THURSDAY, APRIL 20, 1911.

ENGINEERING ARTICLES IN THE ENCYCLOPÆDIA BRITANNICA.

Collection of Articles (loose sheets) dealing with Engineering, from the New (11th) Edition of the Encyclopaedia Britannica. (Cambridge: University Press, n.d.)

THE articles dealing with engineering subjects, in that portion of the new edition of the "Encyclopædia Britannica" which ranges from aëronautics up to irrigation, have been issued separately for the purposes of review. As a whole, the articles attain a high standard of excellence, and the writers are men of acknowledged authority. Some of these articles have appeared in previous editions, and are substantially reproduced; but they have been brought up to date in most cases. Many new subjects have been dealt with in an interesting manner, and the appended bibliographical references are generally of considerable value, and will guide in their choice of authorities readers who desire to obtain fuller information. As might be expected from the necessity for extra condensation existing in encyclopædic articles, there is a lack of due proportion on the part of some authors in treating individual branches of particular subjects.

The article on aëronautics has special interest at the present time, and deals fully with aërostation—the construction and behaviour of machines which are lighter than air. Aviation—the branch of aëronautics which is devoted to flying machines heavier than air, is treated very briefly under the heading of aëronautics, but is also discussed under "Flight and Flying." This subdivision is arbitrary, and from the engineering side it would be more convenient had flying machines of all kinds been grouped together.

The article on "Aqueducts" contains a comparatively brief account of modern practice, but ancient works and historical facts have been dealt with in considerable detail. It is notable also that while works connected with the water supply of Manchester and Liverpool are described at length, no reference is made to the later and equally important works carried out for Birmingham. The article on "Docks" is of great interest and value, giving good information as to most works of the kind; but it is strange to find only the briefest descriptions of modern floating dry-docks, although, as is well known, their development in recent years has been remarkable. Formerly graving docks were practically supreme; they have now become relatively less important, especially in foreign ports, where floating docks are to be found which are capable of lifting the largest ships.

Under the heading of "Canals" one would have expected to find fuller reference to the facts disclosed and suggestions made in connection with the recent inquiry by a Royal Commission into the present condition and use of British canals. The actual reference occupies only about a dozen lines, and looks like an afterthought. A few of the most important canal works of modern times are dealt with in separate articles, including the works at Panama and those incidental to the great enlargement of the Kiel-Brunsbuttel Canal, now being carried out by Germany, as a part of her naval strategy rather than with a view to any commercial benefits to her mercantile marine. In the treatment of certain subjects considerable latitude appears to have been permitted to writers, although the relative importance of these subjects hardly justifies the prominence given to them. In other cases there has been a degree of compression which is to be regretted. Editorial control of such technical matters is undoubtedly difficult, but it might in many cases have been exercised with advantage. The article on "Concrete," for example, deals with a subject of enormous and increasing importance, especially at a time when "ferro-concrete" construction—termed by the writer "steel-concrete"—is making rapid strides, yet its discussion—excellent so far as it goes—is compressed into five pages. On the other hand, the discussion of "Fire and Fire Extinction" occupies more than three times as much space. The latter subject is undoubtedly important, but from an engineering point of view it has not the relative importance which mere space measurement would suggest.

Apart from these criticisms on a few points of detail, it is a pleasure to record the opinion that on the whole the engineering articles constitute a valuable epitome of recent professional practice, and will be of great value for purposes of reference. Not a few of them are worthy of separate publication, the treatment displaying both thoroughness and ability. Some attain almost to the dignity of standard treatises on the subjects discussed, and amongst these may be mentioned the contributions of Dr. Unwin on "Bridges and Hydraulics," Mr. Dugald Clerk's article on "Gas Engines," Prof. Ewing's on "Air Engines," and Mr. Milton's on "Boilers." In many other articles modern practice is well described, and new departments of engineering are illustrated.

Special interest attaches to the articles on "Conveyors," "Elevators," and "Destructors," which deal with engineering appliances that are essential to the life and work of great centres of population. The paper dealing with "Divers and Diving apparatus" is admirable in its clearness and completeness, containing descriptions of recent improvements for working at great depths below the surface of the sea. Dredging is another subject which has been treated at length, and with great ability, both in relation to the construction and maintenance of channels and harbours, and its applications for purposes of scientific research. Diamond and gold mining are dealt with by high authorities in a manner which the general reader can understand. Coal and coal mining are equally well handled. A large number of shorter and less important articles are devoted to descriptions of engineering details and processes. Irrigation receives the attention it so well deserves, excellent accounts being given of the great and beneficial results obtained by British engineers in India, Egypt, and elsewhere, as well as the work done by foreign engineers in other countries.

A few short biographies are included in the

engineering section of the "Encyclopædia," although there is no clear indication of the principle on which the subjects have been selected. The biography of Sir Benjamin Baker is hardly worthy of the man. The article is very brief, and it gives no adequate idea of the great engineering works for which Baker was responsible. This is much to be regretted. On the other hand, the notices of Bessemer and Brassey (father of Lord Brassey) contain excellent summaries of widely differing careers. The description of the "swinging saloon" devised by Bessemer for cross-Channel steamers, and of the failure of that system in practice, illustrate the dangers attaching to ventures into new regions even when they are made by capable inventors who have achieved success in other directions. Bessemer had not mastered the principles of the behaviour of ships at sea, otherwise he would not have attempted to keep a swinging saloon level as the steamer rolled by the control of an attendant who watched the indications of a spirit-level, and manipulated hydraulic machinery. Thomas Brassey was not an engineer, but was simply one of the first and greatest contractors for engineering works. He is shown to have been a man of great business and administrative capacity. The sketch of his life brings into relief his high personal qualities and illustrates the fact that he "was one of the first to aim at improving the relations between engineers and contractors, by setting himself against the corrupt practices which were then common."

W. H. W.

EXPERIMENTAL ZOOLOGY.

Experimental-Zoologie. 3: *Phylogenese.* By Dr. H. Przibram. Pp. viii+315+xxiv. plates. (Leipzig und Wien: F. Deuticke, 1910.) Price 18 marks.

THIS volume, the third instalment of the author's work on experimental zoology, is planned on the same lines as the preceding parts; it deals essentially with the nature of species and the origin and modification of specific characters. It gives a concise summary of the work which has been done in various branches of the subject, with short discussions and criticisms where the author considers them necessary. It is on the whole, however, rather an encyclopædia of the phenomena of species than a discussion, as is indicated by the fact that 70 out of 315 pages are devoted to the bibliography and index. In some cases rather more criticism would have been welcome, for the author summarises papers of very different importance with an impartiality which sometimes makes it difficult to gauge the relative value of the work.

In general, the treatment is exceedingly complete, and includes accounts of papers which might have been overlooked without giving just cause for complaint, but there are a few rather surprising omissions. For example, in dealing with heredity, the work of the biometrician school is scarcely mentioned apart from Galton's formulation of the law of ancestral inheritance; Nettleship's Bowman lecture on hereditary eye-diseases is omitted; and still more surprising is the absence of any reference to Gamble and Keeble's work on the effects of coloured surroundings on pigment development. Poulton's work on the same subject is also treated rather inadequately.

The plates are of the semi-diagrammatic kind used in the first volume, and are excellent as illustrations of the text; they are folded so that a plate can be turned out for reference while reading, but it would make it easier to find the plate required if the numbers were visible when they are folded. As in the previous volumes, the use of the letters *a* and *α* is sometimes confusing; in plate vii. we notice that the numbers 4*a* and 4*c* are interchanged, and in the description of plate xxiv., Fig. 14, the use of the word "heterozygote" is misleading. We mention these small defects in the hope that an English translation will be undertaken, in which they may be remedied.

The book opens with a discussion of the criteria of species, in which the importance of physiological characters (blood tests, &c.) is emphasised, and a tabular summary is given of various classes of specific characters. The two short chapters which follow deal with the possibilities of asexual (somatic) and sexual transmission of characters. Chapter iv. consists of a very complete catalogue of experiments in hybridisation, both of crosses between distinct species and between races or varieties. This fills 100 pages, and is most valuable as a list of all the most important cases up to the year 1909. In the succeeding chapter these results are analysed. It is concluded that the first cross (F_1) may show (1) a blend, (2) a mosaic, or (3) alternative appearance of the parental characters. In the F_2 generation the first and second classes may give young all like F_1, or Mendelian segregation may occur; the third class always gives a Mendelian result. The view that Mendelian characters are borne by chromosomes is provisionally accepted. A good account is given of dihybrid and polyhybrid cases, and of the phenomena of "latency" and sex-limited inheritance. In crosses between distinct species the characters often blend, because apparently corresponding characters in different species are not allelomorphic. The relation of Mendel's and Galton's laws to each other is described, and in a discussion of the relation of alternative to blended inheritance a suggestion is made for bringing both into one category.

Chapter vi. (63 pages) gives a summary of work in the production of characters by environment, and their inheritance. Among the work on Protozoa, Dallinger's experiments are not mentioned; and in the long section devoted to the Lepidoptera, we think that a fuller discussion might have been given of the means by which colour-production is influenced by temperature and other factors, as indicated, for example, by Gräfin von Linden's work. The theoretical conclusions to be drawn from this chapter are postponed to the end of the book. In the chapters on selection and mimicry, a good account is given of experiments and observations by various workers, and it is concluded that although natural selection can bring about the survival of the fittest, and although mimicry of a noxious species may be a protection to the mimic, yet selection can originate nothing, but only isolate "pure lines" already existing.

In the final chapter causes of change in specific characters are classified (chemical, mechanical, light, heat, &c.), and finally a valuable discussion is given of the three chief hypotheses of specific change—germinal variation, transmission of somatic acquirements, and parallel effects of environment on soma and germ. The arguments for and against each are set forth in tabular form, and it is concluded that few, if any, observed facts are inconsistent with the third hypothesis, while it has important experimental and circumstantial evidence in its favour.

L. D.

REFERENCE BOOKS OF BIOCHEMISTRY.

Biochemisches Handlexikon. Herausgegeben von Prof. Emil Abderhalden.

iv. Band, 1 Hälfte: *Proteine der Pflanzenwelt, Proteine der Tierwelt, Peptone und Kyrine, Oxydative Abbauprodukte der Proteine, Polypeptide.* Pp. 352. Price 14 marks.

vii. Band, 1 Hälfte: *Gerbstoffe, Flechtenstoffe, Saponine, Bitterstoffe, Terpene.* Pp. 538. Price 22 marks.

(Berlin: J. Springer, 1910.)

THESE two books form the first halves of vols. iv. and vii. of a work in seven volumes on biochemistry, which is intended, as the editor states in the preface, to perform the same function for the biochemist as "Beilstein" does for the organic chemist.

Although the work is termed a hand-lexicon, the articles are arranged as monographs, and there is no discoverable system by which the reader may trace out any detail to which he may want to refer in any one of these long articles. There is no table of contents nor any index to help one, and in any well-regulated laboratory one might almost as well, so far as trouble is concerned, search out the original literature as refer to one of these articles.

For example, one of the best articles in the two half-volumes under review is that on the saponins by Prof. Kobert, of Rostock, occupying 84 pp., and describing nearly as many members of the group as there are pages in the article. There is no apparent method in the arrangement of the description of the members, and nothing to guide us as to where any particular member is to be found. It so happens that the writer is at present working at the biochemistry of an important and well-known saponin occurring in ivy-leaves, and therefore he looked keenly through these 84 pp. to see if there was anything new about it. The search was disappointing; after a long and weary hunt not one word was to be found in the whole article concerning it. This will never do in a work intended to be the biochemical rival of "Beilstein." In that work each volume carries its index, and it is to be hoped that purchasers of the present work will not have to wait longer than the appearance of the second halves of the volumes for the indispensable index.

The two half-volumes which have so far appeared form very dull, dry, and uninteresting reading even for a "Handlexikon," and lack the saving virtues of a lexicon of completeness and ready accessibility to detail.

It would have been an improvement if the articles had been issued as separate monographs; and even then one might question why it was necessary to write some of them at all. Better monographs and more complete have been compiled by other writers in several of the subjects, and are well known and accessible to all workers in biochemistry; and in certain of the others the subject of the monograph is interesting to such a small circle of readers only that it might still be allowed to rest in the original archives, where the half-dozen workers on the subject know quite well where to find the papers they require.

One wonders how many readers will take any deep interest in the wonderfully detailed article of 112 pp. from the pen of Dr. O. Hesse on "Die Flechtenstoffe," under which title, the author informs us at the outset, we are to understand "organic compounds which occur only in the 'Flechten' or lichens, and accordingly are peculiar to these plants." Again, of the very few who have the requisite special training to struggle through Dr. Hesse's article, how many will ever require in the entire course of their lifetime any of the wondrous detail of Dr. Kobert's article on saponins coming immediately after it? There is certainly a deep and abiding comfort in thinking upon the amount of human lore in complete ignorance of which one can pass happily and successfully through this mortal life.

Turning to the articles in the two half-volumes which interest a wider circle of readers, such as those in vol. iv., first part, on the vegetable and animal proteins, their hydrolytic and oxidative products, and the polypeptides, these may be described as somewhat more useful, although the cast-iron form into which they are thrown robs them of much of their interest. One becomes somewhat fatigued by the continuous repetition in mournful, broad-faced type of Vorkommen, Darstellung, Bestimmung, Koagulationstemperatur, physikalische und chemische Eigenschaften, physiologische Eigenschaften, u.s.w. If the monograph form is to be selected for a hand-lexicon, why not give some freedom to the authors to throw the matter into their own form and style, and so infuse some life into what they are writing, instead of dissecting it out in this way like a dead body? An index to each monograph would easily give orientation to anyone looking for a special detail. The cast-iron plan pursued in the present work, moreover, loses space instead of gaining it by continued reiteration of the same facts for each member of a many-membered class. For example, the actions of the digestive juices upon polypeptides could be given in tabular form in a space of one or two pages by putting the whole thing connectedly and together; instead of this, practically the same statements are repeated in describing each member of the legion of polypeptides. Again, in the article on the saponins, the reaction of each individual to the generic colour-test with concentrated sulphuric acid is given with tiresome repetition, as well as many other matters of

a general character, all of which, it may be remarked, have in this article already been given in an introductory description of general properties of the group.

Apart from details, nearly all the articles which deal with subjects of general interest will be found to present a well-known and familiar appearance to the biochemist. Any laboratory which possesses E. Fischer's work on the amino-acids and polypeptides can have little service for the present monograph on the same subject in this series. The article on the vegetable proteins in the "Biochemischen Arbeitsmethoden," written by the same author, edited by the same editor, and issued by the same publishing house (reviewed in NATURE a few months ago), takes much of the wind out of the sails of the article on the "Proteine der Pflanzenwelt" in the present colossal work, which is appearing simultaneously with the equally colossal "Handbuch der biochemischen Arbeitsmethoden" under Prof. Emil Abderhalden's guidance.

There would appear to be a paying market for any large work on chemistry issued in Germany, for that country seems to have become the world's factory for this type of literature, and of all German editors Prof. Emil Abderhalden seems to be the most prolific, as witness the twin works, each of about seven volumes, and each volume so fat that it becomes itself a twin, issuing at the same time under his editorship. But one occasionally feels there can be too much of this thing, and is inclined to cry out, "Halt, halt; we must work as well as read," and spend our money, at least in part, upon materials and equipment for our laboratories, which bid fair to be starved by too much cooking for our libraries.

BENJAMIN MOORE.

METABOLISM OF PLANTS.

Der Stoffwechsel der Pflanzen. By Prof. A. Nathansohn. Pp. viii+472. (Leipzig: Quelle and Meyer, 1910.) Price 12 marks.

THE great advances that have been made in recent years in research into the leading principles and fundamental facts of the physiology of plants have made it necessary to specialise in particular directions, and the literature of the subject shows in consequence a tendency to deal with two aspects of the general life of plants almost entirely apart from one another. Of these the first embraces the phenomena of the individual life; the second, the relations of the individual to the conditions of its environment. In the present volume Dr. Nathansohn has undertaken to deal almost exclusively with the former of these problems, and has set before himself the task of discussing the present position of the metabolic phenomena characteristic of the green plant. The book is not intended to displace the standard text-books on the subject, but to deal more exhaustively than is possible in the latter with the gradual unfolding of knowledge and the gathering together of the mass of detail which has been accumulating for the past decade or longer.

In pursuance of this design he has dealt with his subject in eight sections, following the general line of treatment of his predecessors. Beginning with the absorption of material from the soil and the atmosphere, he deals with the construction and management of foods, certain problems of nutrition, immediate and deferred, respiration and the regulation of energy, and the phenomena of secretion and excretion.

The discussion of the first of these questions, involving the absorption and transport of water, involves the examination of many physical and chemical questions, which are ably handled, with a due avoidance of dogmatism. The author introduces the second problem with a historical summary of the earlier work on the question of photosynthesis, or, as he prefers to call it, carbon dioxide assimilation. It is a little disappointing to find him almost stopping short here with the researches of the Sachsian period, and dealing very briefly with the result of later investigations. His treatment of the metabolic processes and phenomena in which non-nitrogenous substances are concerned leads one to regret that while the sugars are dealt with at great length, he has very little to say about the glucosides, inulin, and the celluloses. The metabolic phenomena in which these are concerned are of considerable importance, and a graphic presentation of them is just now much to be desired. In his treatment of nitrogenous substances, too, Dr. Nathansohn has dealt at some length with the proteins, giving them, as is natural, a position commensurate with their importance in metabolism; but he leaves us wishing he had devoted more space to such bodies as the alkaloids, which he dismisses somewhat briefly.

While appreciating the great amount of valuable material which the book contains, the English reader will be struck with particular deficiencies. The point of view leaves something to be desired. The book treats of the plant as a machine rather than as a living organism. No doubt it is a machine, but it is much more than that; it is capable of regulating all its chemical and physical processes according to its requirements from time to time and to the variation of external conditions. The part played by the living substance in the various changes and rearrangements that constitute metabolism is only too easily lost sight of. It is especially necessary to emphasise this fact, particularly in the discussion of the respiratory phenomena, or one might suppose that the respiratory interchanges take place for the most part without any involvement of the protoplasm, as if sugars, or fats, or what not, are oxidised in the cell by direct action of oxygen upon them. The fact that respiration is an indication of profound auto-decomposition and reconstruction of the protoplasmic molecule might have been made more impressive to the reader of the chapters which deal with this subject.

Another feature which is very remarkable is the narrow range of literature which the author quotes. Out of a total of some 450 references, a bare dozen or so are English, and scarcely more than a score are French. The English reader will certainly regret the very scant attention that has been paid to Eng-

lish researches. Surely in the story of the metabolism of the carbohydrates room might have been found for the classic work of Brown and Morris, and Brown and Escombe on the physiology of the foliage leaf and of the germinating barley grain; in other places for the work of the Cambridge school on the enzymes, the phenomena of gaseous interchange, and the conditions of respiration; and for the researches of Chittenden, Vines, and others on the phenomena of proteolysis. The discovery of erepsin is not mentioned, though its importance in the metabolic phenomena of proteins is beyond dispute. The author is apparently satisfied with the researches of the German scientific world, which, from the point of view of the advancement of knowledge, can only be regretted. J. R. G.

AGRICULTURAL ESSAYS.

Lectures Agricoles. By Prof. C. Seltensperger. Pp. 576. (Paris: J.-B. Baillière et Fils, 1911.) Price 5 francs.

"IL y a trois manières d'enseigner: on peut instruire en amusant, instruire en ennuyant, et même ennuyer sans instruire." The book before us opens with this incontestable statement, and when we reach the end we feel that the editor has kept well clear both of the second and third methods, and has succeeded in maintaining interest throughout.

The plan of the book is, we believe, entirely new in agriculture. It is not a text-book in the ordinary sense of the word. There is a scheme running through it, but the chapters are not written by one author, or even written expressly for the book, but are taken from the writings of the best known French agriculturists. Thus there is a lack of continuity and an absence of detail, but by way of compensation the reader gets a fine breadth of view, and he is introduced to the best agricultural experts in his country.

M. Schloesing writes on the soil, and succeeds in a very few pages in giving a picture that will carry the student a long way in his studies. M. Nivoit writes on railways and agriculture; he points out that France is not specially rich in minerals, but she has a good soil and an incomparable geographical position; thus a great variety of crops is possible, and good transport facilities become indispensable. Instances are given of what has already been accomplished: the Compagnie Paris-Lyon-Méditerranée carries fruit from Avignon to Paris in 24 hours, to London in 40 hours, to Hamburg and Berlin in 80 hours. The advantage to the grower is enormous, but the local consumer may suffer; where formerly he could often buy fruit at very low prices, he may now have to pay actually more than in some of the markets further off. This, however, is a detail that is easily remedied.

The applications of electricity in agriculture are dealt with by M. Petit. It is regarded only as a source of power, the direct effects of the discharge on plant-growth not being considered. As a driving power it has many advantages, and it is attracting attention in France; for us here, unfortunately, it is as yet inaccessible in country districts.

A number of chapters deal with the general economic and social problems of agriculture. Where there are so many small holdings and so few hedges as in France, the question of boundary lines between one man's property and his neighbours' becomes a fruitful source of dispute and of vexatious litigation. M. Muret deals with this problem, and gives some very useful advice to the disputants.

There are a number of admirable illustrations throughout the volume, which, however, are not always connected with the text, and are sometimes not even explained. In several chapters, especially those dealing with insect and fungoid pests, the absence of detail is felt more than it is elsewhere. References are, however, always given to inexpensive text-books where the further information can be obtained. Considering the very wide range covered—practically the whole of the agriculture of France—and the very modest price of the book, it must be put down as one of the most generally useful of the admirable series to which it belongs.

MICROSCOPY FOR ZOOLOGISTS AND ANATOMISTS.

Grundzüge der mikroskopischen Technik für Zoologen und Anatomen. By A. B. Lee and P. Mayer. Vierte Auflage. Pp. vii+515. (Berlin: R. Friedlander and Son, 1910.)

IN this the fourth edition of an established publication the authors have not found it necessary to make any material alteration in the contents of the previous edition. They have added, however, much new substance derived mainly from various microscopical journals; medical periodicals, numerous though they be, having, to the authors' regret, been almost entirely unproductive. As will be gathered from the title the scope of the work is limited to anatomical and zoological microscopy. Such limitation is strictly observed. Even in the general paragraphs all temptation to wander off into by-paths is sternly resisted. Although the authors give freely of their own experience, they refer largely to the labours of others. The book is, in fact, crowded with condensed information, which has been industriously and exhaustively compiled during the last four years from suitable sources in many languages. References to these sources are always given. Nine chapters (131 pages) are devoted to the preliminary operations of killing, fixing, hardening, and imbedding. Seven chapters (94 pages) deal with staining; five (45 pages) with cements, varnishes, injections, and bleaching. Nine (140 pages) of the remaining ten chapters treat minutely the specific examination of the embryo and of various tissues and organs: one chapter (39 pages) is restricted to invertebrates. There is a copious index of no less than sixty-two pages, so that consultation of the contents is easily made.

A glance at any chapter, or group of chapters, readily reveals the thoroughness of compilation and the judgment of the authors. Thus, the essential process of imbedding is introduced by a general chapter (No. 6) on the subject. This chapter (*inter alia*) summarises the merits and demerits of the chief varieties of microtomes. It also summarises the ad-

vantages and disadvantages of paraffin and celloidin as imbedding materials. Around these much controversy has raged. The authors conclude that, while very thin sections can without doubt be best obtained in celloidin, the greater difficulty of manipulation and the greater requisite dexterity will probably lead an inquirer who wishes to work out a structure quickly and easily to adopt paraffin. As paraffin and celloidin are the chief imbedding agents, each of these is fully treated in a separate chapter, each chapter being of about twenty pages.

The chapters on stains are particularly full, and every colouring medium appears to be included. The recipes for their composition are given with quantitative accuracy, and, in the general preface, Dr. Mayer raises a protest against the vagueness with which such concoctions are frequently quoted. In several cases the important matter of stain durability is suitably discussed. The synonyms of tar dyes are always given.

It may be that to many investigators the most useful chapters will be those which deal specifically with organs and tissues, while other students will perhaps find the chapters on invertebrates the most attractive. Fulness of treatment is as much in evidence in these specialised regions of applied microscopy as in the more general parts of the book. The chapter on embryology (33 pages), for example, covers the animal kingdom; nerves are treated in three chapters (54 pages); and, under the heading of Echinoderms, each of the main subgroups is separately described.

The work as a whole gives the impression of unvarying thoroughness and completeness. It should be a valuable and indispensable auxiliary in the library of every biological laboratory. An appendix, compiled while the book was in the press, brings the contents thoroughly up to date. A. N. D.

DARWINISM AND PHILOSOPHY.

Dogmatism and Evolution: Studies in Modern Philosophy. By Prof. T. de Laguna and Dr. Grace A. de Laguna. Pp. v+259. (New York: The Macmillan Co.; London: Macmillan and Co., Ltd., 1910.) Price 7*s.* 6*d.* net.

