.

The neopallium of these animals has been mapped out into various areas, which on the dorso-lateral and mesial aspects appear to present (1) "motor," (2) general sensory, and (3) undifferentiated or unspecialised characteristics, the two former being in every way the best developed neopallial regions. On the postero-mesial aspect a field has been delimited which possesses sensory features; a portion of this is unspecialised, and the remainder is believed to represent the cortical distribution of the optic and fifth sensory nerves respectively. Certain differences in the extent and state of development of these various areas occur in the several animals, and these agree with certain differences in their habits.

The total depth of the cortex in the best developed regions differs in the three animals, yet the relative depth of the separate layers is about the same in all. Micrometric measurements of the cortex of the mole have been made by Dr. Bolton, and these have been compared with the latter's measurements of the cortical layers in the developing human fœtus and the normal human adult. Dividing the cortex into the portions above and below the granular layer, it is found that the increase in depth of the human cortex as compared with that, say, of the mole is *very* largely due to increase in the "*supra-granular*" (*i.e.* the true pyramidal) layer.

The conclusions as to the functional significance of the neopallial primary cell layers in the Insectivora and in mammals belonging to other natural orders so far examined form a complement to those advanced by Bolton. The "*infra-granular*" layer (iv. and v.), omitting the constituent cells which possess motor or analogous functions, is concerned especially with the associations necessary for the performance of the instinctive activities, the "supra-granular" (ii.) with the higher associations ("intelligence"), the capacity for which is shown by the educability of the animal. In practical animal behaviour the two sets of processes are probably more or less constantly interwoven, the higher activities (supra-granular layer) coming to the aid of the lower so far as the capability of the animal allows. In the case of lower mammals, *e.g.* Insectivora, the limits of this capability are comparatively soon reached, and correspondingly these mammals possess a relatively poor "supra-granular" layer.

Anthropological Institute, December 19, 1905.—Prof. W. Gowland, president, in the chair.—The origin of Eolithic flints from natural causes: S. H. **Warren.** Mr. Warren classified eoliths as follows:—(1) Flints with battered surfaces formed by prolonged concussions; (2) flints with flaked surfaces formed by sharp percussions; (3) flints with chipped edges formed by (*a*) indiscriminate battering, (*b*) perpendicular pressure. The possible causes of the production of eoliths were considered by Mr. Warren to be:—(*a*) human agency; (*b*) wave action; (*c*) water abrasion by streams, rivers, floods; (*d*) soil abrasion by the pressure and movement of soil creep and foundering; (*e*) the drag of ice; and (*f*) wear and tear on the surface of the ground. The eoliths of the first class, as defined above, may obviously be due to water abrasion. Those of the second class bear evidences of percussion-flaking, acting along the lines of least resistance, but show no control-working upon a definite design. It is concluded that these forms, together with those having indiscriminately battered edges, are likewise due to water abrasion. It is noteworthy that these classes are characteristic of river gravels of various ages, and may be reproduced by artificial rolling. The flints with definitely pressure-chipped edges include the typical "plateau implements" of Sir J. Prestwich. The chief forms are a general chipped edge, and the notch, either single or in various combinations, such as the double notch with intervening point. It is found by experiment that these are the forms produced by the fortuitous pressure of one flint against another. The angle of chipping and the type of the fractures are also identical in the case of the experimental productions and the plateau flints. These pressure-chipped eoliths are characteristic of hill-drifts which have suffered from the movement of soil-creep and foundering, and it is concluded that this is the cause of the chipped edges. This process is named "soil abrasion" in contradistinction to water abrasion. Collateral evidence of these differential soil movements under pressure is furnished by the frequent association with the eoliths of the hill-drifts of flints with surfaces striated in all directions. Subsidiary causes of the pressure-chipped eoliths, or those which have operated in certain special cases, are the drag of ice and wear and tear on the surface of the ground, including the impact of the hoofs of animals.

EDINBURGH.