THE authors explain that the term "dogmatism" is here used to denote the body of logical assumptions which were generally made by thinkers of all schools (*e.g.* Berkeley and Hume, as well as Descartes and Leibniz) before the rise of theories of social and organic evolution. The first part of the work is devoted to the analysis and illustration of the dogmatic principles. The second part, entitled "Revolution and Reaction," deals with the opposition offered to the old dogmatism by the critical philosophy and absolute idealism. The third part, which is developed to greater length, deals with the pragmatist revolt.

From our naturalist's point of view we turn with most interest to what the authors have to say in regard to the Darwinian theory of evolution, and we are not disappointed. It is shown that while the idea of evolution first became effective in the realm of social science, it was conceived in an essentially abstract fashion, without any adequate consideration of the factors which operated. "It was not until the work of Darwin in biology that there existed anything like a scientific theory of evolution, based on wide and intensive empirical study." But "the importance of Darwin's work did not lie simply in the fact that it provided an acceptable theory of the evolution of organic species." His success gave investigators in other fields confidence in their clue, and opened the way for a universal theory of evolution. Moreover, "the bridging of the gap between man and the lower orders meant a transformation of those sciences dealing with essentially human activities."

While psychology and ethics have developed in post-Darwinian days under the application of evolutionary methods, logic has until recently remained untouched. "Until the rise of pragmatism no thoroughgoing attempt was made to explain the fundamental notions of logic itself in the light of the selection hypothesis." "Pragmatism is the first whole-hearted attempt at an appreciation of the significance of Darwinism for logical theory." What the authors seek to show is that the attempt has only half succeeded;

"that conceptions and methods inherited from the dogmatic empiricism of the eighteenth century go far to vitiate the evolutionary empiricism of to-day; and that the critical revision of these inherited notions from an evolutionary standpoint will make of pragmatism a far less iconoclastic movement."

The student of organic evolution will be interested in the clear contrast which the authors make between the Darwinian and the Hegelian concepts of evolution. The course of organic evolution is not conceived by biologists as a dialectic; it is not to be explained in terms of mere logical relationship; external circumstances, instead of being unessential, are determining factors. The later stage cannot be described as the necessary realisation of the earlier. "Had external circumstances been ever so little different, the succeeding stages of the process might have been profoundly different." Organic evolution cannot be properly described as the progressive unfolding of a reality potentially existent throughout. Applying the point of this contrast to rational thought, the authors maintain that on the Darwinian view, thought is regarded not as the end and determinant of organic development, but as a product and (more importantly) as a moment or factor in that development—"a factor whose existence and nature are throughout conditioned by the part it has to perform in organic life." J. A. T.

GEOLOGY AND THE DOCTRINE OF DESCENT.

Abstammungstheorie mit Rücksicht auf Erdgeschichte. By Prof. H. Pohlig. Pp. 191. (Stuttgart: Gesellschaft "Neue Weltanschauung" and F. Lehmann, 1909.) Price 2 marks.

SCIENCE in England has been peculiarly fortunate in its popular exponents, especially on the biological side; the only regret is that they are so few. In Germany there is no lack in number, but it would be insincere to express unqualified admiration of the prevailing style. Most of us probably would prefer

Huxley to Haeckel, and the present work is an "Haeckelismus" without the redeeming grace of genius. It is dogmatic, and, still worse, it is dull.

The question of the origin of life is easy to the author. Scattered through infinite space and time is carbon, which in its original state forms the simplest germs of life (Zoatoms). These are so small that even under the highest magnification they are seen only as an irresolvable dust. It is they alone which are able to assimilate the carbon which has lost its life (we are not told how it loses its life). When the earth was molten the Zoatoms surrounded it like an atmosphere, like the meteorites around a heavenly body. Then, of course, come Protists, Protophytes, and Protozoa, and all is plain sailing until we reach the commencement of the Cambrian, where we, for the first time, encounter fossil remains; not, however, representing, as we might expect, the beginnings of life, but all, or almost all, the great subdivisions of the Invertebrata. This remarkable fact has taxed the ingenuity of geologists not a little; the author makes short work of it; two or three pages are devoted to describing the various kinds of rock metamorphism, one or other of which is asserted to have blotted all the pre-Cambrian fossils out of existence, except Eozoon, which is most likely a Stromatopora-like organism, saved by a strange chance from destruction.

Geologists, the author says, have spoken of a Carboniferous continent—Glossopteris land; this is "grund falsch," and contradicted by the facts (which are not cited).

The notion of pre-Tertiary glacial epochs is widely accepted by geologists, but it is "grund falsch" and "unthinkable." A deep sea before the Triassic period is also "unthinkable." No climatic zones were "possible" before the Tertiary era.

The profile of the Pithecanthropoids is still *very* ape-like, as is seen in the lowness of the forehead, the projecting jaws and retreating chin, the slope of the occiput, and the size of the face. (This statement is arrived at by piecing together Neanderthal man and Pithecanthropus.)

After all this, we are glad to be assured that the soul is immortal; it resides in the Zoatoms, and so may be dispersed, but not destroyed.

There are several references in footnotes, almost without exception to other works by the author.

OUR BOOK SHELF.

Grundlagen der Ballonführung. By Prof. R. Emden. Pp. vii+140+Taf. 3. (Leipzig and Berlin: B. G. Teubner, 1910.) Price 2.80 marks.

THIS book contains twenty-two paragraphs or chapters. It opens with a statement of the general laws governing the relations of a balloon to the air which supports it, beginning with the density of the gases employed and their lifting forces, and proceeding with the consideration of the distribution of force in the envelope.

Balloons are classified by the author as being of constant mass or constant volume (*i.e.* as having closed or open envelopes), and the behaviour of the classes in rising and falling is discussed.

The proper use of ballast is treated, and the importance of having too much ballast rather than too little is emphasised. Paragraph 18 deals with captive balloons, especially with regard to the height to which they can ascend in a wind. The diagram illustrating this point appears to be wrong, the construction employed indicating that the height in question is $L(1-\cos\alpha)$, where L is the length of the rope and α its inclination to the vertical, instead of $L\cos\alpha$ (as it should be).

The subsequent paragraphs are connected with the use of the ballonet and the relative merits of closed and open envelopes, and, finally, in paragraph 22 some remarks are made on the steering of dirigible balloons.

There does not appear to be much that is new in the book, but it has the merit of being compact, and most of the information it contains appears to be correct.

For how long frail structures such as balloons will have a place in warfare when opposed to the hardier, cheaper, and quicker flying machines is a question which will be decided in the next few years, but for so long at any rate Dr. Emden's book will be found useful. A. MALLOCK.

Vaccine Therapy: its Theory and Practice. By Dr. R. W. Allen. Third edition. Pp. x+277. (London: H. K. Lewis, 1910.) Price 7*s.* 6*d.* net.

THE principle of treating bacterial infections by vaccines, *i.e.* sterilised preparations of the organisms which are disturbing the normal balance, has taken firm hold in modern English medicine. It has not reached its present position without a struggle, and even now it must be admitted that the proof of its usefulness depends more on the cumulative weight of personal impressions than on any rigid demonstration such as an extensive case-statistic would supply. In practice, however, an increasing body of influential opinion is in its favour, and the acceptance with which former editions of this work has been received shows that it meets a demand.

The present issue, which has been entirely rewritten, aims at "enabling the general practitioner to approach with confidence a case requiring therapeutical immunisation." With this object a sketch is given of the nature of opsonins, the use and meaning of the opsonic index, and the method of preparing vaccines, while the various infections are treated at somewhat greater length with regard to their special requirements. A considerable number of individual cases is given to illustrate the selection of appropriate doses, and the results which may reasonably be expected from them in different circumstances. These include failures as well as successes, and the results of recent work in this country are summarised as fully as the scope of the work permits.

As the author himself recognises, however, accurate diagnosis is a prime essential of success, and this presupposes an acquaintance with practical bacteriology, which the general practitioner does not possess, and such a book as this can do little to supply. Some space indeed might well have been saved by omitting the altogether inadequate treatment of the method of isolating and recognising the organisms which may be found in a given case, and devoted to a more critical appreciation of the problems involved in bacterial inoculations.

Die Eiszeit und der vorgeschichtliche Mensch. By Prof. G. Steinmann. Pp. iv+96. (Leipzig: B. G. Teubner, 1910.) Price 1.25 marks.

PROF. STEINMANN, with evident pleasure, contributes this work on the Ice age to a popular series issued by the firm of Teubner. The black letter type shows the audience for which it is intended, and it will admir-

ably carry on the campaign of the German geologists for a more general understanding of the earth. After indicating that an oceanic and moderately cold climate, rather than a continentally extreme one, will provide the conditions for an Ice age, the author appeals to the scenic features of a country where glaciers have worked their way. He supports the view of the over-deepening of valleys by glaciers, and clearly points out the effects of differences of pressure in different regions of a complex ice-stream. Prof. Heim would doubtless remark that the U-form indicated in the picture of the Lauterbrunnen valley (p. 21) is obviously due to taluses; but little fault can be found with the author's account of the variety of characteristic outlines traceable in all regions that have undergone an Ice age.

The etching out of cirques primarily by frost-action, as on the margin of melting snow, rather than by the glaciers that ultimately occupy them, is surely sustainable, in spite of what is said on p. 37; but we agree with the author that the erosive power of glaciers has been very freely underrated. The study of moraines and outwashed materials is used to explain the phenomena of the North German plain, and the lost freshwater lakes of Bolivia are introduced as evidence of the universality of the Ice age. New interest is aroused by the account of pre-Glacial and Glacial man with which the book concludes. G. A. J. C.

LETTERS TO THE EDITOR.

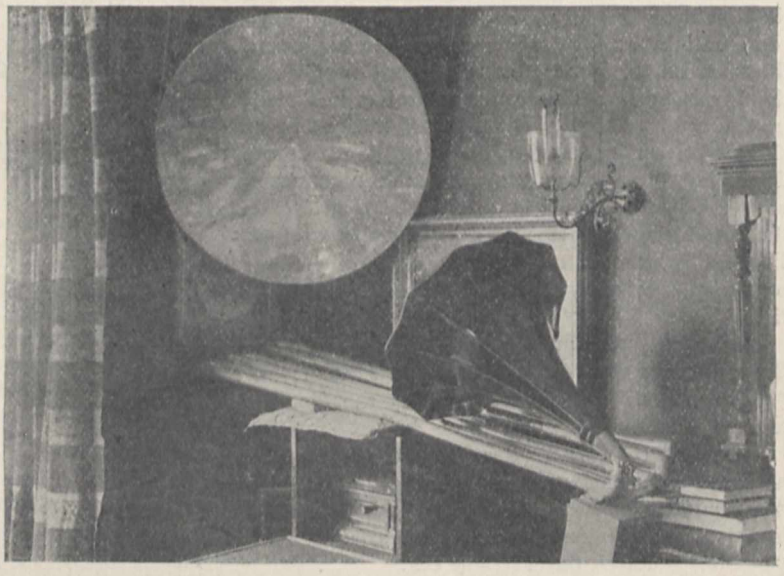
[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of* NATURE. *No notice is taken of anonymous communications.*]

Further Experiments with the Gramophone.

IN NATURE of April 15 and October 21, 1909, I described various experiments with the gramophone. Since then I have made many efforts to get rid of the hissing and grating noises that detract so much from the instrument as a reproducer of musical sounds, and at last I have had an encouraging measure of success. The gramophone, as will be seen in the accompanying figure, is enclosed in a wooden cloth-lined box, and a tube passes tightly through a hole in the wall of the box from the end of the taper arm that carries the sound box of the instrument. When the sound box is tightly closed by raising and locking the front lid, as seen in the figure, the sounds of the machinery, and also the vibrations from the free side of the diaphragm of the sound box, are completely damped off. The noises, caused by the friction of the needle point on the hard disc of the record, pass, of course, along with the musical sounds, through the taper arm to the tube that escapes from the box. This tube is suitably connected with lengths of tin tubing, 1½ inch in diameter, and the sounds are thus conveyed through as many feet of tubing as may be found necessary. I have found the most efficient length of the entire tube, until it reaches the horn or resonator (the attachment of which is seen in the figure), to be, say, 54 feet. The effect of the long tube, while empty, is to increase the volume of the tones, but, of course, the noises are also intensified.

I have always been struck by the fact that the friction noises seem to be quite separate and distinct from the musical tones, either when a voice is singing with an accompaniment, or during the reproduction of an orchestral piece of music—indeed, by an effort of attention, I have so trained myself that I can hear one without hearing the other. This suggests that in the ear there is a mechanism for the detection of noises of high pitch as distinct from ordinary musical tones. It occurred to me that by causing the sounds to pass through numerous narrow channels, freely communicating with each other, the noise-sounds, presumably caused by short waves of high pitch, might be damped off by interference, while the longer waves, corresponding to musical tones, might pass through unaltered, except as regards loss of energy from friction. My purpose was attained by filling a segment of the tin tube, say, from 4 to 8 feet in length, with a mixture of hard peas and beans, corrugated by age or drying. The experiment succeeded. The friction noises were damped down, while the musical tones, although rather "dulled" in quality, that is to say they lacked brilliancy, were purer, and, to my ear, much more natural.

Other substances were tried—glass balls, marbles, small fir cones, gravel, shreds of tin—but the best effect was



Gramophone arranged to get rid of friction noises.

obtained with the peas. Brilliancy was obtained by using, as suggested and made by Mr. Ernest De la Rue (who has been much interested in these researches), zinc tubes filled with fragments of corrugated zinc, and the use of these has been protected by patent by Mr. De la Rue. By a combination of the zinc fragments with the peas and beans, I get delightful effects, so that the gramophone-music is so immensely improved that I cannot listen with any pleasure to the "naked" gramophone sounds, as the attention is not now disturbed by the "frying-pan" noises.

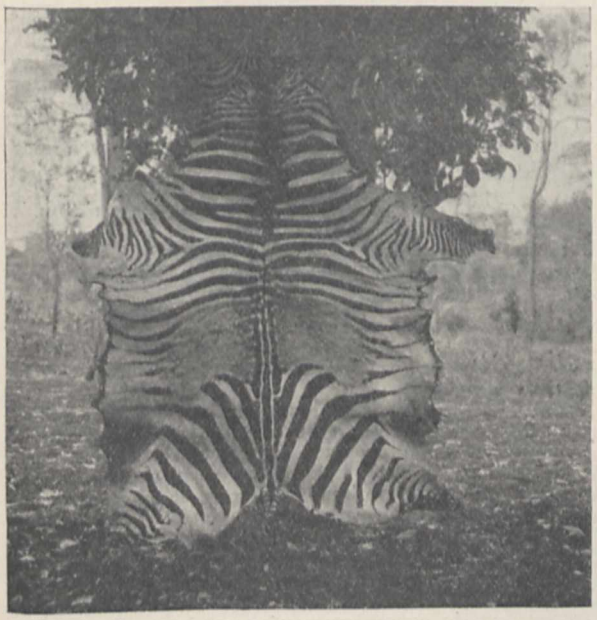
As listening to music so reproduced is a kind of auditory illusion, any contrivance that will heighten the illusion may be expected to give more pleasure if the illusion is of the right kind. Usually one feels a sense of unreality in the music apparently rising from the bottom of the "horn," more especially in listening to a human voice. To get rid of this, I angle the horn, as shown in the figure, so as to reflect the sound waves from a tin reflector (parabolic in character) so placed as to send the sounds to the other side of the room. One then ceases, while listening, to think of either the gramophone or the horn, as the sounds come from the reflector, and the effect is much more real and natural.

I believe the application of this method of "acoustical filtration" may be applied by ingenious mechanics in such a way as to do away with the necessity of building up such an array of tubes as is seen in the figure. The method enables one, in a room of moderate size, to listen to pure music. One cannot help observing how it mellows a voice that, heard in the ordinary way, sounds harsh

(from the production of overtones of high pitch), and how it brings out the pure tones of the string instruments. The various instruments in an orchestra sound better. Everything is reduced in proportion, and, to use an illustration from art, it is like passing from one of Etty's huge pictures to a delicate and beautiful Messonier, in which one sees and appreciates every detail in an area of small dimensions. JOHN G. MCKENDRICK.

A New Variety of Zebra.

WILL you kindly allow me a little space to direct attention to a new and very interesting variety of Grant's zebra, shown in the accompanying photograph sent me by my friend Mr. C. W. Hobley, C.M.G., commissioner at Nairobi, East Africa? The specimen, writes Mr. Hobley, "was obtained by Mr. G. H. Goldfinch, assistant game ranger of the East African Protectorate, a few months ago in the neighbourhood of the Rift Valley. The



animal has a "big whitey patch in the middle of the back, and it came out of a herd which were all the same. I suppose it is a Mendelian 'sport,' which has become dominant in that particular herd, like the white waterbuck on the Euaso Nyiro, north of Kenia."

I propose to call this variety in Mr. Pocock's terminology, *E. quagga*, var. Goldfinchi, or in the old terminology, *E. Burchelli*, var. Goldfinchi. Mr. Hobley adds that the print is a little dark, as "the stripeless saddle on the body is very markedly white in the skin itself."

April 11. WILLIAM RIDGEWAY.

Implements of Moustierian Type from the Rock of Gibraltar.

IN a paper read before the Royal Anthropological Institute on March 7 (NATURE, March 16, pp. 100–101) I gave an account of recent cave-exploration at Gibraltar. In one of the caves thus described, the discovery of various mammalian remains was recorded, together with that of human bones, pottery, and stone implements.

In regard to the latter, a close comparison was made with cave implements, and the similarity of certain examples to implements of the Moustierian type was remarked. But a guarded opinion was given, and this caution, I am now glad to state, seems to have been excessive.

On March 31 Dr. Allen Sturge very kindly examined the specimens with me, and he allows me to record his opinion on four implements submitted to him. The conclusions were fully borne out by comparisons with specimens in Dr. Sturge's magnificent collection. Of the four implements, three (Nos. 2, 7, 13) are judged to be definitely of Moustierian type; the remaining one (No. 15) is either "Moustierian" or "early Aurignacian" (the next and following stage).

Thus out of eleven stone objects (from the cave in question), that are undoubtedly implements and not mere splinters, four are distinctly Palæolithic, and of an early period. So far as I know, Palæolithic implements have not been previously recognised or recorded in connection with the caves of Gibraltar. Moreover, those now mentioned were not accompanied by any polished implements or by any metal objects.

The recognition of Palæoliths of the Moustierian type gives some ground for hope that eventually the whole series of cultural epochs may be established for the caves at Gibraltar, as has been done elsewhere. Further, the discovery of a human skeleton of that period might throw a flood of light on the significance of the Forbes Quarry skull. In any case, exploration will be resumed with increased zest in view of these possibilities.

In conclusion, I would point out that Obermaier seems to hold the opinion that the associations of culture with fauna will be found to differ in the Mediterranean area and in western or central Europe (*L'Anthropologie*, 1909, Tome xx., p. 520). My investigations have already suggested a marked similarity between the Gibraltar caves and some of those at Mentone. Probably the northern limit will be found to include Les Eyzies. Lastly, the preceding remarks are written with full appreciation of the weight of Commont's remarks (1910) as to the significance of isolated examples of implements referable to a particular age. W. L. H. DUCKWORTH.

Anthropological Laboratory, New Museums,
Cambridge, April 5.

Damage done to Skulls and Bones by Termites.

THE extensive damage done to skulls and bones generally in many of the graves of Egypt and Nubia has been attributed to beetles, the bodies of these animals having been found in the earth which is invariably associated with the damaged area, the latter being, in fact, always covered with earth unless it has been knocked off during removal of the skull from the grave.

There is good reason, however, for believing that the damage is the work, not of bettles, but of termites, which still exist in these countries.

These animals, as is well known, never work without covering all their operations with a tunnel or ramification of tunnels composed of earth or grains of sand firmly stuck together by some secretion from the ants themselves. Under cover of these earthworks, they devour whatever substance they have built over, and the destruction is sometimes so complete that nothing but a shell of earth remains, the substructure having been entirely eaten away. In such cases the original form of the destroyed article may be distinctly seen, as the mud covers it in a fairly thin uniform layer, following all its lines and contours. A good example of this was seen at Koshtamna in Nubia, about seventy miles south of Aswan. Here a small wooden statue of a king was still standing in its original position in a tomb chamber, but the crown and more prominent features of the face, completely covered though they were with mud, still preserved the outlines of the form beneath. When, however, the mud was removed, it was found that the statue upon which it had been built was almost completely destroyed, only fragments of the wood being left here and there.

In the case of skulls and bones precisely the same thing happens. A skull is found covered with mud firmly stuck on, and with the traces of the white ants' tunnels running through. If the mud is removed, large areas of the cranial walls may be found to have disappeared altogether. In less exaggerated cases, holes will be seen with white, gnawed edges, or perhaps only the surface of the bone has been attacked. The cranial sutures are a favourite site for the commencement of the termites' operations.

The presence in some cases of the dead bodies of small reddish beetles embedded in the mud on such skulls led to the not unnatural conclusion that they were the authors of

the mischief. The following facts, however, show this to be incorrect.

In the first place, the tunnels, which run in all directions beneath the cake of mud, are too small to contain the beetles found embedded in it.

Secondly, the beetles are found in many other parts where there is no sign of damage to the bone, and quite commonly, in the case of mummies, beneath the linen wrappings where these are in contact with the skin, in which situation they are frequently embedded in the resin or bitumen which has been used in the mummifying process. In these situations there is, of course, no mud whatever, while the damage to the bones is *always* associated with earthworks and tunnels.

Thirdly, though the same earthworks appear in every direction in the grave containing affected bones, on the roof, walls, coffin, &c., no beetles are ever found anywhere in association with such workings except on the body.

Fourthly, in mummified bodies, where the wrappings, soaked in bitumen, are so hard as effectually to have excluded even the ravages of white ants, the works of which may, nevertheless, cover the *outer* surface of such wrappings, beetles are still found in and about the mouth and nose of the mummy, some stuck to the teeth, others to the linen with which the mouth is filled, but *not* in this case on the outer surface of the wrappings, where they ought to be if they were the authors of the earthworks which cover the mummy cloths.

From these facts it seems clear that the beetles were present before the process of mummification was complete, that they became covered over when the body was wrapped, or possibly were not hatched until this was complete, and so are found stuck to the resinous wrappings. In cases where less bitumen or other substance was employed, and the body was merely wound in cloths, the white ants were able to make their way through these with the greatest ease. While doing so they would come in contact with the beetles which had been included in the wrappings, and these would then perforce become embedded in the mass of earth brought up by the termites. It is noteworthy that *complete* bodies of beetles are seldom or never found in the mud. If carefully examined, their heads, legs, and under parts are usually gone, only the tough wing cases remaining, and these are so strong that to a certain point they will resist crushing with the fingers. On the other hand, beetles complete, so far as the naked eye can detect, in every part, even to the delicate antennæ, have been found under the wrappings, and particularly in the neighbourhood of the mouth and nose. The inference from this is, of course, that the white ants devoured the softer parts of the beetles when they found the bodies of these animals in their path, leaving the hard portions stuck in the mud of their buildings.

DOUGLAS E. DERRY.
Anatomical Department, University College,
London, W.C.

What is the genotype of X . . us Jones, 1900, based upon a species erroneously determined as *albus* Smith, 1890?

Statement of Case.—Jones proposes a new genus *X . . us*, 1900, type species *albus* Smith, 1890.

It later develops that *albus* Smith, 1890, as determined by Jones, 1900, is an erroneous determination.

What is the genotype of *X . . us*, 1900; *albus* Smith, 1890, or the form erroneously identified by Jones as *albus* in 1900?

Discussion.—The nomenclatorial problem expressed in the caption of this note is solved in two diametrically opposite ways by different authors.

Some writers maintain that the original *albus* Smith, 1890, is the genotype, while others maintain that the genotype is represented by the species actually studied by Jones and misdetermined as *albus* Smith.

Cases of this general nature have given rise to considerable confusion in nomenclature, and several such cases have been referred to the International Commission on Nomenclature for opinion.

At the last meeting of the Commission, the principles involved came up for discussion, but it was impossible to reach a unanimous agreement. On account of the differences of opinion, the secretary was instructed to make a careful study of a number of cases, and to report upon the same to the Commission.

It is not difficult to foresee that, no matter how the cases are finally decided, great dissatisfaction will arise among zoologists, because the opinion rendered is not the direct opposite of what it eventually will be.

Recognising that this is one of the most difficult cases that has ever been submitted to the Commission, and recognising the fact that, regardless of our action, we shall probably be criticised more on the basis of our decision on this case than because of any other opinion that we have rendered, I am desirous of studying at least 100 cases, if possible, that would come under such a ruling, before my report is formulated.

In view of the foregoing premises, I respectfully request zoologists in different groups to direct my attention to as many instances of this kind as possible with which they are acquainted in their different specialities. Further, since the arguments on both sides of the problem appear to be almost equally valid, it does not seem impossible that the final decision will have to be based upon the arbitrary choice between the two possible rulings, and on this account I am desirous of obtaining all possible arguments on both sides as they occur to different zoologists, and also any personal views based upon convenience or inconvenience, or other grounds, which may be held by different colleagues.

I will hold the case open at least until September 1, for the presentation of arguments by any persons who may desire to submit their views.

C. W. STILES,
April 4. *Secretary of the Commission.*

A Kinetic Theory of Gravitation.

As one who for many years has been attracted by the problem of gravitation, I was greatly interested in Mr. C. F. Brush's "Kinetic Theory of Gravitation" (NATURE, March 23), and in Sir Oliver Lodge's letter relating thereto (NATURE, March 30).

About three years ago I made an attempt to examine how far gravitation might be accounted for by waves of compressional type propagated through the æther (cf. *Phil. Mag.*, January, 1909). Before any such theory can be admitted, even as a working hypothesis, it must be shown by rigorous dynamical methods to be capable of accounting for gravitational attraction. This in itself involves no elaborate analysis, though questions arise as to the fundamental nature of matter and of its motion with respect to the æther.

It appears, in opposition to what might readily be supposed, that Mr. Brush's assumption of a directionally indifferent (isotropic) distribution of waves is not needed; a single progressive train of plane-waves would answer equally well. The real difficulties of the theory are encountered when we consider the several effects, other than gravitational attraction, which might arise from the impact of compressional æthereal waves upon atomic matter. It has to be shown that, under admissible assumptions, the *direct* action of the waves would not give rise to any observable phenomena of motion, and that the heating effect might be *nil*, or small enough to escape observation. Other points no less important have also to be considered; they are dealt with at length in my paper.

I fully concur in Sir O. Lodge's objection to regarding the atom "as a foreign substance—a sort of 'grit' in the æther," and, in the paper referred to, matter was treated as of purely æthereal constitution, the motion of a material body through the æther being regarded as unaccompanied by any bodily transference of *ultimate* matter through finite distances. As to whether the gravitative property of matter is essentially bound up with its constitution, or is due to something external, I think Sir O. Lodge will agree that, notwithstanding metaphysical prepossessions (in which I largely share), we should yet keep an open mind. The real solution of the question is perhaps very different from what we are reasonably entitled to expect!

It may be mentioned, however, that some experiments now in progress seem likely to add very considerably to the difficulty of accepting a compressional-wave theory of gravitation.

C. V. BURTON.
Boar's Hill, Oxford, April 2.

DEVELOPMENT OF BRITISH FORESTRY.[1]

THE work on the development of British forestry by Mr. A. C. Forbes, Chief Forestry Inspector to the department of Agriculture for Ireland, will be welcomed by all interested in the question of afforestation. The author deals with his subject in a lucid and convincing manner. To add to the interest of the book, a large number of excellent photographs illustrating the various types of tree-growth in different soils and localities has been included. These alone form a remarkable and instructive photographic survey of the forest conditions not only within the British Empire, but also to some extent on the Continent.

FIG. 1.—Two-storied Beech Wood, Chiltern Hills. From "The Development of British Forestry."

The opening chapter deals with the national aspects of forestry, and here Mr. Forbes has gone to the very foundation of the subject from historical and geographical points of view. The following chapter deals with the forest requirements of the United Kingdom. It is pointed out that, in comparison with other countries, we have the lowest percentage of total land-surface under woodland, with the highest consumption of imported wood per head of population. The writer calculates that, in addition to the three million acres already under trees, we should require to bring another four million acres or so under forests, giving a total of at least seven million acres, equal to about 10 per cent. of the land-surface. The timber production, forest laws, and forest area of other countries are carefully considered in forming an estimate of the requirements of the United Kingdom. Chapter iii. is on the relation of agriculture to forestry development, and here the author shows himself to be equally at home in agriculture and forestry. This is a most valuable chapter, and shows how the area under trees may be extended without unduly disturbing the agricultural value and produce of the country. Chapters iv. and v. deal respectively with climate and tree-growth, and soil and surface conditions in the British Isles; while chapter vi., on the need for improved methods and practice in British forestry shows how vast improvement could be made in our existing woodlands by the adoption of more scientific and up-to-date methods. Chapter vii., on the economic value of the British forest flora, gives a very valuable and interesting account of the sylvicultural characteristic of the trees generally cultivated in Britain. No one is better able to deal with the financial aspects of British forestry than Mr. Forbes, and chapter viii., which treats of this subject, should prove of the greatest interest to all planters.

The final chapter entitled "The State and Private Ownership of Woods" comes as a fitting termination to a work on the development of British forestry. It is here pointed out how the State, and the State alone, can bring about the much-needed improvement in afforestation of the country. The author, however, clearly points out that the cooperation of the individual is necessary if we are to achieve permanent and all-round improvements. In his own words:—"The co-operation of the individual is as necessary in national forestry as in the creation and development of industries, and the idea that the State can entirely take the place of the individual wood-owner is equally absurd as the idea that the latter can succeed without the assistance of the State."

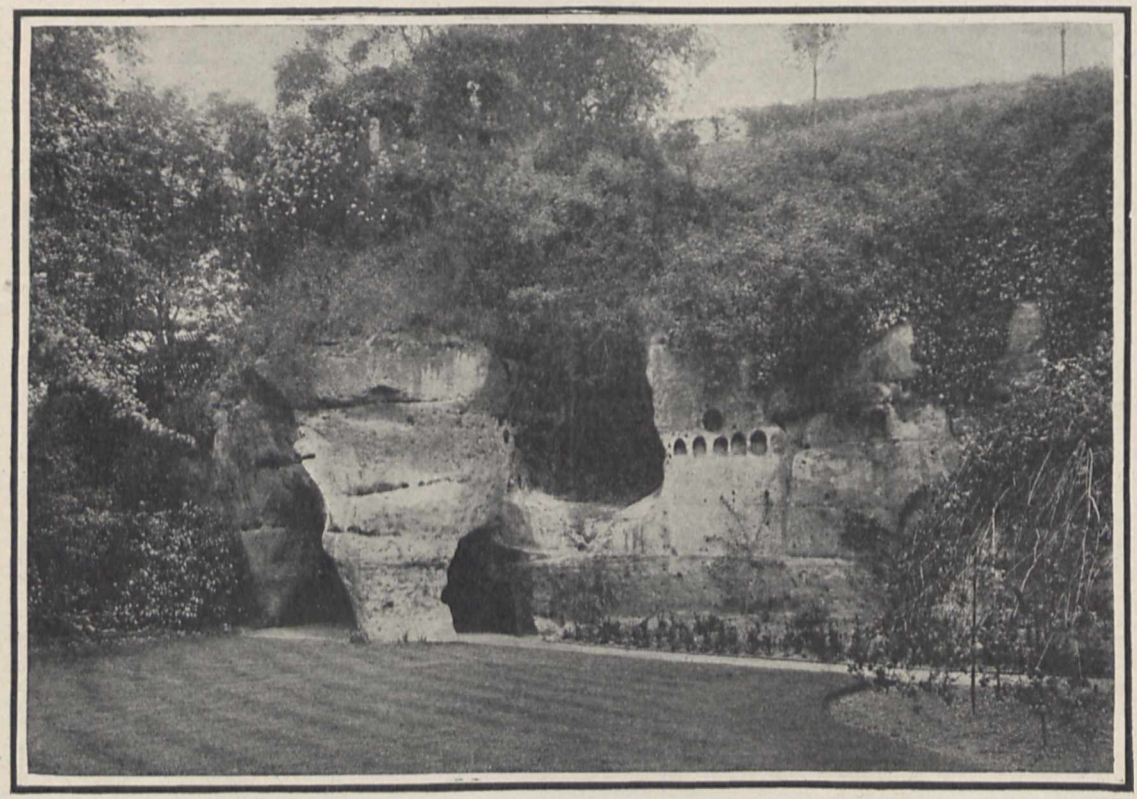
FIG. 2.—Selection Felling in Chiltern Hills Beech Wood. From "The Development of British Forestry."

All through this excellent book the author is moderate in his views and logical in his reasoning. Conclusions are arrived at only after very careful

[1] "The Development of British Forestry." By A. C. Forbes. Pp. xi+274. (London: E. Arnold, 1910.) Price 10s. 6d. net.
"English Woodlands and their Story." By H. Townley. Pp xiii+309. (London: Methuen and Co., Ltd., n.d.) Price 15s. net.

consideration based on personal study and experience. The volume contains many tables of statistics, and is also provided with an excellent index.

"English Woodlands and their Story," by Mr. Houghton Townley, is an interestingly written and well-illustrated work. The book is written more for the forest-lover and student of nature than for the technical forester, but it may be warmly recommended to all interested in any way with trees and forests. The history, traditions, and associations of the old English woodlands and forests are set forth in a most fascinating manner. The laws of olden times, when forests were principally used for the chase, are interestingly described, as well as all matters of historical interest connected with the various forests of England. Nothing could be more interesting than the perusal of this work, which is written in a most readable fashion, and, though not intended as a text-book on forestry, its perusal cannot fail to be of the greatest interest to all foresters and those connected with the management of woodlands, as well as all forest-lovers and students of nature.



The Ruined Monastery in the Rocks, Nottingham Park. From "Cliff Castles and Cave Dwellings of Europe."

THE TROGLODYTES OF EUROPE.[1]

IN his excursions into the byways of archæology and primitive culture Mr. Baring-Gould is always interesting and instructive, and in his present book, dealing with the cave-dwelling troglodytes and the cliff castles of Europe, he has found a subject hitherto little explored and well suited to his powers. The moral of the book, though it is nowhere clearly defined, is the essential unity of human culture, man always adapting to his use the material which his environment supplies.

The chalk formation, traceable from the north of Ireland to the Crimea, and from the south of Sweden to Bordeaux, a distance of about 11,140 geographical miles in one direction, and 840 in the other, with its characteristic cavities and the facility of supplementing them by artificial means, naturally provided habitations for prehistoric man; while in other places tufa, volcanic breccia, and sandstone took its place. Palæolithic man shows his artistic powers not only by graving representations of the men and fauna of the period on ivory and bone, but in the wall-paintings of shelters like those at Les Combarelles and Font-de-Gaume he provides a veritable picture gallery. In a cave recently explored have been discovered actual pieces of sculpture of extinct beasts in the round. The preservation of these frescoes and sculptures is due to the fact that the caves have been sealed up from time immemorial, and subjected to no invasion by man or beast or to any change of air or temperature; further, the primitive lamps fed with melted fat could not produce smoke sufficient to discolour ceiling or wall. The genuineness of these paintings is assured by the circumstance that some are partially glazed over and some half obliterated by stalagmitic deposits. This prehistoric savage type of life survives among modern cave-dwellers in Cornwall and in the strange family of troglodytes described by Sir A. Mitchell, who discovered them dwelling in a state of wretched squalor on the shore of Wick Bay. Among subterranean dwellings the wonderful labyrinthine town ascribed to Og, king of Bashan, at Edrei, in the Hauran, is perhaps the most remarkable example. The best parallel to it in Europe is that strange French town, Trôo, on the river Le Loir, which traverses the fertile upland plain of Beauce, and falls into La Loire at Angers. Here the whole height is like a sponge, perforated

[1] "Cliff Castles and Cave Dwellings of Europe." By S. Baring-Gould. Pp. 324. (London: Seeley and Co., Ltd., 1911). Price 12s. 6d. net.

with passages giving access to cells, and store-chambers, most of the houses being wholly or partly underground. In this country we have examples of similar constructions in the Dene-hole chalk quarries of Darenth Wood and those near Chislehurst, the Cornish excavations known as Fogous, the cave in the Isle of Egg, one of the Hebrides, the scene of the terrible massacre of the Macdonalds by the Macleods, and that on Rathlin Island, where a similar tragedy occurred during the campaign of Essex in 1575, of which Froude supplies a graphic narrative.

From structures such as these Mr. Baring-Gould passes on to the cliff castles occupied by the ruffianly Routiers and Free-Companions in France, and the many caves and similar shelters tenanted by hermits and ascetics, robbers, and outlaws in other parts of Europe. The church has also utilised many subterranean excavations of the same kind, such as the monolithic chapel of St. Emilion in Dordogne, and the still more remarkable underground churches at Plouaret in Côtes-du-Nord, and the Spanish example at Cangas-de-Ones, near Oviedo, where a prehistoric dolmen is used as a crypt.

The value of this interesting, if rather discursive, book is much increased by the series of excellent sketches, most of which were drawn by the author on the spot in his exploration of this remarkable series of monuments.

MAJOR GEORGE LAMB, I.M.S.

WE regret to record the death, which took place at Edinburgh on April 11, of Major George Lamb, director of the Pasteur Institute of India, Karauli (Punjab), in his forty-second year. He was a distinguished graduate of the University of Glasgow, and for some time demonstrator of anatomy in that university, but resigned this post in order to enter the Indian Medical Service. From the first he strenuously applied himself to research, and the extent and nature of his published work strikingly attest his great ability and originality, and his indefatigable industry. Within a few years after joining the service, he had made his mark by researches on Mediterranean fever in India, typhoid fever, and anti-typhoid vaccine, and other subjects connected with the scientific treatment of disease. He was subsequently continuously employed in important scientific inquiries initiated by the Government of India.

Nearly ten years ago Major Lamb was appointed head of the laboratory for the investigation of snake poisons, and became one of the chief authorities on this subject. The results of his observations appeared in about a dozen papers, which deal with the venoms of Russell's viper, the cobra, and the banded krait, their action on the blood plasma and corpuscles and on the nervous system, and with the specificity of their antisera. He was joint author (with Dr. C. J. Martin, F.R.S.), of the section on "Snake Poison and Snake Bite" in the "System of Medicine," edited by Sir Clifford Allbutt and Dr. Rolleston.

Major Lamb's greatest work was done in connection with the Plague Commission to which he was appointed, as senior member, in 1905. He was responsible for the carrying out of that detailed and widespread inquiry into the mechanism of the epidemic spread of plague in India, the results of which have been published in five reports, the last only recently issued. He initiated and throughout bore a prominent part in the long series of experiments and observations which resulted in the conclusive proof of the transference of plague from rat to rat, and from rats to man by the agency of fleas. Since his appointment as director of the Pasteur Institute of India, which took place when the plague inquiry was nearing its close, Major Lamb devoted himself largely to the subject of hydrophobia, and introduced important modifications in the treatment of the numerous cases annually dealt with at that institute.

Major Lamb has left an enduring mark upon three main lines of research—snake venoms, plague, and hydrophobia—each of outstanding importance in Indian medical work, to which he devoted himself successively with characteristic zeal, patience, and skill. His frank and genial manner, his clear grasp of, and self-sacrificing devotion to, the work he had in hand called forth, in those privileged to work with or under him, loyal and enthusiastic cooperation. His wide knowledge of medical science in its application to Indian problems will be much missed in medical and scientific circles both at home and in India, and his friends will deplore the loss of one who had a most genial and captivating personality.

J. H. A.

NOTES.

A PRELIMINARY programme has been issued for this year's meeting of the British Association, which, as already announced, is to be held at Portsmouth on August 30 and following days. The opening meeting will be held in the Town Hall on Wednesday evening, August 30, when Sir William Ramsay, K.C.B., will assume the presidency and deliver his inaugural address. In the same hall the first evening discourse will be delivered on Friday evening, September 1, by Mr. Leonard Hill, F.R.S., on "The Physiology of Submarine Work," and the second on Monday evening, September 4, by Prof. A. C. Seward, F.R.S., on "Links with the Past in the Plant World." The reception room and administrative offices during the meeting will be established in the Connaught Drill Hall, which is centrally situated close to the Town Hall, and within easy access of all the meeting rooms which will be occupied by the sections. The president will have the assistance of a strong body of representatives of the administrative, ecclesiastical, naval and military interests of the town and neighbourhood, headed by H.R.H. Princess Henry of Battenberg and the Mayor, Alderman T. Scott Foster. An afternoon reception and an evening *fête* are announced to be given by the Mayor, and facilities will be arranged for members to visit sites and objects of scientific, historical, and national interest in Portsmouth and the neighbourhood.

A COMMITTEE for the study of the sea was appointed in 1909 by the Italian Society for advancement of science. Its work was so active and promising that a few months later the committee was converted by an Act of Parliament into an institution of the Italian kingdom. The Regio Comitato Talassografico Italiano is to be concerned with investigations of the Italian seas from the physical and chemical points of view as well as from the biological. Great importance will be attached to practical questions concerning the navigation and the fisheries. Investigations of the high atmosphere will also be made in connection with aviation. The president of the committee is the Marine Minister, and representatives of the chief institutes, academies, and societies which take interest in sea investigations have been appointed as members. In addition the committee has a scientific staff of its own; it receives a yearly grant from the Italian Government of 60,000 lira (2400*l.*); and the ships for the cruises are supplied by the Italian Royal Navy. Four cruises in the Adriatic sea have

taken place already, the programme of which was agreed upon with the delegates of the Austrian Government. We understand that a fifth cruise will soon start.

It is announced that Mr. J. H. Grisdale has been appointed director of the Dominion Government's Experimental Farm System, in succession to Dr. William Saunders, C.M.G., who has retired.

The death is announced of Colonel I. C. Walker, who from 1881 to 1890 was Chief Conservator of Forests in Madras, and from 1895 to 1898 Inspector-General of Forests in Mysore.

We regret to see the announcement of the death, at ninety-one years of age, of Mr. T. Rupert Jones, F.R.S., formerly professor of geology at the Staff College, Sandhurst, and the author of many papers and essays on geological subjects.

At the meeting of the Faraday Society to be held on Tuesday, May 2, Mr. A. Scott-Hansen, the well-known Norwegian engineer, will deliver a lantern lecture on "Hydro-electric Plants in Norway, and their Application to Electrochemical Industries." On the same evening a paper is down for reading by Mr. Verdon Cutts, of Sheffield, entitled "Electrometallurgy in the Steel Foundry."

On Thursday next, April 27, Prof. R. W. Wood, of the Johns Hopkins University, will begin a course of three lectures at the Royal Institution on "The Optical Properties of Metallic Vapours," these being the Tyndall lectures. The Friday evening discourse on April 28 will be delivered by Prof. W. M. Flinders Petrie on "The Revolutions of Civilisation," on May 5 by Prof. M. O. Forster on "New Organic Compounds of Nitrogen," and on May 12 by Prof. William Stirling on "Biology and the Kinematograph."

The annual conversazione of the Selborne Society will be held on May 5, in the theatre and halls of the Civil Service Commission, Burlington Gardens, W. This year there will be very interesting exhibits of rural industries, including the prehistoric occupation of Flint Knapping, whch still survives in Suffolk, where gun flints and strike-a-lights for tinder boxes to export to tropical countries is still carried on. The president, Lord Avebury, will take the chair in the theatre, and a lecturette will be given on "The Eggs of Butterflies and Moths," illustrated by photographs by Mr. F. Noad Clark.

The 1912 Boston Electric Show will be held in Boston, Massachusetts, U.S.A., from September 28 to October 26, 1912. It will occupy the whole of the great Mechanics' Building, with more than 105,000 square feet of exhibit floor space and accommodations for more than 100,000 visitors at one time. This building is the largest exhibition structure of the kind in the world. The organisation of this electric show, the financial responsibility of its management, and the scope and policies of the great undertaking, are under the auspices and supervision of the Edison Electric Illuminating Company of Boston.

At the Plymouth Laboratory of the Marine Biological Association, the usual Easter vacation course in marine biology was conducted by Prof. W. Garstang, and was attended by seventeen students from Oxford, Cambridge, the Imperial College of Science, Leeds University, and Bedford College. Dr. C. Shearer, of Trinity College, took a class of six Cambridge students to Plymouth for a course of work on experimental embryology. Artificial parthenogenesis of the eggs of *Echinus esculentus* was successfully carried out by the students, and a number of experiments on the lines of work of Loeb and Driesch were repeated. As is usual at this time of the year, the research tables have been well occupied, eleven visiting naturalists, in addition to three on the permanent staff, having been engaged in zoological investigations.

The first non-stop flight from London to Paris was made, on April 12, on a Blériot monoplane by M. Pierre Prier in 3h. 56m. M. Prier, who is the chief instructor of the Blériot School at Hendon, left that ground at 1.37 p.m., taking a course for Dover *via* Hampstead, Highgate, Greenwich, Chatham, and Canterbury. There was a slight north-east wind as he started, which changed to a north-west by the time he reached Dover, at 2.50 p.m. Thirty minutes later he was over Boulogne, and steering a straight course over Abbeville and Beauvais for Paris, where he arrived at 5.33 p.m., making a perfect landing in front of the Blériot sheds at the Issy-les-Moulineaux aviation ground. The height maintained throughout was between 1500 and 2000 feet, except at the Channel crossing, when he rose to more than 3000 feet. The machine was fitted with a 50 horse-power Gnome motor and three special tanks for an extra supply of petrol, of which, however, barely half was used. M. Prier, who found his way by means of a compass designed by M. Blériot and a map, suffered no inconvenience throughout the journey except slight inflammation of the eyes, due to his neglecting to equip himself with goggles.

The council of the Central and Associated Chambers of Agriculture has appointed a committee to report upon the desirability of the adoption of uniform weights and measures. It is not yet clear how this inquiry will be conducted. On previous occasions when local bodies have been consulted, the reports received from them have been of a contradictory character, so that it has appeared hopeless to propose a system likely to meet with general satisfaction among agriculturists. It is improbable that the metric system would meet with much support. An opinion appears to prevail in some quarters that the weights specified in the Corn Returns Act of 1882 for a bushel of wheat, barley, and oats, respectively, are in some way prejudicial to the cereals market in this country. There is also a proposal to apply the term "hundredweight" to the cental of 100 lb., and to fix the stone at 10 lb. instead of 14 lb., as a preliminary to decimalising our present system of weights. A Select Committee of the House of Commons appointed to inquire into the various weights and measures used in the sale of grain reported in 1893, after a lengthy investigation, in favour of the retention of the weights specified in the Corn Returns Act, and also recommended that the sale of all cereals should be in terms of the hundredweight of 112 lb., and that no other weight or measure of capacity should be referred to in any sale.

Dr. John Duncan Gregorson, whose death is reported to have taken place in the recent massacre of the British mission on the Assam frontier, was born in Lochgilphead, Argyllshire, in 1871. He entered the University of Edinburgh in 1889, and graduated M.B., C.M., in 1894. After a course of post-graduate study, he was for several years in practice in Leytonstone, but formed a desire for work in the domain of tropical diseases, which an offer made to him about eight years ago enabled him to fulfil. During this period he was medical officer to a group of tea estates located around Tinsukia, in Upper Assam, and two years ago published, in the Journal of Tropical Medicine, a paper giving some interesting notes on the methods used in combating disease among the coolies imported from

India to work on the tea gardens. The population under his care amounted to about 25,000, consisting of many races from widely different parts and climates of India, scattered over a large extent of country in settlements, each containing about 2000 inhabitants. The part of Assam in which Dr. Gregorson laboured has a climate admirably suited for the spread of malaria and ankylostomiasis, which, along with cholera and dysentery, were the chief diseases he had to combat. His work was carried on under very considerable difficulties in regard to the extent of country to be traversed and number of cases to be seen and treated, but he dealt with the various problems presented in a vigorous and effective manner. His success was evidenced by the respect in which he was held throughout the district, and by his having been invited to sit on a Government commission to inquire into the conditions at a garden where the death-rate had been exceptionally high.

THE Secretary for Scotland has appointed the following to be a committee to consider and report on certain questions relating to forestry in Scotland, viz.:—Sir John Stirling-Maxwell, Bart. (chairman), the Right Hon. Lord Lovat, C.B., K.C.V.O., the Right Hon. R. C. Munro-Ferguson, M.P., Mr. John D. Sutherland, Sir John Fleming, Sir Matthew Wallace, and Mr. R. H. N. Sellar. Mr. H. Warre Cornish, Dover House, Whitehall, S.W., will act as secretary to the committee. The terms of the reference to the committee are as follows:—"To report as to the selection of a suitable location for a demonstration forest area in Scotland; the uses, present and prospective, to which such area may be put (including the use that may be made of it by the various forestry teaching centres in Scotland); the staff and equipment required for successful working; the probable cost; and the most suitable form of management. To report as to any further steps following upon the acquisition of the said area which, in the opinion of the committee, it is desirable should be taken with the view of promoting sylviculture in Scotland, due regard being had to the interests of other rural industries."

IN *The National Geographic Magazine* for February Mrs. M. L. Oliver gives an interesting account of the remarkable Snake Dance performed by the Hopi Indians at the pueblo town of Oraibi, illustrated by a valuable collection of photographs. This is one of the fertility rites fully described by Prof. J. G. Frazer in the last edition of his "Golden Bough," the legends indicating that the snakes, the progenitors of the tribe, are conciliated as representing the earth spirits. The dance is performed by members of the Antelope clan and by the Snake priests. The latter dance with live rattlesnakes in their mouths, and these at the close of the rite are released at the four points of the compass to wander where they please in the desert. The dance is followed by ceremonial ablution and the liberal use of a powerful emetic to remove the taboo from the officiants.