Royal Society, December 4, 1905.—Lord Kelvin, president, in the chair.—The development of the skull and visceral arches in Lepidosiren: W. E. **Agar.** The material for this investigation had been collected by Prof. Graham Kerr in the Chaco, and by the late Mr. J. S. Budgett in the Gambia. The chief points established were as follows:—The development of the notochord underwent a curious modification, the front end disintegrating at an early stage and being replaced by a forward growth of the remaining part of the chorda. The quadrate was from the first continuous with the trabecula, and there was no hyomandibular. A vestigial palato-pterygoid bar was present. The general development of the skull resembled the process in the Urodeles, especially as regards the occipital region and nasal capsules. There were two pairs of upper labial cartilages. In the change from the larval to the adult form there was no absorption of cartilage, but the chondrocranium showed a steady increase in completeness. —Perturbations in longitude of Neptune by the hypothetical planet: Prof. George **Forbes,** F.R.S. About twenty-five years ago the author had deduced evidence from the distribution of the aphelia of cometary orbits that there existed a planet of considerable mass beyond the orbit of Neptune, and the existence of such a planet was now generally accepted by astronomers. In the present paper, by means of calculations based upon certain assumptions as to position and mass of the hypothetical planet, Prof. Forbes discussed the growing discrepancies between the observed longitudes of Neptune and those assigned by the theories both of Leverrier and Newcomb. The present configuration of the two planets was not the best to bring out clearly the nature of the perturbation, but he thought that in ten years sufficient material would be in hand to enable us to make a serious effort to fix the position of the ultra-Neptunian planet.—Exhibition of two lantern slides of zoological interest: Prof. D. J. **Cunningham,** F.R.S. The one showed a group of monkeys in the Dublin Zoological Gardens sitting in newly fallen snow without the least discomfort; from the beginning of their captivity they had lived in the open air. The other showed a young marmoset clinging in its peculiar fashion to the back of a white rabbit which had acted as foster-mother from the start of the marmoset's individual life.

December 18, 1905.—Dr. R. H. Traquair, F.R.S., vice-president, in the chair.—Library aids to mathematical research: Dr. Thomas **Muir,** F.R.S. After a critical discussion of the various bibliographical aids to the mathematical student, the author proceeded to point out the shortcomings in the equipment of the most important scientific libraries in Edinburgh and Glasgow. Out of sixty-seven important mathematical serials, only thirty-four were to be found in Edinburgh and Glasgow; and of the thirty-one to be found in Edinburgh, twenty-one were duplicated in the university and Royal Society libraries. Dr. Muir hoped that by some system of cooperation between the Edinburgh libraries, or even between Edinburgh and Glasgow, every mathematical serial published in Europe and America would be made available to mathematical workers. At present historical research was absolutely debarred.—Preliminary note regarding an experimental investigation into the effects of varying diets upon growth and nutrition: Dr. Chalmers **Watson.** The experiments consisted in feeding colonies of rats upon various diets, namely, (1) skim milk and bread; (2) rice;

(3) porridge; (4) horse flesh; (5) ox flesh. Interesting details were given and illustrated by diagrams and tables. The rats were found to thrive best on the skim milk and bread. Rice, because of its lack of proteid qualities, stunted the growth. Porridge was inferior to the skim milk and bread, while horse flesh and ox flesh were positively deleterious, being fatal to young rats. Moreover, the mortality among the young was greatly increased when the adult parents were fed on flesh. Experiments were also tried on the effects of change of diet. For example, after the young rats had been reduced almost to starvation point by a flesh diet, they were put on milk and bread, and immediately began to recover, and rapidly reached the maximum growth. In this set of experiments it was found that sweet milk and bread were inferior as a recuperative diet to skim milk and bread. Prof. Schäfer, in whose laboratory the experiments had been carried out, referred to the importance of the research in relation to physical deterioration. Although it would be absurd to apply the results directly to the question of human diets and nutrition, there was no doubt that the physical deterioration so much spoken about was due, not only to underfeeding, but to wrong feeding. So far as the public was concerned, the moral was that we must feed our children correctly.