The Sarawak Museum Journal, of which the first number was issued in February last, makes a good start with a collection of interesting papers describing the resources and people of the State. In the ethnological notes we find a full account of the remarkable Tau Tepang superstition which is current among the sea Dyaks, and particularly among those tribes which are furthest removed from civilisation. The legends of its origin are not uniform. One story tells that a great snake once devastated the land, and that its spirit announced that anyone who succeeded in eating its tongue would gain the hereditary faculty of becoming a Tau Tepang, that is to say, a person whose head possessed the power of leaving its body, and after working mischief during the night, could return to its owner in the morning. Hence all kinds of evil are attributed to such people, who are rigorously excluded from intercourse with their neighbours; and every paddy farm must be carefully guarded with charms, which contain sharp bamboo spikes intended to pierce the face and eyes of any of the Tau Tepang community who may attempt to injure the crops.

FRANZ DE ZELTNER gives in *L'Anthropologie* (tome xxii., p. 1) an illustrated account of some caves containing mural paintings which he has discovered in the French Sudan, near Bamako, Boko, Foudoufo, and Kita. They occur near the entrance of rock shelters, so that no artificial light was needed to make them; the colours employed are yellow ochre, red, indigo blue, black, white, and rarely pink; they were laid on with the fingers, as there are no brush marks, and there is no evidence that grease was used in mixing the colours. He found only eight realistic figures, and these occur in only one shelter; everywhere geometric designs predominate. The conventional representations of man and animals recall the rock engravings of Sahara and Egypt. There is no correlation between the different signs, and their grouping appears to be quite haphazard. The author does not believe that the caves ever were dwelling-places, and he definitely rejects the hypothesis of a magical and totemic origin of the painting; indeed, he states that "nothing in the traditions or actual life of the blacks confirms it, quite the contrary, since the representation of their protecting animal is forbidden to them as well as contact with it." New discoveries are recorded of rock pictographs in Aragon and Estremadura (*L'Anthropologie*, *loc. cit.*, p. 119). At present only a preliminary survey has been made; the paintings appear to correspond with the later phases of palæolithic decorative art, indeed, many of them recall the conventional designs of Mas d'Azil, which mark the decadence of the great art of palæolithic times. No traces were found of a neolithic or any subsequent period.

PROF. PILLSBURY contributes an interesting paper to the current number of *The Psychological Review* on the place of movement in consciousness. In America, the modern tendency to explain mental processes in terms of movement may be said to have begun with James's well-known theory of the emotions. It has since been extended by Dewey and his school, and has been lately utilised to give impetus to pragmatism in philosophy. Space, even from the time of Berkeley, has received a motor interpretation. Time and rhythm have also been referred to movement. Even memories have been explained as a reinstatement of past movements, and the next logical step would be, as Prof. Pillsbury points out, to suggest that the true quality of sensation is motor. "All that is necessary is to assume that each sense organ is connected with definite muscles, that these muscles are excited whenever the sense organ is stimulated, and that the colour or tones that we see or hear have their origin in some group of muscles rather than in a sense organ or in the cortex." The author points out that nothing is gained by such conceptions if we hold the current view that movements themselves are only known through sensations. He cites the results of recent experiments on the motor cortex of living man, which show that the motor impulses originating from the motor cortex contribute nothing directly to consciousness. "Granted that movements are only known by the kinæsthetic sensations, to translate all conscious qualities into motor terms merely transforms all other sorts of sensation into the one sense, and that a sense

relatively poor in qualities." But where the motor theory most completely breaks down is when it attempts to explain functional problems. Meaning, thinking, recognising, have all been tentatively explained in terms of motor theory. Now "movements in and of themselves have no meaning, are not immediately recognised nor understood. These functions require just as much explanation when they attach to movements as to any mental process." Function is evidently something more than movement; use is something more than structure. As the author points out, "more important than either sensation by itself or movement by itself is the fact that consciousness is always an organised system."

IN *The Entomologist's Monthly Magazine* for April Mr. G. H. Verrall adds one hundred species of Diptera to the British list. Of these, seven are entered as new species, but since there is no diagnosis, these would appear to be *nomina nuda*, which may be appropriated by anyone else.

THE Bergens Museum *Aarsberetning* for 1910 contains a brief account of the recent Atlantic cruise of the *Michael Sars*, financed and directed by Sir John Murray. The collections, it appears, are to be worked out at the Bergen Museum, where the types of new forms will be preserved.

ACCORDING to an article by Dr. Bather in the March number of *The Museums Journal*, the Muses are to have no roof over their heads in some of their habitations, for the movement in favour of open-air museums is stated to be making distinct progress. Such establishments will be, of course, for the display of antiquities not liable to deterioration by exposure to the weather, and they will certainly have the advantage of cheapness. It is satisfactory to note that Dr. Bather considers the exhibition of local objects should be the main function of local museums, their first duty being "to interest the people of their city or county in their own history."

THE *Bulletin Scientifique de la France et de la Belgique* is making a praiseworthy effort to advance the assimilation of current scientific literature by publishing an annual "Bibliographia Evolutionis," which is to record not only the titles of books and papers, but likewise to give a *précis* of their contents. The present issue, of which we have been favoured with a copy, deals with the year 1910, and contains 345 items. The compilers are to be congratulated on the celerity with which they have accomplished this work, and are entitled to the gratitude of all students of subjects connected with evolution, both as regards zoology and botany.

IN connection with the arrival of the first living elephant-seal at our own Zoological Gardens, to which reference has been made in NATURE already, it is interesting to note that, according to *Science*, half-a-dozen young elephant-seals from Guadalupe Island, on the Californian coast, have been received at the New York Aquarium in excellent condition. Although not more than nine months old, these young monsters average about 250 lb. in weight, and measure from 4½ to 5 feet in length. Although described as a distinct species (*Macrorhinus angustirostris*), the Guadalupe sea-elephant is identified by Mr. Rothschild with the typical *M. leoninus* of Juan Fernandez, the Crozet form, to which the London specimen belongs, being regarded by him as a race of the same species.

THE habits and life-history of pycnogonids (Pantopoda) form the subject of an illustrated article by Mr. H. Prell in the third part of the Bergens Museum *Aarbog* for 1910. If kept in cold water, the members of the genus Nymphon flourish in aquariums. All of them crawl, but a few are also able to swim by the aid of swimming-hairs, which are more strongly developed in males than in females. They feed entirely on Hydrozoa, more especially Campanulariidæ, and the curious mode in which these organisms are seized and devoured is well shown in the illustrations. The species of Pycnogonum which are parasitic on sea-anemones, the juices of which they suck, are, on the other hand, much more difficult to keep in confinement.

THE accepted classification of the brittle-stars (Ophiuroidea), according to Mr. H. L. Clark in a paper, of 302 pages, published as Bulletin No. 75 of the U.S. National Museum, is little short of an absurdity, nor has any attempt been made for the last thirty years to put it on a rational basis. Unfortunately, the author has not found himself in a position to remedy this unsatisfactory state of affairs, and he has therefore followed a classification based on a compilation of the work of Lyman and some of his successors. Mr. Clark's paper relates to the North Pacific representatives of the group, of which an enormous collection, comprising more than 40,000 specimens, referable to about 190 species, were at his disposal, the bulk of these having been collected by the *Albatross* during various cruises to and from Alaska, Bering Sea, and Japan. Out of 189 species, no fewer than 112 are from south Japanese waters, to which most of them are restricted. This Honshu fauna, as it is called by the author, is evidently related to the still richer Oriental ophiurid fauna, although only about a dozen species are at present common to the two. The Bering Sea fauna is very distinct from that of Honshu, although the two are connected by a group of sixteen common species. Other points brought out in the monograph are the occurrence of West Indian species in the North Pacific, and evidence in favour of the existence of a distinct circumpolar fauna.

A VALUABLE paper on the post-larval development and minute anatomy in the genera Scalpellum and Ibla has been lately published by Dr. F. H. Stewart in the Memoirs of the Indian Museum (vol. iii., No. 2, 1911). The author has been able to supplement, in some important particulars, the accounts of cirripede development as given in Darwin's classical Ray Society Monograph and in Hoek's well-known contribution to the *Challenger* Reports. There are four plates of excellent drawings representing stages between the cyprid-larva and the adult, mostly taken from species of Scalpellum. It will be remembered by students of the barnacles that while Darwin and Hoek had stated the dwarf male forms of Scalpellum and Ibla to be sexually pure, Gruvel at a later date (1899) claimed to detect rudimentary ovaries in the peduncle of the male *Scalpellum peronii*. Dr. Stewart fails to find in *S. squamuliferum*, and also in a specimen of *S. peronii* itself, any cells that can be regarded as ova, and his descriptions suggest the probability of Gruvel's "cellules ovariennes non développées" being, in truth, large cement-gland cells. Dr. Stewart has also established the absence of any trace of a testis in the female *Ibla cumingii*. His work therefore confirms Darwin's distinction of truly unisexual forms, hermaphrodite forms, and pure dwarf-males among the barnacles.

A LENGTHY paper in Russian by Mr. S. Kostytschew, dealing with respiration phenomena in plants, is published in the botanical section (No. 1) of "Travaux de la Société Impériale des naturalistes de St. Pétersbourg" (vol. xlii.). From his experiments and conclusions derived therefrom

the author constructs the following theory :—There are two distinct processes to be considered in respiration. On one hand, there is absorption of oxygen leading to the formation of certain oxidising substances, notably peroxides, and on the other, decomposition of sugar by a ferment. The immediate products of fermentation may give rise to alcohol, or, under the action of peroxides, may be fully oxidised to carbon dioxide and water.

THE administration report for 1909 of the Ceylon Botanic Garden, prepared by the acting director, Mr. R. H. Lock, together with the supplemental report by other officers, has recently come to hand. Reference is made to the importation of agricultural machinery and tools, not only for planters' estates, but also for the rice lands cultivated by natives. The shot-hole borer, *Xyleborus fornicatus*, a pest on tea bushes, has engaged the attention of the entomologist, Mr. E. E. Green. The historic scourge of the coffee plant, the green bug, *Lecanium viride*, was reported from one district as another pest on tea, and a slug, *Mariaella dussumieri*, was notified as a destructive feeder on young rubber plants. The curator records the first flowering of the apocynaceous shrub *Stemmadenia bella*, and the planting of an avenue of the beautiful pink-flowered variety of *Lagerstroemia Flos-reginae*.

AN important and very useful contribution to hepaticology is provided by Mr. S. M. Macvicar in an enumeration and account of the distribution of liverworts in Scotland, which has been published as the twentieth volume of the Transactions and Records of the Botanical Society of Edinburgh. The compilation of localities and collectors for each species is in itself a formidable task, even when assisted by the cooperation of correspondents. In addition, the author has added to the Scotch records many more new species than any other collector; *Aneura incurvata*, *Adelanthus decipiens*, *Acrobollus wilsonii*, and *Calypogeia succica* are four out of several species found as yet by Mr. Macvicar alone. The floristic sketch of the seven botanical provinces contains many interesting details. Considered from an ecological point of view, hepatici become dominant on some of the higher mountain tops, where a Marsupella-Gynomitrium association is often developed. The coterie of Atlantic species is the most important and remarkable, as some of them would be classed as subtropical and do not occur otherwise in Europe.

A PAPER on fungous root tubercles, communicated by Mr. E. G. Arzberger to the twenty-first report of the Missouri Botanic Garden, deals with conditions examined in *Ceanothus americanus*, *Elaeagnus argentea*, and *Myrica cerifera*; at the same time it is stated that apparently all species of Ceanothus and Myrica possess them to some extent. The course of events was found to be very similar for Ceanothus and Elæagnus. The fungus enters a young root, and in consequence a tubercle is formed; hypertrophy leads to the development of a large cortex in which the fungal mycelium ramifies; the nuclei of the invaded cortical cells increase abnormally; then the fungus forms vesicles, regarded by the author as sporangia, and absorbs nucleus and cytoplasm of the host cell; subsequently the fungal cells disappear. In the case of Myrica there is no tendency to break up the contents of the vesicular structures, and the form of the fungus indicates that it belongs to the genus Actinomyces.

BESIDES the vast store of archæological information which Dr. M. Aurel Stein brought back from Chinese Turkestan and Western Kansu, he and his assistants from the Survey of India carried out a very large amount of careful topographical surveying, which very greatly improves the maps of that region. Plane-table surveys were carried on continuously during the journeys, and these were controlled by astronomical observations for latitude made at seventy-two stations, and by others made during a previous journey in 1900–1. From this material ninety-four sheets are being prepared by the Survey of India on the scale of 1 : 253,440, and will be published in the form of an atlas to accompany the detailed report on the scientific results of Dr. Stein's last journey. In the meantime reduced copies have been published by the Royal Geographical Society in the Journal for March. The whole area from Kashgar to Kan-Chou (long. 75°–101°), including the Takla Makan desert and the mountains bounding it, is plotted on the scale of 1 : 3,000,000. Other maps on the scale of 1 : 1,000,000 show the Kun-Lun range on the frontier of Kashmir, and Western and Central Nan-Shan to the eastward. On all these maps, heights which have been determined by triangulation, or by barometric or clinometric observations, are shown, names have been carefully revised, and the areas occupied by cultivation, scrub or jungle, and desert have been distinguished. The whole forms a most valuable addition to Asiatic cartography.

THE monthly meteorological charts for May issued by the U.S. Weather Bureau for the oceans and for the Great Lakes of North America have been received. Among the various data, in addition to the usual mean values, we may mention an article (on the back of the charts) entitled "Weather Lore of the Sea," which includes a large collection of proverbs. These are not given as unfailing signs of coming weather; in fact, it is pointed out that for some, depending on celestial bodies, such as moon and stars, careful records fail to show the slightest influence, but the mariner may find it interesting to verify others at his convenience. The Deutsche Seewarte also makes good use of the space available at the back of such charts. The North Atlantic chart for April contains a detailed account of the quick voyage of the sailing ship *Potosi* to the west coast of South America and back, together with useful remarks as to the course and the advantage taken of actual and average weather conditions.

WHILE the reports published in NATURE furnish an indication of the papers read before the London Mathematical Society, considerable interest attaches to the annual volume in which these papers are published, as affording a survey of the year's work. The Proceedings of the London Mathematical Society for 1910 (London, Francis Hodgson, 1910) shows the same high standard that has been maintained in previous years, and contains thirty papers, notable among which are five important contributions to analysis by Dr. W. H. Young, F.R.S., and papers by Bateman, Hardy, Dixon, Hobson, Lamb, Watson, and others, altogether twenty mathematicians having contributed to the present volume. In applied mathematics we have papers on electrodynamical questions by Bateman, Cunningham, Hassé, and Larmor, on heat by Carslaw, on diffraction by Lamb, and on attractions by Leathem. The importance of maintaining and further stimulating interest in these proceedings will be evident when we compare the output of English mathematical original work with what is being accomplished elsewhere, particularly in America. We have, in addition to the present "Proceedings," our "Quarterly" and our "Messenger," but if a quantitative test is of any value, the American Society's Bulletin and Transactions,

the American Journal and the Annals certainly have the lead. As regards quality, a comparison is not so easily made. In America groups are now receiving most attention; in the present volume analysis largely preponderates.

ACCORDING to a copy of a paper in the Bulletin of the Academy of Sciences of Cracow which has reached us, M. H. Merczyng has succeeded in measuring the refractive indices of water and alcohol for electrical waves of 4·5 and 3·5 centimetres, produced by means of a Righi oscillator working in petroleum. The rays sent out by the oscillator are rendered parallel by passing through a spherical flask filled with petroleum, and then fall at an angle of about 40° on the surface of the liquid. The reflected beam is received by a parabolic mirror, which concentrates it on to a thermo-junction. From the angle of incidence and the ratio of the intensities of the reflected and incident beams, the refractive index of the liquid is calculated. The wave lengths are measured by the Fresnel double mirror method. The results obtained, when compared with the known results for longer waves, show that in both cases the region in the neighbourhood of 4 centimetres is one of anomalous dispersion, the refractive indices increasing as the wave-length increases.

MESSRS. E. R. NORMAN AND CO., 26 Great George Street, Leeds, have issued a pamphlet describing the Sytam system of making notes and filing papers. The system consists of methods of binding together loose sheets of paper which can be readily introduced or removed or changed in position, forming a compact book. There are four different kinds of mechanism suitable for binding together sheets of various sizes, which range from $3\times2\frac{1}{8}$ to $13\frac{1}{2}\times9\frac{1}{2}$ inches. The system appears to be quite practical and easy of application; we have seen a large ledger in which sheets are arranged for the D schedule (chemistry) of the International Catalogue, the names of the sections of the schedule being indicated by projecting tabs on the edges of the sheets, which renders reference very easy.

"REMARKABLE ECLIPSES" and "Remarkable Comets," both by Mr. W. T. Lynn, have just been issued in their eleventh and fifteenth editions, respectively, by Messrs. Samuel Bagster and Sons, Ltd. Both have been brought right up to date, and the most remarkable feature of each is the enormous amount of information compressed within so small a compass and sold at the low price of 6*d.* each net. The former volume includes notes on the most remarkable eclipses of the sun since 1063 B.C., and of the moon since 721 B.C., while the second briefly describes all the remarkable comets of which history speaks, even though it be with far-off whispers. An excellent drawing of Halley's comet, as seen by Miss E. M. Phillips at Barbados on May 17, 1910, is an additional feature, new in this edition.

THE April issue of Mr. C. Baker's quarterly classified list of second-hand instruments contains a description of more than 1500 pieces of scientific apparatus for sale or hire at Mr. Baker's second-hand department, 244 High Holborn, London.

IN Mr. E. P. Stebbing's paper on "Tree Planting in Towns," on p. 197, col. 1, of NATURE of April 6, the word "Etna" should have been "Everest." Mr. Stebbing asks us to correct this error, which was made by his typist, and was overlooked by him in the proof of the paper submitted to him.

OUR ASTRONOMICAL COLUMN.

APRIL METEORS.—Mr. W. F. Denning writes:—"The April meteoric shower will occur this year when there will be little moonlight. With clear skies it ought to be very satisfactorily observed, but the character of its return cannot be predicted.

"On April 19, 1803, there was a fine display, but it has not returned in the same abundance during the 108 years which have elapsed since the date alluded to. There is no reason to anticipate a brilliant exhibition this year, but the sky should be vigilantly watched on the nights of April 20, 21, and 22, so that if the shower actively returns it may be suitably recorded. It is often of short duration, and true Lyrids are rarely, if ever, observed before April 17 or after April 24.

"From observations made at Bristol since 1873, I certainly believe that the radiant point is liable to the same easterly motion as that which affects the emanating centre of the Perseids. But the April stream supplies so few meteors, except on the date of maximum, that it is extremely difficult to get the precise position of the radiant point on the 17th and 18th, and 23rd and 24th. Observers would do well to gather as many apparent paths as possible on the nights just named. Records of meteors obtained at two stations would be specially valuable as serving to indicate the point of radiation accurately. On April 18, 1901, 13h. 10m., a bright Lyrid was recorded by Prof. Herschel at Slough, and by the writer at Bristol, and the radiant was indicated at 266°+33°. This object afforded evidence that the Lyrid focus is a changeable one, for its centre is at 270°+32° on April 20. Additional observations of similar character would supply valuable details bearing on an interesting feature of the display."

THE SPECTRUM OF NOVA LACERTÆ.—Spectrograms of Nova Lacertæ were secured at the Potsdam Observatory on January 6, 7, 8, and 23, and are described by Prof. Münch in No. 4490 of the *Astronomische Nachrichten*. The wave-lengths were determined by taking the mean measured wave-lengths of the hydrogen lines as normal, and then interpolating the other measures. Naturally, no rigid accuracy is claimed for the values as being absolute, but the table is a useful record of the lines seen and of their various intensities and characters. On January 7 Hγ and Hδ were sharply defined on the red side, but diffuse on their more refrangible edges, where they were accompanied by broad absorption bands: the maximum intensity lay on the red side of each line; on the other hand, Hε and Hζ were equally sharp on both sides. The usual decrease in the intensity of the continuous spectrum took place, and on January 23 it was much fainter than on January 7. Prof. Münch discusses the intensity curve of the nova spectrum, and by a comparison of the distribution of energy therein shown with that given by several stars of the A type, he derives an energy curve for the nova.

THE DIFFERENT QUALITY OF THE LIGHT REFLECTED FROM VARIOUS PARTS OF THE LUNAR SURFACE.—It will be remembered that Prof. R. W. Wood found recently that, when photographed in ultra-violet light, various features on the moon presented different appearances from those presented on ordinary photographs.

Working at the Charlottenburg Technischen Hochschule, Herren A. Miethe and B. Seegert have carried the investigation a step further by using two screens in connection with a reflector, one of which transmitted light of wave-lengths 360–330 $\mu\mu$, the other light of wave-lengths 700–600 $\mu\mu$. A comparison of the plates so obtained shows remarkable differences of illumination, especially on some of the surfaces of the *maria*. The higher parts of the lunar surface, especially in the region of the south pole and about the ring mountains of Copernicus, reflect hardly any ultra-violet light, while the north polar regions reflect a great deal. By projecting the two photographs through complementary screens, the differentiation of colour is brought out remarkably, the Sinus Roris and Mare Nubium showing remarkable variations (*Astronomische Nachrichten*, No. 4489).

THE PYRHELIOMETRIC SCALE.—A paper with important bearing on the question of the value of the solar constant is published by Messrs. Abbot and Aldrich in No. 3, vol.

xxxiii., of *The Astrophysical Journal*. Feeling dissatisfied with the Crova alcohol actinometer obtained in 1902, Mr. Abbot conceived the idea of constructing a new form of pyrheliometer. This consists of a double walled, large test-tube blackened within, with a stream of water circulating between the double walls and absorbing the heat collected inside the chamber. The sun's rays shine into this chamber through a measured orifice, and the heat collected by the water is measured by a system of platinum wires forming a resistance thermometer.

Test experiments with electrically heated coils, in which the heat could be measured with great accuracy, have shown that the water system collects all the heat introduced within 1 per cent., and that the solar heat can be collected and measured to within 0·2 per cent. Thus the scale of the solar-constant observations of the Astrophysical Observatory is reduced to the absolute scale of calories (15° C.) per square centimetre per minute within a probable error of 0·2 per cent., an accuracy hitherto not attained.

DOUBLE-STAR OBSERVATIONS. Circular No. 6 of the Transvaal Observatory contains a list of about 350 double stars discovered with the 9-inch Grubb refractor of the observatory during 1910. Mr. Innes directs attention to the common statement that the southern heavens offer a practically unexplored field to the would-be double-star discoverer, and shows that this is by no means the case. The circular also contains a list of double stars discovered by Mr. Ward at Wanganui, New Zealand. The list contained observations of 212 stars, but has been revised, and in some cases the observations confirmed, by Mr. Innes.

Nos. 4486 and 4488 of the *Astronomische Nachrichten* also contain series of double-star measures, the former by Herr J. Voûte at the Leyden Observatory, the second a longer list of micrometer measures by Prof. H. E. Lau at Copenhagen.

MICROMETRICAL MEASUREMENTS OF NEBULÆ.—A useful catalogue of nebulæ lying south of the equator is published as No. 17 of the Publications of the Cincinnati Observatory. In the preface Prof. Porter explains that when the 16-inch Clark refractor was ready for work at the end of 1904 it was decided to observe those nebulæ of Dreyer's N.G.C. which have southern declinations, and the work has been carried on since. There was no idea of discovering new objects, but seventeen were found, of which nine appear certainly to be novæ. The catalogue includes the positions of 669 objects, with the micrometrical measures of them and of the companion stars.

THE MOTION OF CERTAIN STARS IN SPACE.—As an extract from the *Bulletin Astronomique*, we have received a paper in which Prof. Stroobant discusses the question of the sun being a member of a group of stars having a common motion through space. In the result, he finds a fairly strong indication that the sun does belong to such a system, which also comprises the stars α Cassiopeiæ, β Persei, α Persei, α Scorpionis, γ Cygni, and ε and α Pegasi.

THE COMPOSITION OF THE GASES CAUSED BY BLASTING IN MINES.[1]

THE report before us was drawn up for the Government of Western Australia by Mr. E. A. Mann, the Chief Inspector of Explosives. The importance of investigations on the subject of the composition of gases caused by blasting in mines cannot be overestimated, since, hand in hand with the safety in actual use of blasting explosives, there is the possibility of accidents arising from the products of the explosion accumulating in badly ventilated headings. This risk has been recognised by several Governments, and investigations instituted. In the present case a most valuable and suggestive report is the outcome.

Nitroglycerine is the only largely employed explosive which contains more than sufficient oxygen for its complete combustion, and on firing should therefore yield only carbon dioxide, nitrogen, water vapour, and an excess of oxygen. The explosives investigated were mainly nitroglycerin explosives: blasting gelatin (nitroglycerin with approximately 10 per cent. soluble nitrocellulose), gelatin dynamite, and gelignite, both of which contain wood meal and potassium nitrate. Generally speaking, the former contains a slight deficiency of oxygen, whilst the latter two an excess.

The gases produced on firing under actual working conditions were collected by Mr. Mann, who wore for the purpose a Fleuss oxygen apparatus. In all 131 entries were made into the dangerous gases, and analysis invariably showed that carbon monoxide, which is so highly poisonous, was produced, together with small quantities of oxides of nitrogen, dangerous by reason of their physiological activity.

An important ratio obtained is that between $CO : CO_2$, which is a fair measure of the relative dangers of gas-poisoning with the different explosives. The highest is found with blasting gelatin (1 : 6·5), a general average for all the explosives being about 1 : 13. It is well known that pressure on firing exercises an enormous difference in the distribution of oxygen to form carbon dioxide or monoxide, high pressures increasing the CO_2, and this has an important bearing in practice. If the explosives mentioned are fired in a bomb, the maximum oxidation results, since maximum pressure is attained. In a rock, the greater the resistance, either from its character or the position of the charge, the lower should be the ratio $CO : CO_2$. The ideal condition would be where the rock only gives just when the maximum pressure is reached; but this is a condition impossible to realise in practice, so that holes are invariably overcharged, *i.e.* the rock is blown out before oxidation has been completed, hence the production of carbon monoxide.

Two very important points are brought out, first, the influence of the paper wrapper of the cartridge, which gives a deficiency of oxygen on the whole charge. Comparative tests with and without wrappers show that in the case of gelignite the ratio $CO : CO_2$ has been reduced from 1 : 16 to 1 : 51, and in the case of blasting gelatin from 1·95 to 1 : 52. Secondly, the influence of the physical condition of the powder; where the most intimate mixture of the ingredients is obtained, there is every chance of oxidation proceeding more rapidly to the maximum actually obtainable before rupture of the rock. Some excellent coloured plates of the microstructure of many of the explosives under polarised light emphasise the frequent heterogeneity of their structure.

The effect of fuse firing as compared with electric firing is carefully considered, and everything is greatly in favour of the electrically fired charge, fuses being responsible for much deleterious gas.

[1] Report on investigations into the Composition of the Gases caused by Blasting in Mines, by E. A. Mann, Chief Inspector of Explosives for Western Australia. (Perth: by authority: Fred. Wm. Simpson, Government printer.)

DRAINAGE AND MALARIA.

IN India, the sanitary expert adviser of the complacent type must either "bend or break" under the weight of official opinion (held as strongly by the youngest Under-Secretary as the veteran Financial Member) that the Sanitary Department must be classed financially as "unproductive," and must therefore be, in its representations involving expense, tactfully unobtrusive. Hence, possibly, the unconscious evolution of the policy of "quinine prophylaxis," which would relieve the Government of India from applications for loans and "free grants" for radical anti-malarial measures, such as drainage works, requiring the sinking of capital, and would throw upon the inhabitants of malarious areas (who are notoriously impecunious as a sequence of disability to labour) the onus of purchasing an expensive drug—through an indefinite number of years.

In connection with the letter in NATURE of February 9 by Dr. Bentley—one of the small circle of supporters of this policy—and the reply thereto by Dr. Malcolm Watson, there is now available a record[1] of facts at issue, which will enable those interested in a question of much import-

[1] "The Prevention of Malaria in the Federated Malay States." By Dr. Malcolm Watson, with a preface by Prof. Ronald Ross, C.B., F.R.S. Pp. 139. (Liverpool: School of Tropical Medicin , 1911). Price 7*s.* 6*d.*

ance to communities of tropical countries, and, consequently, of our national commerce, to draw their own conclusions. Readers of this very valuable statement of work fulfilled and observations made by a keen and practical sanitarian will find no difficulty in recognising that the "marked rise of subsoil water," which coincided with the increased incidence of malarial fevers, was the "special influence" at work in Klang; that this occurred in an already malarious town in constant communication with surrounding malarious areas, with the result that transfer of infected inhabitants to the swamps of Port Swettenham found ready-made conditions for the continuance, if not aggravation, of epidemic malaria; and, consequently, the increased incidence was not due to the ephemeral effect of importation of ill-fed coolies, but primarily to local physical conditions remediable, and actually remedied, by judicious engineering operations.

This record shows that in Klang and Port Swettenham the abolition of pools by drainage (without the aid of quinine prophylaxis in the former case, even as a temporary measure) rapidly rendered possible commercial undertakings of great monetary value, which had been interrupted on account of disability of the available labour; that whilst there obviously is no desire on the part of the author to belittle the utility of quinine prophylaxis, he found that to secure maintenance of coolie labour upon estates the daily consumption of quinine necessary, under careful supervision of the subjects, was in quantities that a free Indian population could neither afford nor be persuaded to take; that the survivors of this temporising effort remained at the end of two and three years of daily administration of quinine the bearers of malaria parasites, and therefore were a danger to themselves and their neighbours; and that by effectual removal of surplus moisture of the soil, there is excluded fear of epidemic malaria following the introduction of malaria-parasite bearers—an "influence" which, in the absence of drainage, certainly cannot be ignored. Nor is it only in Klang and Swettenham that these results have been illustrated, but in several planting estates, where previously the loss by coolie labour paid for, but unavailable from sickness and death, was of grave moment; here also has been gathered valuable information as to the necessary radius of protective zones.

Seeing that, in accordance with the policy of the sanitary expert advisers of the Government of India, the Punjab Government has recently inaugurated an anti-malarial campaign by purchasing *a ton of quinine*, it is not likely that the amount of this drug found necessary by Dr. Malcolm Watson for the mitigation—not eradication—of malaria in a free population will surprise them. The Government of Eastern Bengal and Assam has, however, adopted a method more likely to be grasped by the people; whilst assigning drug prophylaxis to the millennium, it, in the meantime, asks its malaria-stricken populations to indulge in the so-called quinine "treatments" at three annas *per* head *per* attack—or a sum exceeding the total average annual taxation *per* head on account of district boards serving under it.[1] In this case, presuming two attacks *per annum per* head in a population of 15,421, there would be spent (in one sense) "unproductively" against a preventable disease sufficient to meet the sinking fund and interest, by annual instalments, of a loan for thirty years of one lakh of rupees. Yet the chances are that were a lakh sunk in any well-designed anti-malarial drainage scheme, there would be illustrated the truism that "prevention is better than cure"—both for commercial and humanitarian reasons.

W. G. KING.

SOME PAPERS ON INVERTEBRATES.

IN the report of the Government entomologist, issued by the U.S. Department of Agriculture, for 1910, will be found a full account of the work accomplished during the year under review, and a scheme for future work. Certain points connected with the life-history of the brown-tail and the gipsy moth engaged attention during the year, more especially the presence of isolated colonies of the latter in woodland districts. As the result of these investigations, it was found that newly hatched caterpillars may be carried by wind to a distance of nearly 2000 feet. Of late years the Argentine ant has caused such damage to orange-plantations in Louisiana that several have been abandoned, but it is believed that a practical method of keeping this pest in check has now been discovered.

New species of artificially reared ichneumon-flies and new South American parasitic Hymenoptera form the subject of two articles, respectively by Mr. H. E. Viereck and Mr. J. C. Crawford, in the Proc. U.S. Nat. Mus. (Nos. 1789 and 1786).

It seems somewhat strange that it should be left to a Japanese naturalist to describe new cicalas from Europe and the Mediterranean countries. Nevertheless, such has been the case, and in the Journal of the College of Science of Tokio University, vol. xxvii., art. 18, Prof. S. Matsumura, who writes in German, concludes his paper on this subject, describing as new no fewer than forty-two species, together with two new genera.

In *Naturwissenschaftliche Wochenschrift* of February 5 Prof. J. Meisenheimer records the results of experiments for testing the power of regenerating their wings in insects, the moth *Lymantria dispar* being the subject of these experiments. The first traces of the wings occur as minute outgrowths from the sides of the last two limb-bearing segments of the caterpillar, and in the large series of specimens submitted to experiment these were cut away on one side. In a few instances the wings on the injured side were represented by mere knobs, but in most cases more or less well-developed wings were grown, although very generally smaller than the normal ones. Sometimes one wing on this side may be fairly well grown, and the other quite small. Details on this point, and also in regard to variation in the colour-pattern, are given in the paper.

The Entomologist's Monthly Magazine for March contains two papers—one, with a coloured plate, by Miss E. M. Alderson, and the other, by Mr. E. A. Atmore—on the beautiful little lace-wing fly, *Chrysopa dorsalis*, first added to the British list in 1900 on the evidence of specimens taken in Surrey, but subsequently found in Norfolk. The species, which frequents the needles of Scots fir, has been bred in confinement by Miss Alderson.

A synopsis of the true crabs inhabiting Monterey Bay, California, forms the subject of an article by Mr. F. M. Weymouth, issued as No. 4 of the Leland Stanford Junior University Publications. This communication, which is very fully illustrated, is to form one of a series of papers of similar scope dealing with the fauna of Monterey Bay for the purpose of rendering the local forms of invertebrates easily identifiable by the students at the Marine Biological Laboratory of the University.

The structural arrangements in the females of the decapod crustaceans of the family Peneidæ for receiving and storing the sperm are described and illustrated by Mr. E. A. Andrews in No. 1791 of the Proc. U.S. Nat. Mus. The females of this family present the comparatively rare feature of having special receptacles, or spermatotheca, for this purpose on the ventral aspect of the body, and the different degrees of complexity of these structures in the various species and genera are illustrated by sections. The alleged existence of receptacles of the same type in the females of the deep-sea prawns of the group Eryonidea is considered by the author to be improbable.

North American parasitic copepods of the family Ergasilidæ form the subject of No. 1788 of the same serial. The family, according to Mr. C. B. Wilson, includes ten genera, three of which are described for the first time, while the definition of a fourth is revised. All its members live almost entirely on the gill-filaments or within the gill-cavities of fishes, but whereas adult females become more or less fixed, the males remain free-swimmers, and in the case of one genus do not appear to be parasitic at all. Hence males are much scarcer in collections than females, and after the breeding season can only be taken in the tow. The genera may be arranged in the three subfamilies, of which one is typically fresh water, while the other two are marine.

No. 1783 of the Proc. U.S. Nat. Mus. is devoted to the ninth portion of Mr. C. B. Wilson's memoir on North American parasitic copepods, the author dealing in this

[1] In Italy, under laws passed 1901-03, the poor and all workers have the right to receive quinine for treatment *and* prophylaxis gratuitously from the State.

instance with the family Lernæopodidæ. Special attention has been directed to the development of certain members of the family, the new facts being recorded in a summary at the end of the paper, which is too long and too technical for quotation in this place.

In No. 1785 of the serial just quoted, Mr. P. Bartsch describes several new species of molluscs of the family Vitrinellidæ from the Pacific coast of North and Central America, with illustrations of the shells.

The cyclostomatous polyzoans of the same coast are discussed by Miss A. Robertson in vol. vi., No. 12, of the University of California Zoological Publications, this communication being the third of the series. In addition to the description of new species, the author directs special attention to the ovicel, with particular reference to the investigations of Dr. S. F. Harmer.

A number of polyzoans ranging from the Ordovician to the Cretaceous, and common to Europe and North America, many of which have been included by previous writers in Stomatopora, are referred by Mr. R. S. Bassler in No. 1797 of the Proc. U.S. Nat. Mus. to a new genus under the name of Corynotrypha, for the distinctive characters of which those interested in the subject must consult the original paper.

In the Proceedings of the Royal Irish Academy, vol. xxix. (B), No. 3, Mr. A. W. Stelfox gives an annotated distributional list of the land and fresh-water molluscs of Ireland. The author acknowledges his indebtedness to Dr. Scharff in working out the fauna generally, and to Mr. B. B. Woodward for the discrimination of the species of Pisidium. Fourteen land and fifteen fresh-water species inhabiting Great Britain have not yet been recorded from Ireland, and since most of these belong to the central European fauna, there is considerable probability that they never reached the western island. On the other hand, a Hygromia which apparently belongs to the Cornish outlier of the Lusitanian fauna may turn up on the east coast of Ireland, while search for *Limax tenellus* should be made in the northern and north-western districts.

The slugs of Natal form the subject of a paper, by Mr. W. E. Collinge, published in the Annals of the Natal Museum, vol. ii., part ii. These are referable to fifteen species, arranged in six families, of which the Aperaidæ, as represented by the exclusively South African genus Apera, is new. Of the five species of this remarkable genus, which has hitherto been included in the Testacellidæ, three are found in Natal. The genus is believed by the author to represent a very primitive type, such resemblances as it shows to the Testacellidæ being probably due to parallelism. It was originally described, in 1879, as Chlamydephorus, a name which clashes with the mammalian Chlamydophorus. The author states that the latter name was given by Agassiz in 1844, but it was really proposed in 1824 by Harlan, in the form of Chlamyphorus, and this difference in the original may give rise to the question whether it really preoccupies Binney's Chlamydephorus.

No. 5 of the fifth volume of *The Philippine Journal of Science* is devoted to a description, by Mr. L. E. Griffin, of a new species of the protozoan genus Euplotes, for which the name *Eu. worcesteri* is proposed. The type-specimen was found in 1909 in water brought to the Manila Laboratory from the neighbouring bay. The species, of which exquisite illustrations are given in the plates accompanying the memoir, is very closely related to *Eu. vannus*.

A new generic type of crinoid, *Thalassocrinus pontifer*, from the Philippines is described by Mr. A. H. Clark in No. 1793 of the Proc. U.S. Nat. Mus. It is a stalked form referable to the family Hyocrinidæ, with its nearest relationship, apparently, to Gephyrocrinus.

R. L.

PAPERS ON SYSTEMATIC BOTANY.

AN important feature in the revision prepared by Dr. C. B. Robinson of Philippine Urticaceæ, is the discussion of generic limits and relationships. A new genus, Elatostematoides, is proposed for certain species previously referred to Elatostema or Pellionia, and another genus, Astrothalamus, allied to Maoutia. Under Laportea, a genus of notoriety on account of its stinging hairs, it is mentioned that the hairs are siliceous, and may contain formic and acetic acids; also that prompt relief is afforded by ammonia or carbonate of soda. Many new species are differentiated, notably nine for Laportea and twenty for Elatostema. The first part only of the article appears in the concluding number of the fifth botanical volume of *The Philippine Journal of Science*.

The second number of the current volume of *The Kew Bulletin* contains the diagnoses of thirty new African species, chiefly under the genera Protea, Sorocephalus, Loranthus, and Erythrococca, a note by Mr. G. Massee on a lilac disease, and an article on the beechwood industry of the Chilterns by Mr. W. Dallimore. The lilac disease caused by the hyphomycete, *Helminthosporium syringae*, shows first as a brown stain on either side of the leaf; the stained area extends and darkens, and olive-brown patches of fruit appear; later on, spores are formed in great abundance. Spraying with a solution of potassium sulphide in an early stage serves to check the disease. Mr. Dallimore deals more particularly with the chair-making industry centred in High Wycombe, and the brush-making industry of Chesham.

Recognising the difficulties of delineating the various species of Castilla (Castilloa), Mr. H. F. Pittier designates his careful and well-illustrated revision of the genus in the Contributions from the United States National Herbarium (vol. xiii., No. 7) a preliminary treatment, although his conclusions are based largely upon experience in the field. Ten species are distinguished, of which four from South America are placed in a separate group, while the second consists of Central American species, differing more or less from *Castilloa elastica*. The practical object of the publication is to make known the diversity of species that may be under cultivation as *C. elastica*. It is noted that *C. nicoyensis* is a good latex producer, and that *C. costaricana* is tapped by the native collectors.

A catalogue of non-herbaceous phanerogams cultivated in the Royal Botanic Garden, Calcutta, published as vol. v., No. 1, of the Records of the Botanical Survey of India, is not a mere list of species, but is designed to identify and locate every tree or shrub growing there. For this purpose the plan of the garden is divided into squares distinguished by letters and figures, and in addition each plant receives and is labelled with an individual number; thus one specimen of *Schleichera trijuga* is listed as O 10, 1641. At points corresponding to the intersection of lines posts are inserted in the garden to locate the squares. Further, a record of source and history is tabulated for each individual plant to be registered in a filed system, and special sheets have been designed for keeping note of seeds. The present index part will be supplemented by a systematic part furnishing the "stock account" of the garden.

REPORTS ON GLACIOLOGY.[1]

(1) STUDENTS of glaciology owe a debt of gratitude to M. Rabot, because information on this subject is scattered over a wide field and in unexpected places. To collect that contained in the present number of the *Revue* must have been a heavy task, and its value is increased by a careful classification. The earlier sections deal with matters such as precipitation, its form and relation to altitude, the rate at which snow melts, avalanches and their consequences, the formation of glaciers, their structures, their dates of movement, and their erosive effects, in regard to which last diverse opinions are quoted. If we can believe Prof. Hans Hess, a glacier deepens its bed by 1 metre in from thirty to fifty years, or, in other words, the erosive power of ice is at least ten times as great as that of running water. Figures are cited to support this conclusion, but a tolerable familiarity with glaciers and their works, for at least that time, leads us to suspect there is something wrong with the figures or the observations.

[1] (1) Revue de Glaciologie. No. 3 (avril 1903–1er janvier 1907). By Charles Rabot (Mémoires de la Société Fribourgeoise des Sciences Naturelles, vol. v., Band v., Géologie et Géographie). Pp. 344+30 figures. (Fribourg, Suisse, 1909.) Price 6 francs.

(2) Les Variations périodiques des Glaciers. XVme Rapport, 1909. Rédigé par Dr. E. Brückner et E. Muret. Extrait des Annales de Glaciologie, t. v. Janvier, 1911. Pp. 177–202. (Berlin: Borntrager Frères, 1911.)

Many as are the important facts from almost every part of the globe which the present number contains, it must suffice to notice only the chapter on the causes of variation in glaciers. The data there cited show that, at any rate under certain conditions, the winds are factors, especially in the removal of snow, more potent than has been hitherto supposed. In regions of low temperature, but of high winds, these drive the snow before them, like sand in the desert, and thus check the formation of glaciers. The volume of an ice-stream, speaking in general terms, is a function of two variables, the one alimentation, the other ablation. Hitherto the effect of the latter has been underestimated, the advance or retreat of a glacier having been supposed to be mainly dependent on the amount of the snow which falls on the upper part of its basin.

M. Rabot classifies the years from 1826 to 1906 in groups, according as the rainfall or the summer temperature at Geneva was above or below the average, and states that in the former case the Swiss glaciers, as a rule, retreated, and in the latter advanced. Similar, though less precise, evidence is obtained from other regions, so that it is very probable, to quote Prof. Forel's words, that the variations in summer temperature produce more effects upon glaciers than has hitherto been supposed. On the latter subject, and especially on the changes during the last few years, a very large amount of information is given. In short, its editor has made the *Revue* indispensable to all interested in the study of glaciers.

(2) The Commission Internationale des Glaciers decided at Stockholm last August that this report should appear at an earlier date. Hence a supplement will be necessary to contain documents which have not yet been received. Still, this number includes Europe, with Russian Asia and the United States of North America. The results show a general but slow decrease of the glaciers. To this rule there are local exceptions, which, however, are few except in Scandinavia; and even here they are in a minority. It is suggested that in Norway changes in the humidity of the air, due to the shifting of ocean currents, produce more effect on climate and glacial oscillation than those in temperature. Some sets of observations in the French Alps are more than usually systematic, for the investigators take account of avalanches and calculate the rate of flow and of ablation at the surface of glaciers between two stations. They note that 683 out of 740 avalanches followed a customary course, and estimate the amount of débris brought down by them at 2243 cubic metres. Altogether the number contains not a little interesting information.

THE ASSOCIATION OF ECONOMIC BIOLOGISTS.

THE tenth general meeting was held in the University of Birmingham, under the presidency of Prof. G. H. Carpenter, on April 6 and 7. There was a good attendance.

The president communicated a paper on some dipterous larvæ which last year caused considerable damage to crops of swedes near Dundalk, Ireland. These belonged to an apparently new species of gall-midge and to *Scaptomyza flaveola*. In connection with this species, several points of interest in the structure of the larva were demonstrated by means of photographs and drawings shown in the lantern.

Mr. H. Maxwell Lefroy, in a very interesting address, spoke on the training of economic entomologists. Not the least difficulty in making economic zoologists in England was the preponderance of the academic view and the total absence of the economic view based on experience. He pointed out that, in addition to a training in zoology, botany, and chemistry, a course in agriculture should be taken, and a knowledge of field work in entomology was useful.

Mr. Walter E. Collinge read a paper on house-flies and public health, in which it was pointed out that there was now no longer any doubt that cholera and typhoid fever were both spread by these insects, and that there was accumulating evidence that infantile diarrhœa, dysentery, and tuberculosis were also. Mr. Collinge contended that a proper system of control and prevention were essential on the part of every corporate body having anything to do with the health of the general public. After briefly referring to the ordinances and regulations in force in other countries, he commented upon the inadequate conditions for the keeping of food in the modern dwelling house, and the necessary regulations for the disposal and storage of manure, &c. In concluding, he pointed out that it remained with the general public to educate the authorities in these and like matters if we have to remove from our midst a danger full of potentialities to ourselves and our children, and detrimental to the public at large.

An interesting discussion on the standardisation of economic nomenclature was opened by Mr. H. Maxwell Lefroy, and a committee was appointed to deal with the matter.

Dr. G. H. Pethybridge gave an account of some recent work on diseases of the potato plant in Ireland, where the potato crop is peculiarly liable to suffer. Great advances have been made in recent years in checking the ravages of different diseases, but there are still many that have not yielded to treatment. A considerable amount of attention has been given by the author to these, and the results were very fully described and illustrated.

Mr. W. B. Grove described four little known British fungi, viz. *Mucor spinosus*, *Monilia lupuli*, n.sp., long known to brewers as occurring on spent hops, but hitherto undescribed. *Rhopalocystis nigra* was a new name proposed for *Aspergillus niger*, and *Hormodendron cladosporoides*, a species often confounded with *Cladosporium herbarum*.

Mr. Walter E. Collinge directed attention to the extremely serious nature of the plague of eelworms and white worms which are at present attacking different crops throughout the country, and to the scanty nature of our knowledge of their life-histories and bionomics. Dr. J. H. Priestley initiated a discussion on the systematic recording of diseases of economic plants. The occurrence of the beetle *Necrobia rufipes* in cotton bales formed the subject of an interesting communication by Mr. Joseph Mangan. Mr. G. E. Johnson demonstrated some stages in the life of the nematode living in the nephridia of the earthworm. The association accepted the invitation of Prof. Carpenter to meet in Dublin in 1912 at a date to be fixed later.

THE CONSERVATION OF OUR NATIONAL WATER RESOURCES.

AN interesting paper on the above subject was read by Mr. W. R. Baldwin-Wiseman before the Surveyors' Institution on January 27. This may be considered as the complement to the paper read by the author before the Royal Statistical Society in 1909 on the increase in the national consumption of water. In the earlier paper Mr. Baldwin-Wiseman dealt with the enormous increase in the consumption of water, and the reasons for such increase, and he referred very shortly to the necessity for the creation of a central authority which should be charged with the duty of water conservancy in its widest application, and, for that purpose, should engage in a close and exact study of the water resources of the country. He now deals with some of the methods adopted by different countries to conserve and use in a systematic way the water which they possess. It is rightly pointed out that the particular use of water to which greatest attention is required varies in different countries. In the United Kingdom the water supply for domestic purposes and trade uses is all-important, and with it must be coupled the prevention of stream pollution. In Italy, Switzerland, Norway, and Canada water-power development is predominant. In Egypt, India, parts of Australia, and certain regions of the United States and Canada irrigation claims first place. In Germany and Belgium inland navigation is of extreme importance, while Holland devotes attention to drainage and reclamation.

The author's researches as regards what has been done by various countries for the conservation of water for the different purposes mentioned are of a careful and exhaustive character, and it must have taken considerable time and

labour to collect this information. To all those who are engaged in water schemes perusal of the paper cannot fail to be of interest, but it will probably cause disappointment to find how little information as regards water is available in the United Kingdom in comparison with that available in some other countries.

The author concludes his paper by suggested lines of organisation in this country so as to have all matters relating to water administration under one central authority. It will probably take some time before such a complete organisation as is suggested can be attained, but there is no reason why some of the smaller suggestions should not be carried out at once. We feel sure that if the importance of the question were fully brought before the present President of the Local Government Board he would be able with very little expense and without a large supply of red tape to deal quickly with such suggestions as annual returns from all water-supply and sewage-disposal authorities, and the beginning of a hydrographic survey. If a start were once made and the importance of the matter realised, the larger details of organisation would gradually evolve themselves.