New South Wales.

Royal Society, October 4, 1905.—Mr. H. A. Lenehan, president, in the chair.—Note on some simple models for use in the teaching of elementary crystallography: Dr. W. G. **Woolnough**. The models illustrated the connection between the number of faces in a crystal "form" and the elements of symmetry of the group to which the crystal belongs. Planes of symmetry are represented in the models by mirrors suitably arranged, and crystal faces by triangles of cardboard. The mirrors are so fixed that the multiple reflection of the card reproduces the shape of the most general form possible in the crystal group.

November 1, 1905.—Mr. H. A. Lenehan, president, in the chair.—Provisional determination of astronomical refraction, from observations made with the meridian circle instrument of the Sydney Observatory: C. J. **Merfield**. This paper gives the results of an investigation into astronomical refraction, deduced from some five hundred and fifty observations of forty fundamental stars taken with the meridian circle of the Sydney Observatory during the month of July, 1905. The conclusions arrived at by the author are as follows:—That if observations of zenith distance of celestial objects are taken between limits of time separated by some hours, then greater accuracy in the reductions, to obtain correct positions, can be obtained by taking fully into consideration the fluctuations of the height of the barometer, and especially the variation of the temperature, indicated by the readings of the thermometer, when computing the refractions for a series of observations extending over a period of several hours' duration. Adopting a state of the atmosphere for a mean of the times of observation does not seem sufficient. Further, the refraction table (Bessel) in use at the Sydney Observatory would represent the observed refractions much better if a correction be applied for the difference in the force of gravity at Greenwich and Sydney. This correction is represented by a very simple equation which is a function of the latitudes of the two places. The author also considers that the refractions computed from the Pulkowa tables, after applying the gravity correction, would represent the observed values better than those of Bessel.

DIARY OF SOCIETIES.

THURSDAY, JANUARY 4.

RÖNTGEN SOCIETY, at 8.15.—Presidential address: The Present Position of Radio-activity: Prof. F. Soddy.

CIVIL AND MECHANICAL ENGINEERS' SOCIETY, at 8.—The Present Position of the Sewage Question: J. F. Reade.

FRIDAY, JANUARY 5.

GEOLOGISTS' ASSOCIATION, at 8.—On the Geology of the Country around the Sogne Fjord and the Hardanger Fjord, Norway: H. W. Monckton.

MONDAY, JANUARY 8.

SOCIETY OF CHEMICAL INDUSTRY, at 8.—Cinchona Barks and their Cultivation: D. Howard.—A New Method for the Quantitative Estimation of Acetone: S. J. M. Auld.

TUESDAY, JANUARY 9.

INSTITUTION OF CIVIL ENGINEERS, at 8.—The Elimination of Storm-water from Sewerage Systems: D. E. Lloyd-Davies.—On the Elimination of Suspended Solids and Colloidal Matters from Sewage: Lieut.-Colonel A. S. Jones and Dr. W. O. Travis.

WEDNESDAY, JANUARY 10.

GEOLOGICAL SOCIETY, at 8.—The Clay-with-Flints: its Origin and Distribution: A. J. Jukes-Browne.—On Footprints from the Permian of Mansfield (Nottinghamshire): G. Hickling.

THURSDAY, JANUARY 11.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—The Charing Cross Company's City of London Works: W. H. Patchell (*Conclusion of Discussion*).

LONDON MATHEMATICAL SOCIETY, at 5.30.—On the Diffraction of Sound by Large Cylinders: J. W. Nicholson.—On the Monogeneity of an Algebraic Function: Dr. H. F. Baker.

FRIDAY, JANUARY 12.

ROYAL ASTRONOMICAL SOCIETY, at 5.

INSTITUTION OF CIVIL ENGINEERS, at 8.—Lecture on the Theory of Machines: Prof. J. D. Cormack.

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