The author has added to his paper some tables dealing with the use of water in various countries, and there is also a useful bibliography. M. F.

THE COMPOSITION OF PINE WOOD.

A MONOGRAPH on the "Chemical Composition of Pine-wood," by Prof. Klason, of Stockholm, has been issued by Gebrüder Borntraeger, of Berlin, as the second of a series of "Schriften des Vereins der Zellstoff- und Papier-Chemiker." In addition to the importance of pine-wood as the chief raw material of the paper industry, this particular wood has acquired a special scientific interest from the important colour-reactions in which it has figured as a test material. Thus phloroglucinol imparts a red-violet colour to a pine splinter moistened with hydrochloric acid, aniline sulphate a yellow colour, pyrocatechol and resorcinol a red-violet, pyrogallol a grey-violet, pyrrol and indol a red, phenol a blue, α-naphthol with sulphuric acid a green, hæmatoxylin a violet, naphthylamine hydrochloride a yellow, aminoanthracene hydrochloride a red, phenylhydrazine hydrochloride a yellow, and so forth.

These reactions appear to be characteristic of a substance to which the name of "lignin" has been given; similar reactions are shown by the well-known flavouring substance "vanillin," but this is not present as such in appreciable quantities in pine-wood. Lignin is richer in carbon than cellulose, but contains the same proportion of hydrogen; it differs from cellulose in that it is not dissolved by ammoniacal copper oxide, and gives no blue coloration to zinc chloroiodide, but can be reconverted into cellulose by oxidation, and separated from it by dissolution in alkalis or by the action of sulphites, which appear to convert it into soluble sulphonates. The author has analysed the calcium sulphonate, and attributes to it the formula $C_{40}H_{44}O_{17}S_2Ca$; this corresponds with a composition $C_{40}H_{42}O_{11}$ for lignin itself, but molecular weight determinations give values above 4000. In addition to two molecules of sulphur dioxide, lignin combines with two atoms of iodine, and thus contains three double-bonds in the C_{40} complex; four methoxyl groups are present and one hydroxyl group. The substance is probably a condensation-product of coniferyl alcohol,

$$CH_3O.C_6H_3(OH).CH:CH.CH_2.OH,$$

(a substance which can be oxidised to vanillin), with an oxyconiferyl alcohol in which the substituents are grouped in the same way (1 : 3 : 4 : 5) as in gallic acid, thus

$$2C_{10}H_{12}O_3+2C_{10}H_{12}O_4-3H_2O=C_{40}H_{42}O_{11}.$$

Lignification appears to consist in embedding the pliable cellulose in a hard crust of lignin; by the action of a sulphite the lignin is dissolved out, and the clean cellulose which is left constitutes the paper pulp. The sulphite extracts, from which lignin can easily be recovered, might very possibly prove to be valuable raw material for the manufacture of artificial vanillin. T. M. L.

RECENT ADVANCES IN TURBINES.[1]

ON two previous occasions I have addressed this institution on the steam turbine. At the time of the first lecture, in 1900, the turbine may be described as having been in the "advanced experimental stage." Six years later it was meeting with "general acceptance" in certain fields. To-night I propose to review its progress from 1906 to the present time; but before doing so I shall, with the view of leading up to the subject, and at the risk of some repetition, briefly explain the chief features of interest, and recapitulate some of the earlier steps in its introduction.

The first turbine of which there is any record was made by Hero of Alexandria 2000 years ago, and it is probably obvious to most persons that some power can be obtained from a jet of steam either by the reaction of the jet itself, like a rocket, or by its impact on some kind of paddle-wheel. It is, however, not so obvious that an economical engine could be made on this principle. In the year 1888 Dr. de Laval, of Stockholm, undertook the problem with a considerable measure of success. He caused the steam to issue from a trumpet-shaped jet, so that the energy of expansion might be utilised in giving extra velocity to the steam. Recent experiments have shown that by such a device nearly the whole of the available potential energy in the steam is converted into kinetic energy of velocity in a straight line, the velocity attained into a vacuum being about 43,000 feet per second. Dr. de Laval caused the steam to impinge on a paddle-wheel made of the strongest steel, which was allowed to revolve at the highest speed consistent with safety, for the centrifugal forces are enormous. Unfortunately, materials are not strong enough for the purpose (in the large sizes the speed is nearly half that of a rifle bullet), and the permissible speed of the wheel can only reach to two-thirds of that necessary for good economy, as we shall presently explain.

Dr. de Laval also introduced spiral helical gearing for reducing the enormous speed of his wheel to the ordinary speeds of things to be driven, and we shall allude to this gear later as likely to play a very important part generally in future turbine developments.

In 1884, or four years previously, I dealt with the turbine problem in a different way. It seemed to me that moderate velocities were essential if the turbine motor was to receive general acceptance as a prime mover. I therefore decided to split up the fall in pressure of the steam into small fractional expansions over a large number of turbines in series so that the velocity of the steam nowhere should be great, and consequently, as we shall see later, a moderate speed of turbine suffices for the highest economy. This principle is now universally adopted in all except very small turbines, where economy is of secondary importance. This arrangement of compounding turbines also appeared to me to be surer to give a high efficiency, because the steam was caused to flow in a non-expansive manner through each individual turbine, and consequently in an analogous way to water in water turbines, where high efficiency at that date had been proved. I was also anxious to avoid the well-known cutting action of high-velocity steam on metal.

The close analogy between laws for the flow of steam and water under small differences of pressure have been confirmed by experiment, and the usual formula $=\sqrt{2gh}$, where h is the hydraulic head, gives the velocity of issue from a jet for steam with small heads and also for water, and we shall presently follow this part of the subject further in dealing with the design of turbines.

Having decided on the compound principle, it was necessary to commence with small units at first, and in spite of the compounding the speed of revolutions was still high.

Though, as we have said, the de Laval turbine appeared four years later, the de Laval cream separators were in use prior to 1884, and I had the advantage of seeing their beautiful means of balancing—the supporting of the bearings in elastic rubber sleeves, which at 6000 revolutions absorbed vibration and allowed the bowl containing the milk to rotate about its centre of gravity instead of its geometric centre. The first compound steam turbine

[1] Discourse delivered at the Royal Institution on Friday, March 10, by the Hon. C. A. Parsons, F.R.S.

ran at 18,000 revolutions, and had slightly elastic bearings. The turbine teeth or blades were like cog-wheel teeth, set at an angle and sharpened at the front edge, and the guide blades were similar. Gradually the form of the blades was improved—curved blades with thickened backs were introduced. The blades were cut off to length from brass material rolled and drawn to the required section, and inserted into a groove with soft brass packing distance pieces between and caulked up tightly, and dummy labyrynth packings of various types introduced. The design was improved so as to reduce steam leakages and provide for greater expansion ratios.

The construction of a suitable dynamo to run with the turbine involved nearly so much trouble as the turbine itself; the chief features were the adoption of very low magnetic densities in the armature core and small diameters and means to resist the great centrifugal forces. The dynamo was also mounted in elastic bearings. Now that the turbine has found its most suitable field in large powers, and the speed of revolution is consequently reduced, elasticity in the bearings is less essential, and in large land plants and in marine work rigid bearings are

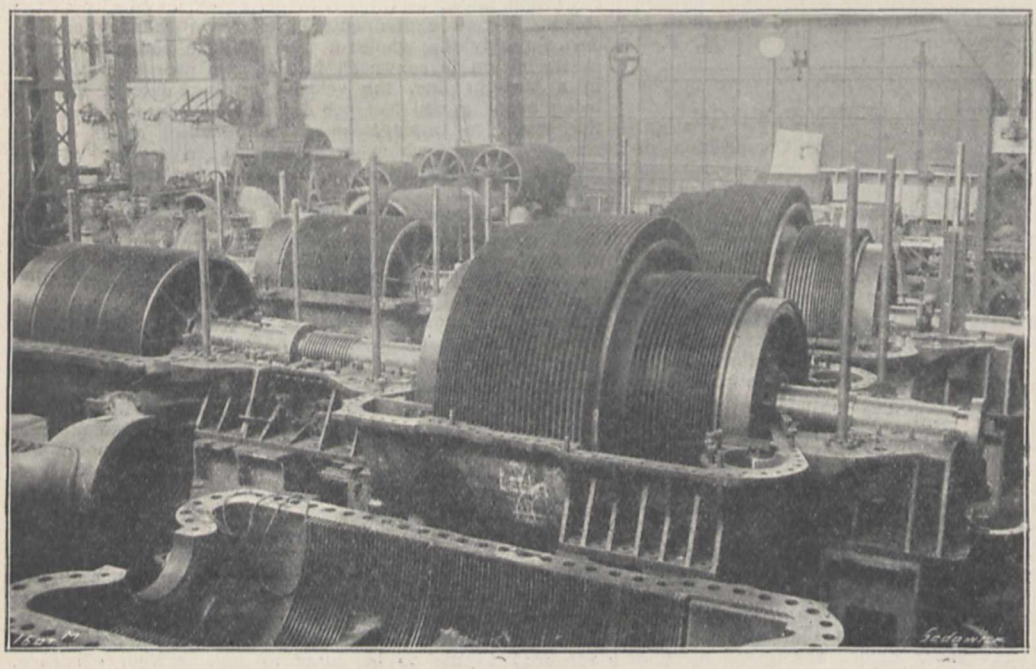


FIG. 1.—Turbines being completed. (From *Engineering*.)

now universal. I have said that steam behaves like an incompressible fluid in each turbine of the series, but as it is highly elastic, its volume increases with the succession of small drops of pressure, and the turbines have to be made larger and larger. This enlargement is secured by increasing the height of blade, by increasing the diameter of the succeeding drums, and by altering the angles and openings between the blades. All three methods are generally adopted to accommodate the expanded volume of one hundredfold in the condensing turbine.

Now as to the best speed of the blades. It will be easily seen that in order to obtain so much power as possible from a given quantity of steam, each individual row of blades must work under appropriate conditions. This, as has been found by experiment, requires that the velocity of the blades relatively to the guide blades shall be about one half the velocity of the steam, or, more accurately, equal to one half the velocity of issue from rest due to the drop of pressure in guides or moving blades. The curve for efficiency in relation to the velocity ratio has a fairly flat top, so that the range of velocity ratio for high efficiency is wide, and the speed of the turbine may be varied considerably about that for maximum efficiency without materially affecting the result.

In compound turbines the efficiency of the initial rows may be generally assumed as about 65 per cent., and of the latter rows at 75 to 85 per cent., and, considering the whole turbine, approximately 75 per cent. of the energy in the steam is delivered on to the shaft. The expansion curve may be expressed approximately by $pv = \log p_1/p_2$, where $p_1 - p_2$ is the drop in pressure across any turbine; pv is obviously not quite constant, but if a mean value is assumed the error is small. The expansion curve therefore lies between the adiabatic and isothermal curves for steam, but nearer the former, and the errors in these assumptions are found by experiment to be of much less importance than the errors in workmanship and imperfections of materials that are unavoidable in practical mechanics. The differential thermal expansions of the metal of which the turbine is made are the chief reason for large working clearances and loss by leakage, though every available means is taken to mitigate such loss.

In turbine design, the expression of the velocity ratio between the steam and blades may be represented by the integral of the square of the velocity of each row through the turbine, which is a coefficient called K. If K, for instance, as usual in land turbines, equals 150,000, then we know that with a boiler pressure of 200 lb. and a good vacuum the velocity ratio is 0·55, and the turbine is working close up to its speed for maximum efficiency. In large marine work, where weight and space are of importance, K varies from 80,000 to 120,000, or even to 140,000. With K = 80,000, a loss of efficiency of about 9 per cent. below the highest attainable is accepted. With K = 120,000, the deficit is only about 1½ per cent.

There are many forms of turbines now on the market, but we need only consider four chief types, which are:—

First, the compound reaction turbine, with which we have been dealing, representing more than 90 per cent. of all marine turbines in use in the world, and about half the land turbines driving dynamos.

Secondly, the de Laval, which is only used for small powers.

Thirdly, the "multiple impulse compounded," or Curtis, which has been chiefly used on land, but which has been fitted in a few ships.

Lastly, the compound reaction type, with one or more "multiple impulse elements" added to replace the reaction blading at the high-pressure end.

We may dismiss the numerous other types as simply modifications of the original type, without any scientific interest.

Let me explain the latter types. The multiple impulse principle is the only substantial innovation since the compound reaction and the de Laval turbines came into use. It was proposed by Pilbrow in 1842, and first brought into successful operation by Curtis in 1896. A little consideration should be given to it as involving some characteristic points of difference from what has been said about reaction blading. It will be seen that Curtis used the de Laval divergent nozzle, and that he

also uses compounding, but generally only 5 to 9 stages as compared with 50 to 100 in the compound type. The same principles as regards velocity ratio apply, but owing to the repeated transfer of the steam between fixed and moving buckets at each velocity-compounded stage, the best velocity ratio in a four-row multiple impulse is only one-seventh, and the best obtainable efficiency 44 per cent., and therefore much lower than reaction blading under favourable conditions.

The good points of the multiple impulse type are that there is very little loss by leakage, and that therefore, in spite of its low efficiency, one or more multiple impulse wheels can in certain cases usefully replace reaction blading at the entry to the turbine, because in slow revolution turbines of moderate power the blades are short at the commencement, and there is consequently much loss by leakage through the clearance space. As a rule, one multiple impulse wheel is generally preferred, and is followed by reaction blading; the expansion ratio on to the wheel is about threefold, and it generates about one quarter of the whole power. Occasionally several wheels in separate chambers are placed in front of the reaction blading, but there are serious practical drawbacks to this arrangement. The multiple impulse wheel at the commencement has a further advantage in that, when highly superheated steam is used, the temperature is much reduced by expansion and work done before it passes to the main turbine casing.

The highest efficiency yet attained by land turbines has been with the pure compound reaction turbine of large size, where the high-pressure portion is contained in a separate casing of short length and great rigidity; the working clearances can then be reduced to a minimum.

The first turbine imported into Germany in 1900, of 2000 horse-power, was on this principle, and also the latest turbines, of 12,000 horse-power, which generate current for the Metropolitan Railway in London.

In marine work the same arrangement has been almost universal since 1896, when the original single turbine of the *Turbinia* was replaced by three turbines in series (on the steam) on different shafts.

Here there is the additional advantage that, owing to the power being subdivided over three shafts, smaller screws are admissible, and the speed of revolution may be increased in the ratio of 1 to $\sqrt{3}$.

Generally, the turbines are placed two in series, as in cross-Channel boats, the *Mauretania* and *Lusitania*, torpedo craft, battleships and cruisers, or sometimes three in series, as in the liner *La France* and the latest and largest Cunard liner now building. Four in series have been proposed, but not constructed.

The war vessel in commission is working at reduced

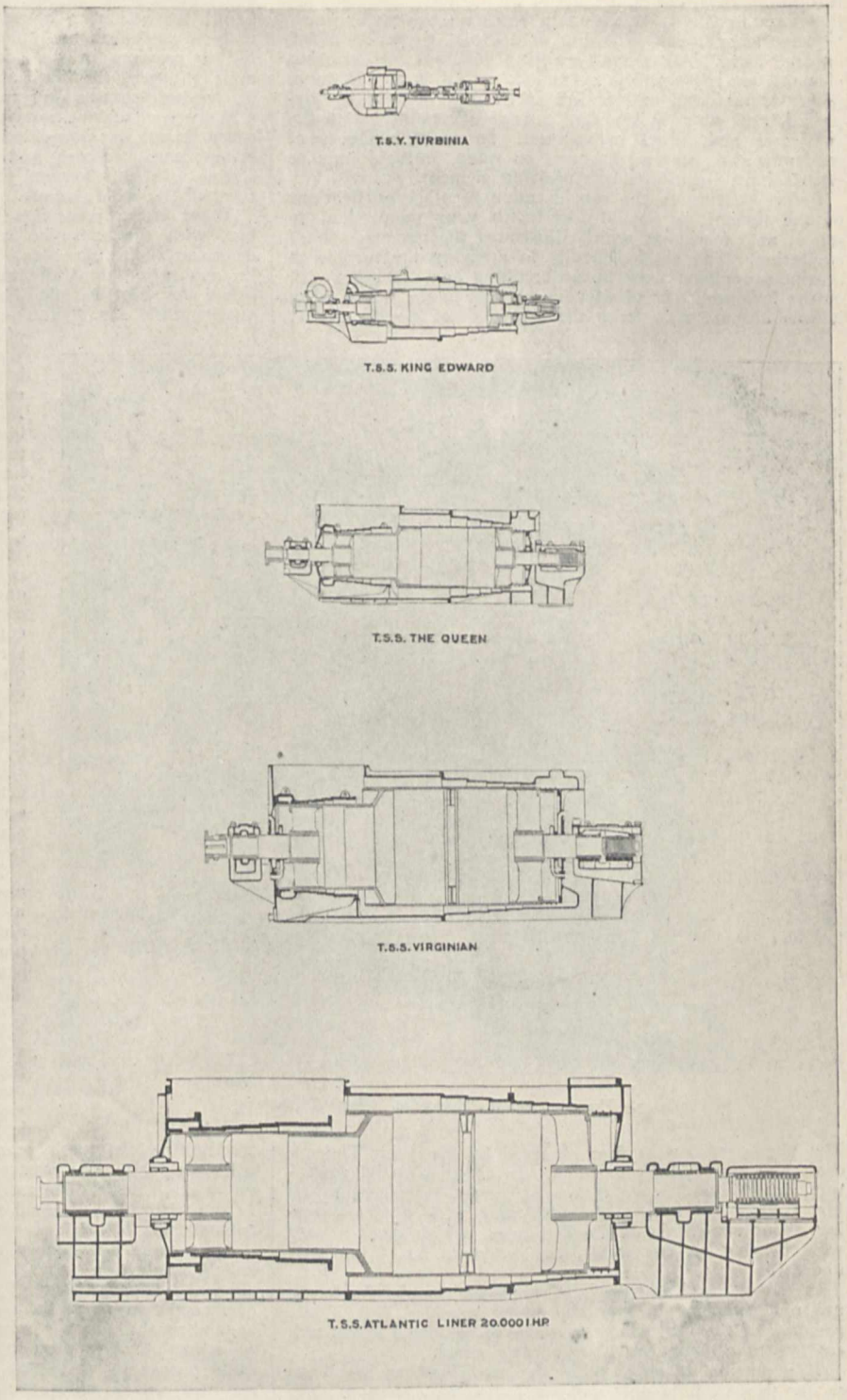


FIG. 2.—Progress in size of turbines. (From *Engineering*.)

power for most of the time, and on long voyages economy of fuel is of great importance. For this purpose, additional turbines are fitted in front of the main full-power turbines. They are naturally of small size, and may be in separate casings, or the main high-pressure turbine may be lengthened by the addition of a cruising portion added on in front. All these cruising turbines or cruising elements are more or less by-passed, according as additional power is required, and at full speed they are entirely by-passed, and when in separate casings are connected to the condenser and rotate in vacuum. In some instances of modern naval construction one or more multiple impulse wheels have constituted the cruising element.

Before passing to the consideration of other applications of the turbine, I should like, with your permission, to repeat an experiment which illustrates the phenomenon of cavitation. The chief difficulty in applying the turbine to marine propulsion arose in the breaking away of the water, or the hollowing out of vacuous cavities in the water when it was attempted to force the screw above certain limits.

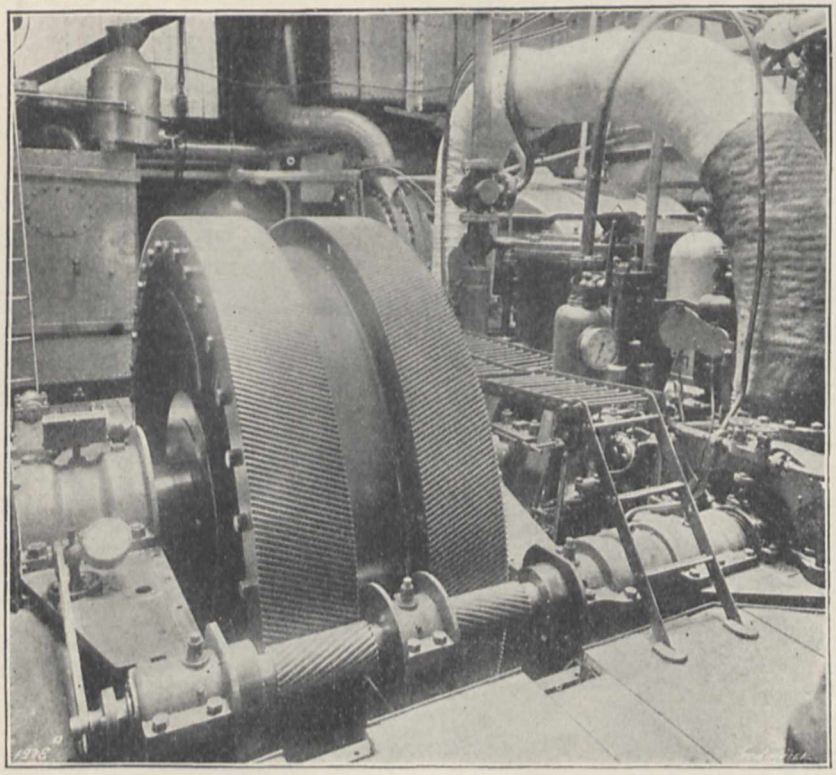


FIG. 3.—The gearing of the *Vespasian*. (From *Engineering*.)

The phenomenon was first observed by Sir John Thornycroft and Mr. Sydney Barnaby. In order to avoid cavitation, which involves great loss of power, propellers in all fast vessels are now made with very wide blades covering about two-thirds of the disc area, which gives a very wide bearing on the water, and prevents its giving way under the force.

In models, and in vessels of moderate speed, the forces are not sufficient to tear the water asunder, but if the pressure of the atmosphere is removed, a model screw will cavitate at a comparatively moderate speed.

The marine turbine, with the modifications we have so far described, is only suitable for vessels of more than 16 knots sea speed, and to make it suitable for the remaining two-thirds of the tonnage of the world has been our constant aim. The first plan to this end to be adopted is somewhat in the nature of a compromise, and is called the combination system, because the reciprocating engine is used to take the first part of the expansion and the turbine to complete it. From what we have said it will be apparent that this coalition of the reciprocating engine and turbine is a good one, because they each work under advantageous conditions. The reciprocating engine expands the steam to about atmospheric pressure, and the turbine carries on the expansion with high efficiency down to the pressure in the condenser. Now, though a large and high-speed turbine deals with the high-pressure portion of the expansion as economically as a reciprocating engine, a slow-speed turbine cannot be made to do so; but, on the other hand, a slow-speed turbine expands low-pressure steam much further and better than any reciprocating engine. In this system the turbine develops about one-third of the whole power.

About fifteen years ago I filed a patent for the system, but, with the exception of fitting the British Admiralty destroyer *Velox* in 1902, few steps were taken towards its application until the turbine had become firmly established for fast vessels, because we feared the technical public would say, "You are trying to bolster up a failure of the turbine." About three years ago Messrs. Denny, of Dumbarton, who in 1901 built the first mercantile turbine vessel, the *King Edward*, built the first combination vessel, the *Otaki*, of 9900 tons dead-weight capacity and 13 knots sea speed. She has ordinary twin screws driven by triple-expansion engines exhausting into a turbine driving a central screw. The initial pressure at the turbine is 9 lb. absolute, and it generates one-third of the whole power. The combination vessel was found to consume 12 per cent. less coal on service than her sister vessel *Orari* on the same service, fitted with quadruple reciprocating engines.

The next combination vessel was the *Laurentic*, of 20,000 tons, built by Messrs. Harland and Wolff, a sister vessel, the *Megantic*, being fitted with quadruple engines, and on service at the same speed the saving in coal by the combination is 14 per cent.

Messrs. Harland and Wolff are also fitting the combination system in the White Star liners *Olympic* and *Titanic*, of 60,000 tons displacement, and some other companies at home and abroad are also adopting the combination system.

There is another alternative solution which promises to extend the field of the turbine further over that of the reciprocating engine. We mentioned before that de Laval had in the 'eighties introduced helical tooth gear for reducing the speed of his little turbines. For twenty-three years it has worked well on a small scale. Recent experiments, however, have led to the assurance of equal success on a large scale for the transmission of large powers of many thousand horse.

After some preliminary experiments some years ago on helical reduction gear, which showed a mechanical efficiency of more than 98 per cent., a 22-feet launch was constructed in 1897; the working speed of the turbine was 20,000 revolutions per minute, which was geared in one reduction of 14 to 1 on to the twin-screw shafting driving twin propellers at about 1400 revolutions. The speed attained was 9 miles per hour, and this little boat was many years in use as a yacht's gig.

The next step was the purchasing of a cargo boat in 1908, the *Vespasian*, of 4350 tons displacement, and triple expansion engines of 900 horse-power. After thoroughly overhauling and testing her existing machinery for coal and water consumption, the engines were replaced by

geared turbines, the propeller, shafting, and boilers remaining the same. On again testing for economy a gain of 15 per cent. was shown over the original machinery, and subsequent minor alterations have increased this gain to 22 per cent. There are two turbines, a high pressure and a low pressure, each driving a pinion at 1400 revolutions, gearing into a main wheel on the screw shaft making 70 revolutions per minute. The gearing is entirely enclosed in a casing, and is continually sprayed with oil by a pump. Ordinary centrifugal governors on the turbines control the speed, and because of the enormous angular momentum of turbines (some fifty times that of an ordinary marine engine) the acceleration is so slow that the governors have time to act, and consequently no racing has ever occurred in the heaviest weather, and it is certain that if geared turbines come into use there will be no more cases of broken screw shafting as has hitherto been common with reciprocating engines.

The vessel has now been carrying coal from the Tyne to Rotterdam for about a year, and has covered about 20,000 miles and carried 90,000 tons of coal across the North Sea. The pinion on the lecture table was specially removed from the vessel last week for this lecture, and shows a wear on the teeth of under 2/1000″ in this time, and its life will therefore be equal to or greater than that of a vessel.

Gearing promises to play an important part in war vessels for increasing the economy at cruising speeds. We explained the difficulty in obtaining good economy at the high-pressure end of marine turbines, and in replacing such portions by geared high-speed turbines we have a complete solution. The Turbinia Company are now constructing two 30-knot destroyers of 15,000 horse-power, wherein the high-pressure portion and cruising elements are geared in the ratio of 3 to 1 and 5 to 1 respectively to the main low-pressure, direct-coupled turbine. Their use will increase the radius of action of the vessels at cruising speed to a very considerable extent over that of any similar destroyer without gearing. Similar gearing is proposed for warships, with similar prospective advantages.

Gearing may also find a place in cross-Channel boats and liners for the high-pressure portion of their turbines, but the greatest material gain will be in extending the use of turbines to vessels of slow speed.

Gearing enables very high coefficients to be used in marine work at full speed, and good coefficients at all speeds without much increase in weight, and under such conditions a geared high-speed reaction turbine is much more efficient at the high-pressure end than the multiple impulse wheel or wheels we have considered, and will probably dispense with their use generally. Gearing in marine and land work promises to give to the turbine a level consumption curve like that of the gas and oil engine. Half a century ago nearly all screw vessels had mechanical gearing, one element being composed of wooden teeth, for gearing up the speed of the engine. Subsequently the speed of engines was increased, and gearing abandoned. Now a very slow-speed turbine is an impossibility, and accurately cut steel gearing seems to be a permanent and satisfactory solution.

Low-pressure turbines worked by the exhaust steam from other engines are coming into general use on land under the name of "The utilisation of exhaust steam," for they utilise what was formerly a waste product, the exhaust steam from non-condensing engines.

They are generally employed in the generation of electricity or in the working of blast-furnace blowers and centrifugal pumps and gas forcers, but recently an exhaust turbine of 750 horse-power has been applied to driving an iron plate mill in Scotland. The turbine revolves at 2000 revolutions per minute, and by a double reduction of helical gears drives the mill at 70 revolutions. A flywheel of 100 tons weight revolving at the same speed as the rolls equalises the speed. During each rolling the turbine and flywheel collectively exert 4000 horse-power, the maximum deceleration at the end of each roll being only 7 per cent.

So satisfactory has gearing proved up to the present on a small and also comparatively large scale that it seems probable that by its use turbines will be more widely adopted in the future for power purposes generally.

There are at the present time just above 6,000,000 horse-power of marine turbines completed and building, and also an equal horse-power of land turbines of the compound reaction type.

AUSTRALASIAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

THE Australasian Association for the Advancement of Science held its thirteenth meeting at the Sydney University on January 9–14 inclusive. In a short article in our issue of February 23 last (vol. lxxxv., p. 558) a brief outline of the proceedings at the meeting was given. We have now received from Mr. J. H. Maiden, the permanent honorary secretary of the association, an extended account of the meetings and presidential addresses delivered in the various sections, and are glad to publish a fuller report of what proved an important and successful gathering of Australasian men of science and their friends.

The president for the year, Prof. Orme Masson, F.R.S., professor of chemistry in the University of Melbourne, presided over the meeting, which was attended by more than 500 members, the membership being above 800. Every State in the Commonwealth was represented, and also the Dominion of New Zealand.

The president gave a garden-party in the afternoon of January 9, and delivered his address in the evening in the Great Hall of the university. His Excellency the Governor, Lord Chelmsford, was in the chair.

The work of the meeting was divided among eleven main sections, each with its own president, vice-president, and secretary. The following is a list of sections with the name of the presidents:—

Section A, Astronomy, Mathematics, and Physics: Prof. T. H. Laby, professor of physics in Victoria College, Wellington, N.Z. Section B, Chemistry, Metallurgy, and Mineralogy: Prof. B. D. Steele, professor of chemistry in the University of Queensland, Brisbane. Section C, Geology: Prof. P. Marshall, professor of geology in the University of Otago, Dunedin, N.Z. Section D, Biology: Mr. F. M. Bailey, Government botanist at Brisbane. Section E, Geography and History: Prof. G. C. Henderson, professor of history in the University of Adelaide. Section F, Anthropology and Philology: Mr. Edward Tregear. Section G—two departments, (1) Social and Statistical Science: Mr. E. W. H. Fowles; (2) Agriculture: Prof. W. Angus, late director of agriculture in Adelaide. Section H, Engineering and Architecture: Mr. Ellwood Mead. Section I, Sanitary Science and Hygiene: Dr. W. Perrin Norris, Commonwealth Director of Quarantine, Melbourne. Section J, Mental Science and Education: the Rev. E. H. Sugden.

Prof. Masson spoke first of the earliest attempts to bring about a visit of the British Association to Australia. In 1909 the matter was brought under the notice of the Australasian Association, of the universities and scientific societies of Australia, and of the Federal and States Governments. All united in cordial support of the proposal, and old financial difficulties were dispelled by the far-sighted generosity of the political rulers. The Government of the Commonwealth, acting officially for all Australia, sent a formal invitation, which was unanimously accepted by the British Association for the year 1914. Prof. Masson said it was his good fortune to attend the Sheffield meeting last September, and to speak there with the High Commissioner as the inviting deputation; and he bore testimony to the hearty feeling that prevailed and to the strong desire shown by many of Britain's most distinguished men of science to profit by this opportunity of seeing Australia, to study its science on the spot, and to play a part in what will surely prove a great event in the history of imperial unity.

He went on to describe recent advances in chemistry. He dealt first with the atomic theory, and proceeded to explain with great clearness ionic dissociation, conductivity through gases, molecular collision, the periodic law, radioactivity, and the transmutation of metals. Towards the end of his address he referred to the theory of the spontaneous transformations of the atom, whereby new kinds of atom, both electrical and material, are produced, some of the latter having but a short life before they in turn

undergo spontaneous disruption like their parents. Recent as this theory of successive atomic transformation is, it may be regarded as proved; proved by mathematical analysis and quantitative observations, proved by its explanation of a host of related phenomena, proved by its successful predictions of previously unknown facts. Perhaps the most interesting thing about it is that it confirms and tends to complete the old atomic theory. The transmutation of elements is proved at last, but man has not learned to cause it; he has only learned that it has been going on in nature since the beginning. Perhaps, in utilising the intense energy of the natural radio-active transformations of radium, or its emanation, we may succeed in influencing the life-history of other, more sluggish, atoms, and thus hasten transmutations which would otherwise be so slow as to escape our observation altogether. Ramsay has done some work in this direction, and has got some curious and interesting results, but it is too early to speak with certainty of their meaning. One extension of the disintegration theory, however, seems unavoidable. The power of spontaneous disruption, involving the creation of new atoms out of old, can hardly be the exclusive property of uranium, radium, thorium, and a few other elements of large atomic weight; it must rather be an inherent property of atoms generally.

The president closed with a few remarks of local interest. "The great advances that I have sketched," he said, "are, of course, attributable in the main to European workers. Yet we may, I think, take some satisfaction in the fact that teachers and students of the universities in this part of the world, or graduates who have gone home from here, have contributed somewhat from time to time. These Australasian contributions include work on the general theory of solution, on the mobilities of ions, on electrode potentials, on conductivity in aqueous and other solutions, on the dynamics of chemical change, on gaseous ions, and on radio-active phenomena. The older universities of Australasia are growing, and new ones are arising, as in Brisbane and Perth. Naturally and inevitably there is a tendency nowadays to ask of universities a greatly increased attention to more utilitarian developments of science. It is so in England, where, for instance, the University of Sheffield devotes a great department to the metallurgy of iron and that of Leeds cultivates its schools of textile fabrics, dyeing, and domestic economy. It is so in Australia, where there is a steady pressure put upon the universities to develop increasingly on the lines of technical schools. All this is, doubtless, as it must be; but it is beset with a certain danger. The risk is that the whole energies of these institutions, where teachers are always too few, and equipment is never too plentiful, will be directed towards the useful applications of science, and science itself will be neglected. This, if it occurs, will be a pitiful result, and will not tend to raise Australia among the intellectual countries of the world. Let us be a practical people and have due regard to utility; but let us also have some means and leisure to cultivate the vastly more interesting inutilities, for thus only can we hope to increase Australasia's contribution to the true advancement of science."

The evening lectures were two in number, one on January 10, by Prof. G. C. Henderson, professor of history in the University of Adelaide, who chose for his subject the "Mutation Theory of Evolution in History." The lecturer said that from 1870 onwards evolutionary philosophy has pervaded all departments of intellectual activity, and has stimulated patient and painstaking research in all directions. Physical evolution, or evolution in the organic world, was one thing; psychical evolution, or evolution of human life and affairs, was another and very different thing. He wished, he said, to state plainly that they could not apply the current theories of organic evolution to the history of any race of human beings. Few people would care to deny that the champions of the organic theory of evolution had rendered invaluable service, not only to science, but even to religion. They had challenged and laid low many a doctrine that was little better than a superstition; they had forced religious men to discriminate more carefully between what is metaphorically and what is literally true; and they had converted many an ignorant dogmatist into an earnest and reasonable seeker after truth. But it must not be imagined that victory had been all on one side. By no means. The evidence of poetry, history, philosophy, and reasoning religion was stronger than it ever was in support of the essential differences between organic and human life. It would appear from recent pronouncements that some of the leading thinkers in the medical and biological professions are disposed to reckon with the influence of mind over body more frankly and fully than they had done hitherto.

The evening lecture on January 12 was by Prof. P. Marshall, of Dunedin, professor of geology in the University of New Zealand, who chose for his subject, "Glaciers of the Southern Alps," which was illustrated by some of the most remarkably beautiful slides that have ever been produced of a wonderful region.

The evening of January 13 was devoted to a combined conversazione given by the association and the Royal Society of New South Wales in the Great Hall of the University, when a number of exhibits were shown in the hall itself, and, in addition, the laboratories of the engineering, biological, and physics schools were thrown open. Prof. J. T. Laby exhibited a fine model of the Brennan mono-rail. During the evening the Mueller memorial medal, "for researches in natural science," was presented by the President (Prof. Masson) to Mr. Robert Etheridge, curator of the Australian Museum, in recognition of his researches in palæontology and Australian ethnography.

The following extracts from the presidential addresses in the various sections will give some idea of the wide scope of the meeting.

In Section A, Prof. Laby discoursed on "Recent Advances in Physics." It is rather interesting to find, said Prof. Laby, that physicists trained in the Australasian universities are advancing science in all parts of the world. Most of the theories and discoveries in radio-activity we owe to Prof. Rutherford (Christchurch); new views as to the conduction of electricity through gases to Prof. Wellisch (Sydney); important contributions to the theory of light by President Maclaurin (Auckland); many and varied researches in ionisation to Dr. Kleeman (Adelaide); the organisation of metallurgical research at the National Physical Laboratory, London, to Dr. Rosenhain (Melbourne); the establishment of an institution for the training of those engaged in optical industries of London to Mr. Chalmers (Sydney); of spectroscopic research to Prof. Duffield (Adelaide); while Gray (Melbourne), Lusby (Sydney), Glasson (Adelaide), Florance (New Zealand), are all contributing researches in physics from various English laboratories. It is to be hoped, he continued, that in the future an increasing amount of such investigations will be carried out in Australasian laboratories, so that these laboratories will come to be generally regarded not merely as places where existing knowledge is expounded, but where new knowledge is obtained, where there flourished an enlightening spirit of investigation. "When our laboratories come to be generally regarded in the light I have described, it can but increase their reputation in all directions and make the community have that confidence in science which is so typical of the German people, and so intimately connected with their unprecedented industrial progress."

In Section B, Prof. Bertram Steele chose for his subject "Inorganic Solvents." He said the solubility of a pure substance depends very obviously on the nature of the solvent. We thought of barium sulphate as being a most insoluble salt, being insoluble in weak or strong acid or alkaline solutions; but it should be borne in mind that all such solutions contained water, and by the substitution of pure sulphuric acid for the water it would be found that a large quantity of barium sulphate could be got into solution. Liquefied ammonia, largely used at present on the commercial scale for the manufacture of ice, was a solvent of quite unique properties, and it has been found that two classes of substances, which from the study of their reactions alone or in water solutions were classified as "acid amides" and ammonium salts, would be regarded to-day as something equivalent to the acids had they been first investigated in liquefied ammonia. All facts pointed to the conclusion that the nature of the solvent plays a most important part in conditioning the behaviour of a given substance in solution. The result of recent work in this field showed that present theories were likely to be

modified, but not discarded, by still further investigations.

In Section C, Prof. Marshall dealt with the "Basin of the Pacific Ocean." There were, he said, various theories as to its origin. It had been suggested that it was the scar left by the moon when it came away from the earth; that the hollow had been actually inherent in the pear-shaped form the earth took on cooling; and that it was a subsidence area which had existed since the Triassic period, that part of the earth's crust having fallen in owing to shrinkage. It had been supposed that a land bridge existed between New Zealand and South America not so long ago, so as to explain the resemblances between the flora and fauna of tropical South America and New Zealand. The differences of opinion as to the age and permanence of the basin were as great as those in regard to its structure. Little certainty can be got at present. Structural, rock, and depth characteristics support the idea that the real boundary of the south-west Pacific passes through New Zealand, Kermadec, Tonga, Fiji, the New Hebrides, the Solomons, and the Admiralty Islands. This supposition practically coincides with biological knowledge as to plant and animal distributions within the area. The land connections or approximation took place, he considered, in late Mesozoic or in the Pleistocene times—probably the latter. The eastern Pacific Islands are different in structure, nature, and origin from the lands on this line, and have been peopled by chance immigrants from them. The keen controversies upon all matters of interest to New Zealand geology are, however, only to be expected. The land is so isolated, and the views of geologists have been largely based upon other countries. But at the next meeting of the congress there should be more knowledge available, for there is at present a movement on foot to make an expedition to all the eastern groups of islands in the Pacific, and to gather material for a better scientific description than there has been so far.

In Section D, Mr. F. M. Bailey gave some notes on indigenous plant life. He dealt interestingly with the longevity of seeds. A great deal depends upon the climate in which the seeds are kept. Seeds near the tropics soon lose their vitality, whereas those in a drier climate retain it for a period extending in many instances over quite a number of years. Mr. Bailey pointed out that the usual method of calculating the age of a tree by the concentric rings could not be relied upon in Queensland, for in some seasons more than one might be formed, while in others one might not be made in one or more years. Reference was made to the tenacity of life among indigenous grasses—a circumstance in which Australia is unique. During certain times of drought trees have been killed, and on digging up one of the supposed dead grasses it showed not a sign of life, but with the advent of rain the whole country, in the course of a few weeks, would be waving with grass, not alone from seed, but from these supposed dead roots. Some interesting remarks were made upon "sports" in plant life, Mr. Bailey, who had had a long experience as a cultivator of plants, expressing the opinion that most of the indigenous plants termed varieties owed their variation to "sporting" rather than to sexual reproduction.

Prof. G. C. Henderson in Section E put forward a "Plea for Colonial Historical Research." The time has now arrived, he said, when the history of the Commonwealth should be undertaken in a systematic and scientific way, and the institutions through which that might be done are the universities. The historical work done in Australian centres is preparatory, and should find its fulfilment in research. The best material for research is now available, and by means of scholarships, and especially open scholarships, the right men can be found. Prof. Henderson said that the only comprehensive history of Australia that was based upon a perusal of original and trustworthy material was vitiated from beginning to end by the author's determination to prove that the aborigines were victimised by rapacious politicians and squatters.

In Section F no presidential address was delivered, as the president, Mr. E. Tregear, was at the last moment unable to leave New Zealand.

Mr. E. W. Fowles, the president of Section G1, gave an address on unemployment. From a mass of theories and discussions, said Mr. Fowles, several principles seemed to rest on solid ground. (1) Every man should be given a chance of employment—but not necessarily continual chances. (2) Sentimental treatment of unemployment is futile; the time has come for scientific handling of the problem. (3) The problem is more than local; it is national. (4) Different conditions obtaining in different countries require different remedies. (5) There is no one cure-all. The theorists who imagine a land tax or any other one reform will automatically eliminate the unemployed have been completely discredited. (6) Although there are special conditions in different localities, the same causes produce the same results the world over. Having thus stated the set principles, the president went on to say that the points still debatable were that every workman has a claim on the State to be provided with work, and that the unemployed are a necessary and permanent factor in our present industrial system. For the purpose of scientific treatment, the unemployed might be divided into two classes, those temporarily without regular employment, and those permanently without regular employment.

The relation of science to the further development of Australian agriculture was dealt with by Mr. W. Angus in Section G 2. Mr. Angus commenced by showing the progress made in wheat-growing and stock production in Australia. He pointed out that between the years 1860 and 1868 the increase in area under crop was very large—larger than for the past twenty years. The average yields were quite as good, if not better, than they had been for the last eight years. The development, so far as wheat production was concerned, has been more in the direction of extending the area under crop than in any very marked increase in the yield resulting from improved methods of agriculture. He referred to the introduction of fertilisers and the use of the drill, and the great improvement they have made in the industry. He went on to point out the great need of research work to meet the special problems of this country, and dwelt upon the want of finality under the present separate State systems. Some problems are causing a loss of thousands of pounds from year to year. In the investigation of several of them really good work has been done on individual lines, but it had been left just at a stage in which it is of little practical use to anyone. He then dealt with a number of the more urgent of these problems in regard to which combined action was highly necessary. "Take-All" is rapidly spreading in Australia, and it is most desirable to do something at this stage to check it. "Bitter Pit" in apples, a disease not yet investigated, is causing great loss to the fruit industry, and requires immediate attention.

Referring to "dry-farming," he directed attention to the way the wheat areas are being extended into the country of light rainfall, and said that if the Australian farmer could grow wheat profitably in, say, more than 2,000,000 acres of land in each of the four wheat-growing States, then this is a matter which ought to be taken up without delay, and with some of the spirit and in the business-like manner that practical men and men of science are doing in America.

America has instituted a system of soil surveys, the envy of every progressive agricultural community. That work of this kind should be of value to the Australian producer must be evident to all, and what is most needed before anything is undertaken is an agreement among the States as to a definite system, so that from the commencement they might be working on similar lines.

Among other things needing attention is the work of wheat improvement by selection and cross-breeding. Then there is the investigation of such diseases as "Dry Bible" and red rust in wheat, and the raising of varieties immune from attack. There is also the question of strength in flour, and the fixing of a uniform method of determining same, the process of nitrification under Australian conditions, the arrangement of a more uniform system of experimental work, and the comparison and publication of results, investigation into the quality and composition of surface and artesian waters as regards their suitability or otherwise for irrigation.

What is wanted is not a Royal Commission to report, but a body of trained workers to tackle the matter on

systematic lines. Such action has been taken by organisations similar to theirs—for example, the Agricultural Education Association of Great Britain and the Breeders' Association of America. The opportunity seems a good one for the Australasian Association to associate itself with questions of practical importance to the agricultural industry.

Agriculture has to run upon more scientific lines, and the farmer must be even more of a trained producer than in the past. There must be a change in the relations of the man of science and the farmer. They must become more and more co-workers, and have many more interests in common. Hence there must be some half-way meeting-place, and he could think of no more suitable institution than the experimental farm properly equipped and rightly conducted. These farms should be controlled by trained men. They should also be properly equipped—laboratories, workrooms, special implements, and special conveniences. Mr. Angus suggested the establishment of a Central Research Station on the lines of the great institution at Rothamsted. Failing that, the establishment of a Federal Research Station, properly equipped and staffed by the very best men the Commonwealth could provide, would meet the case.

In Section H, dealing with engineering and architecture, Mr. Elwood Mead, chairman of the Victorian State Rivers and Water Supply Commission, submitted a paper on the conservation of water in Australia. In two-thirds of this continent, said Mr. Mead, it is doubtful, seeing that the average annual rainfall is less than 20 inches, whether, with the most economical usage, enough water can be conserved to permit of all the land being occupied or all the mines worked, and it is certain that wasteful or improvident use will mean that large areas of fertile and fruitful soil must for ever remain barren. The Commonwealth Government should, he said, move in the matter, and if that is not feasible, then there should be concerted action by the States. Among the questions this investigation would deal with were the source, the extent, and the probable permanency of underground supplies. In Queensland alone the wells which tap this underground reservoir have a length of more than 310 miles, and had cost above 2,000,000*l*. Nearly 2000 bores had been sunk there. Prof. Gregory had estimated that in 1903 the wells of New South Wales discharged about 22,000,000 cubic feet a day, and those of Queensland 63,000,000 cubic feet. Since that time the number of wells and the discharge had increased. Much of this water is wasted, the prevailing practice being to allow the water forced to the surface to escape. Consequently there is loss by soakage and evaporation. Seriously, Australia should consider whether it is wise to allow this waste to continue.

That the supply is not unlimited, said Mr. Mead, need not be argued. Not only is it limited, but it is less than will be needed for domestic and stock purposes alone. Artesian supplies could not be expected to provide for it. Just how limited the supply was, and how long the flow would continue, were the vital questions. Should the conclusions of Prof. Gregory be correct, the exhaustion of Australia's underground reservoir was inevitable, and it would go out like a snuffed candle.

The presidential address in Section I was delivered by Dr. W. P. Norris, Commonwealth Director of Quarantine, on "Public Health Ideals." Dr. Norris quoted some striking examples of disasters brought about by man's blind dealings with nature. But this rashness, this capacity for experiment and adventure, is the very essence of progress; and, finding he has suffered, man has sought to know more of the world in which he is placed that he may save himself. As his knowledge gathers in volume and becomes precise and ordered, so the beginnings of sanitary science are reached. Man has already furthered his own evolution considerably, half-unconsciously, and for his personal advantage. Science seeks to discover the all-powerful, the all-mighty, the abiding, the permanent, the eternal, in and behind things. There can be little doubt but that to-day man is within reach of real and abiding knowledge, and that if he but has the will, the earnestness, and high seriousness necessary, he may enter into his kingdom—the Regnum Hominis of which Bacon believed, and of which Ray Lankester has more recently told in his Romanes lecture. Science urges the deliberate assumption of his kingdom by man as an absolute duty, in order that he may make good his position in the kingdom of living things, and avoid the holocausts of the past.

The presidential address in Section J, mental science and education, was delivered by the Rev. E. H. Sugden, who spoke of music as an instrument of education.

The principal resolutions passed by the council of the association were the following:—

Magnetic Observatories.—"In view of the great scientific importance of continuous magnetic observations at selected stations, the council most strongly urges the establishment of magnetic observatories at Perth and Port Darwin, to supplement the long-continued and extremely valuable magnetic work of the Melbourne Observatory. The council learns with gratification that the reduction of the forty years' observations of the Melbourne Observatory is now completed, and would earnestly request that the Victorian Government authorise the printing of the results." The foregoing resolution to be brought to the notice of the Commonwealth, Victorian, and Western Australian Governments.

Seismological Equipment.—"That the council directs the attention of the Governments of Western Australia, South Australia, New South Wales, and Victoria to the desirability of increasing and improving the seismological equipment of their respective observatories, in order to fulfil such modern requirements as are represented, for example, in the first-order seismological station in the St. Ignatius College Observatory at Riverview."

Physical and Chemical Data.—"That a committee, consisting of Prof. Masson, Prof. Warren, Prof. Laby, and Dr. Love as secretary, be appointed to cooperate with the International Commission for the collection and annual publication of all determinations of physical, chemical, crystallographic, and engineering constants, and that a sum of 25*l*. be granted towards the work of the committee."

Meridian Observatory.—"That the Australasian Association for the Advancement of Science respectfully directs the attention of the Government to the following resolution, which was passed at the International Astrographic Conference held in Paris in 1909. This resolution the association most strongly supports." Resolution referred to:—"Considering the very small number of observatories in the southern hemisphere organised for work of high fundamental precision, it is very desirable in the interests of science that a meridian instrument of the most modern type should be installed in Australia."

Teaching of Elementary Geometry.—"That, pursuant to the provisions of the resolution carried in Brisbane with regard to the teaching of elementary geometry, a committee, consisting of Prof. Carslaw, Mr. Lucas, Mr. R. H. Roe, with Mr. P. Board as secretary, with power to add to their number, be appointed to carry out the instruction contained in the last half of the Brisbane resolution."

Yass-Canberra Observatory.—"That the council of the A.S. express its gratification of the action taken by the Commonwealth Government in regard to the creation of an observatory at Yass-Canberra, and would recommend that in order to comply with the request of the International Union for Solar Research, brought before the council at the Brisbane meeting in January, 1909, such observatory be designed to fill, amongst other requirements, those of a solar observatory."

Australian History.—"That in the opinion of this association it is desirable that the governing bodies of the public libraries in Sydney, Melbourne, Adelaide, Brisbane, Perth, and Hobart, should communicate with the Secretary of State for the Colonies, asking that duplicates of the despatches that passed between the Governors of the colonies and the Secretaries of State up to a date fixed upon by the Secretary of State should be placed under their charge, and that a copy of this resolution be forwarded to the secretary of each of the libraries aforementioned."

Australian Aborigines.—"That the general council be requested to communicate with the State Premiers, directing their attention to the advisability of adopting a uniform method of spelling Australian place-names."

"That the system of orthography for native names of

places adopted by the council of the Royal Geographical Society, the Foreign and Colonial Office, the Admiralty, and the War Office be used."

"That an organised scheme for the future of the Australian aborigines be formulated and submitted for the consideration of the Federal and State Governments, and that the following be a committee to collect evidence, draw up and submit a proposed scheme to aid these authorities in the event of their consenting to take up the question, and that such scheme receive the support of the association:—Prof. J. Wilson, Dr. Norris, Prof. Baldwin Spencer, Prof. Stirling (Adelaide), Mr. Gillen, Rev. Dr. G. Brown, Archdeacon Lefroy, Dr. Cleland, with power to add to their number."

Anthropometric Tests.—"(1) This section recommends that all anthropometric measurements under the control of the Australasian Governments be based on the schedule of the British Anthropometric Committee. (2) That the advantage of utilising for this purpose the existing machinery for medical inspection of school children in the various States, and of the compulsory cadet service of the Commonwealth, be urged on the authorities concerned. (3) That a committee, consisting of Profs. Masson, Lyle, and Osborne, Drs. Norris and Harvey Sutton, Mr. Tate, Colonel Watson, and the Public Works Architect, be appointed to investigate the subject of ventilation in buildings, and that the committee be asked to present a report to the next meeting (Melbourne)."

General Recommendation.—"That the president of the association be requested to communicate with the Prime Minister of the Dominion of New Zealand, and place before him the desirability of proceeding with the work of describing and publishing the results of the examination of the collection of fossils made by the officers of the Geological Survey of New Zealand, and deposited in the Dominion Museum, Wellington."

"That it is important in the interests of higher education that additional university teaching should be provided in the department of philosophy, more especially in the subjects of sociology and experimental psychology."

"That a time limit be set for authors of papers read before the association, which shall not be exceeded except by special arrangement made beforehand with the sectional committee."

"That a general discussion on 'The Eucalypts and their Products' be brought forward at the Melbourne meeting."

Geophysical Observatory at Barren Jack.—The sum of 50*l.* was voted to assist in defraying the expense of establishing a geophysical observatory near Barren Jack reservoir, for the purpose of attempting to measure the amount of earth tilt under load.

Survey Work around New Zealand.—"That, in the opinion of the Australasian Association, the investigation of the continental shelf around New Zealand and the islands of the south of New Zealand is a work of pressing necessity, both for scientific and for economic reasons; and the association, while recognising the value of the work already done in this direction, would urge upon the New Zealand Government the desirability of taking advantage of the facilities offered by the stay of the Antarctic exploring ship, *Terra Nova*, in New Zealand to complete the survey of the surrounding seas by soundings and dredgings as far as possible."

Protection of Forests.—"That, in view of the vital importance of the conservation of water in Australia by the protection of forests and timber around the sources of its rivers and streams, and which was to have been considered at the present congress, but was deferred until the next meeting in Melbourne, by resolution carried last Monday, it is advisable that a special committee be now appointed to deal with the question in the meantime, and also bring it to the notice of the several Governments of the Commonwealth, in order to prepare the way for a more successful result when dealing with the matter at the Melbourne meeting."

Geological Committees.—(1) A committee to inquire into the question of the classification of the Permo-Carboniferous of Australia, with a view to the revision of the nomenclature. (2) A committee for recording structural features in Australia. (3) A committee to investigate and report on the glacial phenomena in Australasia. (4) A committee to investigate questions of quaternary climate in Australasia. (5) A committee for the investigation of the alkaline rocks of Australasia.

Tidal Survey.—"The Australasian Association for the Advancement of Science at its Sydney meeting in 1911 views with satisfaction the successful establishment by the New Zealand Government of the Tidal Survey, and trusts that at many of the outlying islands automatic tide gauges may be established, and the results systematically analysed. It directs that a copy of this resolution be forwarded to the Prime Minister of New Zealand."

Scientific Literature.—"That a committee be appointed to consider the steps which should be taken with a view to the compilation of a list, as complete as possible, of the scientific serial periodical literature, both in public and private possession in each of the principal centres of Australia."

The council passed the following resolutions with regard to Antarctic exploration:—"This committee recommends that the sum of 1000*l.* be paid from the funds of the association towards the expenses of the proposed Antarctic expedition, on the following conditions:—

"(1) That the expedition be under the supreme command of Dr. Mawson, free from control by any authority outside Australia.

"(2) That the details of the scientific work and the appointment of the members of the expedition be placed in the hands of a special committee of the association, such committee to have full power, subject to the approval of the leader of the expedition. But this condition shall be open to modification after consultation with the Commonwealth Government.

"(3) That Sir E. Shackleton's full consent to the first condition be first obtained.

"(4) That the sum subscribed be spent upon instruments, which shall become the property of the association on the conclusion of the expedition."

The Governor, Lord Chelmsford, gave a garden-party at Government House, Rose Bay. The association received similar hospitality from Miss Macdonald, principal of the Women's College.

The president of St. Ignatius College, Riverview, invited the members of Sections A and C to visit the college to inspect the fine seismological observatory installed at the college. Other invitations were received from various engineering departments of the State. Dr. Harvey Sutton, of Melbourne, gave a demonstration showing how to make and to throw boomerangs.

Prof. T. W. Edgeworth David was unanimously elected president for the next meeting of the association, which will be held in Melbourne in 1913.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

THE thirty-eighth annual dinner of the old students of the Royal School of Mines will be held on Thursday, May 4, at the Café Monico, Piccadilly Circus, W. The chair will be taken by Sir Thomas H. Holland, K.C.S.I., F.R.S. Tickets may be obtained from the hon. secretary, Mr. Arthur C. Claudet, 6 and 7 Coleman Street, London, E.C.

ON Tuesday, April 25, at 10 a.m., Mr. Clifford Dobell will commence a series of twenty lectures on the structure and life-history of the Protista (Protozoa and Protophyta) in the zoological department of the Imperial College of Science. The lectures will be given on Tuesdays and Thursdays at 10 a.m., and will be followed by practical work on Wednesday, April 26, at 5 p.m. Prof. E. W. MacBride, F.R.S., will begin a course of sixteen lectures on "Experimental Embryology." These lectures will be given on Wednesdays and Fridays at 5 p.m., in the zoological department of the Imperial College. Practical work in connection with the lectures will be given twice a week, at times to be arranged. Both Prof. MacBride's and Mr. Dobell's lectures are free to the public.

IN *The School Review* for April a report appears of a lecture by the superintendent of schools at Munich, Dr.

Kerschensteiner, in which he describes the compulsory continuation schools of that city, where more than 90 per cent. of the children between the ages of six and eighteen are in attendance at one class or other of public school, and where the pupils in the compulsory continuation schools average 330 hours per annum of attendance. These schools are of two kinds, a highly organised kind for youths between the ages of fourteen and eighteen during their apprenticeship, at which they receive instruction in specific relation to their trades, and a continuation school for girls, at which three years' attendance is compulsory subsequent to the close of the primary-school career at the age of thirteen. The boys' schools cater specifically for every trade in which there are twenty-five apprentices, and there are fifty-two special trade schools as well as twelve general schools. The girls' course of instruction, at present, deals almost exclusively with domestic matters, but attention will be devoted to industrial affairs as the scheme is thoroughly developed. "The only path to real State-community," remarks Dr. Kerschensteiner, "is to accustom the children from their earliest years to do their work, not only for their own personal advantage, but also for the advantage of their youthful companions. Only thus can we hope to develop the two great fundamental virtues of devotion to aims outside ourselves and of consideration for the interests of others. And only thus will it in all probability be possible to preserve our great modern constitutional States from the dangers which threaten them through their own industrial, economic, social, and political development."

AT the afternoon sessions of the forthcoming Imperial Education Conference, which will be held on April 25–28 inclusive, the following papers will be read and followed by discussion:—Tuesday, April 25: Mr. H. J. Mackinder, M.P., the teaching of geography from an imperial point of view, and the use which could and should be made of visual instruction; Prof. H. E. Egerton, some aspects of the teaching of imperial history. Wednesday, April 26: Mr. Marshall Jackman, experimental work in the teaching of arithmetic in elementary schools; Mr. J. G. Legge, practical education in elementary schools; Mr. J. Strong, secondary education in Scotland. Thursday, April 27: Dr. J. A. Ewing, C.B., F.R.S., engineering education; Mr. J. H. Reynolds, higher technical instruction. Friday, April 28: Mr. R. Blair, trade schools; Mr. Graham Balfour, continuation schools. These sessions will be held at the Foreign Office, and persons who have special knowledge of, or interest in, the various subjects which are to be dealt with at each particular session have been invited, but in view of the small space available the number of invitations has had to be strictly limited.

THE London County Council has recently decided to make a maintenance grant of 8000*l.* to the Imperial College of Science and Technology, South Kensington, S.W. In return for this grant it secures the privilege of nominating twenty-five students for one year's free instruction at the Imperial College. These places are to be filled as from October, 1911. The instruction will be of an advanced nature, and therefore only advanced students who are qualified to enter on the fourth year of the course should apply. There is no restriction as to income, but intending candidates must be ordinarily resident in the administrative county of London, and must be students at an institution aided, maintained, or approved by the Council, for this purpose, who have attended regularly courses of instruction for at least two sessions. The free studentships do not entitle the holders to any maintenance grants, but cover all ordinary tuition fees. No examination will be adopted for the final selection of the students from the applications received. The free studentships will be awarded on consideration of the past records of the candidates, the recommendations of their teachers, the course of study they intend to follow, and generally upon their fitness for advanced study in science applied to industry. It is quite possible that, in special cases, the free places may be extended to two or more years. Application forms (T. 2/268) can be obtained from the Education Officer, London County Council, Victoria Embankment, London, W.C., and must be returned not later than Saturday, May 27, 1911.

THE summer field session for 1911 of the School of American Archæology, of the Archæological Institute of America, will be held at El Rito de los Frijoles, near Santa Fé, New Mexico. Facilities will be given students to observe or to participate in the excavations, begun in 1908, and now in progress at Tyuonyi, near by talus pueblos and cliff-dwellings. Excursions will be made to facilitate a study of botanical and other environmental conditions of the tribes dwelling in the vicinity. During August, lectures will be given on the distribution and culture of the tribes in the south-western section of the United States; on the evolution of design as shown in ancient Pueblo art; on the native languages, and methods of recording them. A course will be given by Dr. Lewis B. Paton, formerly director of the American School in Jerusalem of the Archæological Institute of America, on "The Ancient Semites," to afford an opportunity of a comparative study of cultures developed in semi-arid regions in the eastern and in the western continents. The object of the annual summer field session of the School of American Archæology is to bring together persons interested in the study of anthropology, for investigation and discussion, and to give students the opportunity for field work needed to supplement university instruction. At the close of the session opportunity will be given to visit the pueblos of Taos and Acoma, and the Government excavations among the cliff-dwellings in the Mesa Verde National Park, Colorado. Details of the summer session may be obtained from the Director of the School of American Archæology, Santa Fé, New Mexico.

THE council of the Teachers' Guild has addressed a letter to the Board of Education on the subject of co-operation between labour exchanges and local education authorities, approving the principle of such cooperation, provided that the employment of juveniles be primarily considered from the point of view of their educational interests and permanent careers. The guild recommends that the subcommittees to be appointed for this work should include county councillors, H.M. inspector and council inspectors, directors of technical and continuation classes, representative employers and workmen, and representatives of the head teachers, of the school managers, and of the care committees (where they exist). The central offices for this work should be located within, and form part of, the offices of the local education authority, and from age fourteen to seventeen the "juveniles" should be, to some extent, under the supervision of the education officers of the county authority. The letter points out the important results which may flow from the adoption by local authorities of the powers offered to them by the Education (Choice of Employment) Act, 1910. We quote the following passages, which summarise views frequently expressed in NATURE:—"In the past the lack of adequate linkage between the work of the ordinary schools and that of technical classes has been felt to be a most serious hindrance to technical education. The removal of this hindrance is desirable, but of greater future importance is the opportunity for systematic schemes for the continued education of boys and girls *directly after they have left school*. . . . The experience of teachers, and of those engaged in research into mental development, points to the enormous importance of the period between fourteen and seventeen years. . . . The work of ordinary elementary and secondary schools should be in closer touch with everyday life. . . . Some of the work of continued education should be done in day schools. The cooperation of employers is essential."

FORTY-ONE annual conferences of the National Union of Teachers have been presided over by men whose addresses have received and deserved considerable public attention. This year, for the first time, a woman took the presidential chair, and special interest therefore attaches to her speech. We recognise in Miss Cleghorn's address a womanly regard and sympathy for the children, which in no wise detracts from the breadth of view evinced by her chairmanly utterance. Dealing first with the infants' departments, she deprecated the exclusion of young children under five when home conditions do not permit adequate maternal care and training. Again, it is a disastrous policy to promote children to the older depart-

ments before they are fit, as is frequently done for the sake of higher grants. For the lower standards in the boys' and girls' departments she claimed more freedom, more activity, a better bridge from the infants' school. She asked that in the ordinary schools there should be a later leaving age, a more suitable curriculum, smaller classes, better attendance. All education up to twelve should be primary in name and practice. The transition to secondary schools should be easy for all scholars about the age of twelve years, and secondary schools of varying types should provide the coping-stone of primary education. Miss Cleghorn pleaded for the abolition of half-time, for a more vocational bias in the work of the present secondary schools, and for the extension to England of the powers already granted to Scotland of enforcing attendance at continuation schools until the age of seventeen years.

AMONG other matters of wide interest which were brought before the National Union of Teachers at the Aberystwyth conference we note especially the careful statement of the difficulties attending ameliorative medical work, contributed by Dr. Lewis Williams, the Bradford medical superintendent. At the Bradford school clinic 6446 cases were dealt with during last year, of which 3520 have actually received treatment, and of these 3000 have been cured of disease, had vision corrected, or teeth attended to. It is impossible to read this paper without arriving at the conclusion that the school clinic is a valuable—even a necessary—institution, and that the case for the extension of school clinics has an appalling strength. In view of recent controversies, it was inevitable that keen interest should be shown in the subject of a paper by Mr. T. P. Sykes, "Function and Position of H.M. Inspectors of Schools in the Elementary-school System," read at the same conference. The paper was evidently written before the recent Parliamentary discussion, and its main purpose was to put forward a view of the duties of the inspectorate which is very different from the one which appears to prevail. Mr. Sykes would wish inspectors to devote their energies to securing proper conditions of work, involving adequate expenditure and administration. They should see that the Medical Inspection and the Child Feeding Acts are properly carried out, that schools are not overcrowded, that there are proper staffs of certified teachers, that salaries are such as to secure efficiency. As a professional teacher, Mr. Sykes protested against the present system of interference by inspectors with methods of teaching, and he gave instances of its deleterious effect. Mr. Sykes did not, however, suggest any method of testing the efficiency of the work.

SOCIETIES AND ACADEMIES.

LONDON.

Geological Society, April 5.—Dr. C. W. Andrews, F.R.S., vice-president, in the chair.—E. S. **Cobbold**: Trilobites from the Paradoxides beds of Comley (Shropshire), with notes on some of the associated brachiopoda by Dr. C. A. Matley. The author describes and illustrates the type-specimens of *Paradoxides groomii*, Lapworth, 1891, and the associated trilobites from the basement beds of the Middle Cambrian of Comley Quarry. Among the latter there are two or three other species of Paradoxides, represented by fragments insufficient for specific determination; also a species of Dorypyge, allied to *D. oriens*, Grönwall, and one of Conocoryphe allied to *C. emarginata*, Linnarsson. He also describes some of the trilobites from a higher horizon containing *Paradoxides davidis*, Salter, and *P. rugulosus*, Corda; and notes on the brachiopoda from this horizon are contributed by Dr. Matley. A complete list of the trilobites hitherto identified from the local Cambrian deposits is given.—Dr. D. **Woolacott**: The stratigraphy and tectonics of the Permian of Durham (northern area). The Permian strata of Durham and Northumberland lie unconformably on a basin of the Coal Measures; they may be divided into:—(4) upper red beds with salt and thin fossiliferous Magnesian Limestones (only exposed in the south of Durham), 300 feet; (3) the Magnesian Limestone; (2) the Marl Slate, 3 feet; (1) the Yellow Sands, from 0 to 150 feet. These beds, which vary much in thickness, lie in North Durham in the general form of a syncline beneath Sunderland. The unfossiliferous Yellow Sands are probably a deltaic formation reassorted by wind, the other beds being the result of deposition in an inland sea undergoing desiccation. The magnesium carbonate existed in the waters of the sea, and was either deposited along with the calcium carbonate or introduced by seepage when the beds were being laid down. Great changes in the amount and distribution of these carbonates have, however, taken place since deposition. The percentage of calcium carbonate is sometimes more than 99, while that of magnesium carbonate is occasionally as much as 50. The fauna of the Magnesian Limestone is very restricted (about 140 species) and most peculiarly distributed. The marked palæontological features are the profusion of individuals in the Middle Fossiliferous Limestone (which appears to have formed a shell-bank in the Middle Magnesian-Limestone sea), and their sudden disappearance in the Upper Limestone. No corals, echinoderms, polyzoa, brachiopods, or cephalopods have ever been found above the top of the Middle Fossiliferous division, only a few fishes, gastropods, lamellibranchs, entomostraca, and foraminifera occurring in the Upper beds. The Lower and Middle Fossiliferous Limestones are marked by the presence of *Productus horridus*, Sow. Fish-remains occur at two horizons, namely, the Marl Slate and the Flexible Limestone, and the beds above these deposits. The Brecciated beds, which occur at various horizons, chiefly, however, in the two Middle divisions, constitute the most marked tectonic feature of the Magnesian Limestone of the area. They have been produced by thrusting, which brought about a decrease in the lateral extension of the Permian. Associated with the breccias are other proofs of thrusting:—(1) thrust or shear-planes; (2) disturbed and displaced masses of Lower Limestone; (3) intruded breccias; (4) slickensided and grooved, horizontal and vertical surfaces; (5) cleavage; (6) folding, both on a local and on a general scale; (7) buckling, thickening, and squeezing-out of beds; (8) phacoidal and other structures; and (9) fissuring.

DUBLIN.

Royal Dublin Society, March 28.—Mr. R. Lloyd Praeger in the chair.—Prof. T. **Johnson**: (1) *Archaeopteris simplex*, sp.nov.; (2) Is Archæopteris, Dawson, a pteridosperm? The author gave an account of his examination of specimens of Archæopteris, Daws., in the botanical division of the National Museum, and in the Royal College of Science, Dublin. He recorded in the first part of his paper the occurrence in the south of Ireland, in the Upper Devonian beds, of *A. hibernica*, var. *minor*, Crépin, *A. roemeriana*, Göpp., and *A. Tchermaki*, Stur, in a fertile state. In the second part of the paper certain features in the structure of *A. hibernica*, Forbes, sp., are described. The more interesting features are the presence of fertile adaxial and sterile abaxial lobes in the fertile pinnule or *sporophyllule*, the vascularity of the stalk of the sporangium, and the transverse septation of the latter. The paper concludes with a discussion of the relationship of Archæopteris to the Ophioglossaceæ, the Sphenophyllaceæ, and the Pteridospermeæ.—Dr. J. H. **Pollok**: The vacuum-tube spectra of the vapours of some metals and metallic chlorides. The author showed reproductions of the spectra of the metals or chlorides of thallium, lead, copper, bismuth, iron, aluminium, chromium, manganese, nickel, cobalt, barium, strontium, calcium, magnesium, potassium, sodium, and lithium taken by means of his new quartz vacuum tube. As observed in the spectra referred to in part i. of this paper, there is invariably a marked difference between the spectra taken without a condenser and with a condenser in the secondary circuit. In the former case bands show a greater tendency to develop, in the latter there are invariably many more lines, but some become weaker. The new lines, and lines that become stronger, are very generally those showing the discontinuous lines when metallic electrodes are sparked in air, and a spherical condenser is used in photographing.

Royal Irish Academy, April 10.—Rev. J. P. Mahaffy, president, in the chair.—Major **Berry**: The Sierra Leone cannibals, with notes on their history, religion, and customs. Traces of a formerly richer flora and the remains of human settlements would tend to prove that the Sahara was subject to cyclical periods of aridity and humidity, and that in Palæographical times it possessed a climate favourable to life. It was in the Sahara that the Mediterranean race probably originated and sent forth waves of migration, one of which, moving southwards, pushed the blacks back to the unhealthy coast-line. These blacks were by the Arab historians called the Dem-Dem, and are now known as the Mampas. Formerly they must have been powerful, but are now broken up along the coast from the Gambia to the Niger. From time immemorial these people have practised cannibalism, less for food than as a sacrament, with definite ritual curiously resembling that of ancient Mexico and Egypt. There are traces of a Mother Goddess, and the symbology connected with their religion and customs suggests other than local origins. Details of the customs and cannibalistic ritual collected in the country by the author are given and discussed.

GÖTTINGEN.

Royal Society of Sciences.—The *Nachrichten* (physico-mathematical section), part i. for 1911, contains the following memoirs communicated to the society:—

November 16, 1910.—E. **Kohlschütter**: The structure of the earth's crust in German East Africa.

January 14, 1911.—W. **Voigt**: Contributions to Lord Rayleigh's theory of grating-inflexion.

December 10, 1910.—N. **Galli** and K. **Försterling**: Theoretical and experimental researches on the optical behaviour of minimal metallic films.

November 26, 1910, and January 28, 1911.—W. **Voigt**, with a note by H. A. **Lorentz**: General considerations on emission and absorption in connection with the question of measurements of intensity in the Zeeman effect.

DIARY OF SOCIETIES.

THURSDAY, APRIL 20.

SOCIETY OF DYERS AND COLOURISTS, at 8.—The Dyeing of Paper Pulp: R. Bickerstaffe.

MONDAY, APRIL 24.

ILLUMINATING ENGINEERING SOCIETY, at 8.—The Ratio of Light to Illumination: Havdn T. Harrison.—Some Notes on the Effect of Wall-papers upon the Illumination of Interiors: P. J. Waldram.

VICTORIA INSTITUTE, at 4.30.—The Sidereal Universe: Sir David Gill, K.C.B., F.R.S.

TUESDAY, APRIL 25.

ROYAL ANTHROPOLOGICAL INSTITUTE, at 8.15.—River Life and People in Upper India: P. B. Bramley.

ROYAL STATISTICAL SOCIETY, at 5.—The Application of the Method of Multiple Correlation to the Estimation of Post-censal Populations: E. C. Snow.

WEDNESDAY, APRIL 26.

ROYAL SOCIETY OF ARTS, at 8.—The Production and Identification of Imitation and Artificial Gems: Noel Heaton.

GEOLOGICAL SOCIETY, at 8.—The Llandovery and Associated Rocks of North-eastern Montgomeryshire: A. Wade.—Geology of Northern Nigeria: Dr. J. D. Falconer.

BRITISH ASTRONOMICAL ASSOCIATION, at 5.

THURSDAY, APRIL 27.

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

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

MATHEMATICAL SOCIETY, at 5.30.—On the Geometry of a Deformable Octahedron: G. T. Bennett.—A Symmetrical Method of Apolarly Generating Cubic Curves: W. P. Milne.—The Solution of the Homogeneous Linear Difference Equation of the Second Order (Second Paper): G. N. Watson.—A Cartesian Theory of Complex Geometrical Elements of Space: G. B. Mathews.—The Number of Primes of given Linear Form: Lieut.-Col. A. Cunningham.—On the Proofs of the Properties of Riemann's Surfaces discovered by Lüroth and Clebsch: Prof. M. J. M. Hill.

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

FRIDAY, APRIL 28.

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

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

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

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

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