THURSDAY, JULY 27, 1911.

THE ENCYCLOPÆDIA BRITANNICA.

The Encyclopaedia Britannica: a Dictionary of Arts, Sciences, Literature, and General Information. Eleventh edition. Vols. xv.–xxix. (Italy—Zymotic Diseases, and index volume.) (Cambridge: University Press, 1911.)

A GENERAL notice of fifteen volumes of the dimensions of "The Encyclopædia Britannica" can, at best, be based only on a process of "browsing" through them, and of turning to a subject here and there as it strikes the mind. In these volumes there is ample scientific material on which to examine two claims that have been put forward on behalf of the work on general grounds. The first is that its use as a work of reference purely, for the discovery of one isolated fact or another, is not its only use, not even its primary use, since for this purpose a reference book of less ample size probably fulfils any demand that the ordinary inquirer is likely to make. Not that "The Encyclopædia Britannica" fails in this object; the number of its article headings is well known to have been enormously increased in the present edition, every judicious addition of a heading adds to its value as a work of reference simply, while the existence of an index volume, though somewhat elaborating the mechanical process of discovering an isolated fact, eliminates the necessity of exercising imagination in finding information to which no article heading directly points. But beyond this, it is claimed that the work is usable by readers as a library in itself, and, secondly, that the desire to make it thus usable has justified the new editorial policy of making the articles under the broad scientific or other headings, not exhaustive treatises on the whole of each subject, but, wherever possible (it is not always so), comparatively brief notices confined strictly to main lines, and indicating to the reader the further headings to which he may turn if he desires to pursue the subject. Another most important aid in this pursuit has been given, as will presently be seen, as a new feature of the index volume.

A few of the articles under general scientific headings in the second half of the volumes may be taken as illustrating the above thesis. Dr. A. N. Whitehead's article on mathematics covers little more than four pages; it defines the science, briefly reviews its history, and indicates its scope and application, and in doing the last it indicates upwards of fifty other headings, under which any branch of the subject may be pursued. Dr. Max Verworn's notice on physiology is laid out on similar lines; anatomy, cytology, digestive organs, respiratory system, touch, smell, taste, vision, hearing, plants (physiology), are a few of the branch lines to which this concise summary shows the way. In the article on zoology, Sir E. Ray Lankester writes at greater length, it is true, than do either of the authors just named in their general treatises, but he does not go outside the history of the whole subject, with particular reference to the various important systems of classification which have been laid down, leading up to that adopted in "The Encyclopædia Britannica" itself. It may be added here that the editors have not feared the adjectival heading (a form open to much abuse in reference books, as such headings are not easy of preconception by the reader) when it appears appropriate, from the point of view of the specialist, to a clearly defined compartment of a general subject. Thus Zoological Distribution and Zoological Nomenclature are very properly made the headings of separate articles, instead of being made great sections under the general heading of zoology. The one is dealt with very clearly by Mr. Lydekker, who has contributed a great mass of zoological matter to the whole work; the other is by Dr. Chalmers Mitchell, who incidentally gives his high authority to the subject of zoological gardens.

The index has in a large degree followed the model of that provided in the tenth edition, but certain obvious improvements have been introduced. By the use of a distinctive type it is made clear when any index heading is also an article heading in the text. The reader is thus able to appreciate at once that any references which follow under such an index heading are merely supplemental to the article itself, and it would appear that a more judicious selection of such "casual" references has been made than was made in the index to the last edition. Indeed, some of the larger blocks of index references, as, for example, those dealing with the history of large countries, have obviously been made, not by simply collecting and editing the references gathered by independent indexers in the course of their work, but by means of a selection (by one hand) of the verbal references which a user of the index would naturally expect to find, and the subsequent attachment of the proper page and volume numbers to them. This must have involved a great deal of research, and as such work was dependent upon the completion of the whole of the text, it may be said that the index has been issued with laudable promptitude.

But the new feature of the index volume referred to above, as an aid to the pursuit of a given broad subject through the whole of the work, is perhaps more worthy of praise than the index itself. This is the classified list of articles, which the editors "believe to be the first attempt in any general work of reference at a systematic catalogue or analysis of the material contained in it." Under such broad divisions as art, biology, geography, history, medical science, physics, &c. (there are twenty-four of these divisions in all), and under appropriate departments within each, practically the whole of the article headings in the "Encyclopædia" are classified and subclassified, so that a reader who wishes for a bird's-eye view of all the article headings in the department (say) of pathology, therapeutics, and surgery, can turn up that group and see them at a glance. This is a most important addition to the use of the "Encyclopædia," not as a work of general reference, but as a special encyclopædia on any given subject. Incidentally it furnishes perhaps a more remarkable conception of the magnitude of the work than do even the textual

volumes themselves; the department of pathology, therapeutics, and surgery alone is found to contain nearly 250 separate articles, exclusive of biographies (which are always classified together at the end of each main division or department). The editors of the list have evidently been faced with an exceedingly difficult problem in allocating some of the headings to their most appropriate department; any system of duplication which would have allowed every department to indicate every article which had any bearing upon it would have become hopelessly cumbrous, and those who use this list may sometimes have to turn from their own special subject to a kindred department. But the whole list is so clearly arranged that this process presents no difficulty.

It would be improper to attempt a detailed notice of any one branch of science in a general survey of a series of volumes which include such notable contributions as the article on Palæobotany by Dr. D. H. Scott, Prof. Seward, and Mr. Clement Reid; Prof. H. F. Osborn's Palæontology; Mr. Leonard Spencer's Mineralogy and Prof. J. F. Kemp's Mineral Deposits; Dr. Stockman's Pharmacology; Prof. Poynting's article on Sound; Magnetism, by Shelford Bidwell, and Terrestrial Magnetism, by Dr. Chree; Map by Dr. Ravenstein and Col. C. F. Close; Prof. Abbé's Meteorology; Ocean and Oceanography, by Dr. H. R. Mill and Prof. Krümmel, and a host of others. But it is possible to refer in general terms to the satisfactory character of the illustrations which classify so many of these important treatises, from the admirable textual sketches which serve to illustrate the main features of some of the remarkable ancient maps described by Dr. Ravenstein, to the coloured plates accompanying the articles on pathology and parasitic diseases. The coloured plates are for the most part exceedingly good; most of them (such as the beautiful Orders of Knighthood, in the preparation of which King Edward VII. took so great an interest) fall outside the scientific articles. Reference, however, may be permissible to the admirable illustration under "Process" of the four stages of the three-colour process, worth far more than its bulk in textual explanation. The half-tone reproductions can only be criticised on the score of occasionally showing evidence of printing at high pressure, while there are some faults of manufacture—in the volumes before us we have happened upon one plate bound in duplicate, while a certain plate-map which is indexed does not appear. But as a whole the half-tones are excellent, and some which call for high detail, such as those illustrating "Lace" or "Pathology," are beyond praise. Engineers will value the cosmopolitan series of plates and line diagrams in the articles on ship and shipbuilding, to which Sir Philip Watts and the Rev. Dr. Warre have contributed. The line drawings throughout the work have printed satisfactorily on the thin paper, and the fineness of some of the zoological drawings (for example), or those illustrating Mr. A. H. Smith's article on jewelry, is admirable.

It will be understood that the examples named are chosen at hazard out of hundreds, for the illustrations, if their treatment by the manufacturers is open to the criticisms already made, afford evidence of systematic editorial arrangement and of no sparing hand on the part of the publishers.

The statistician has found less material for his use in the present than in past editions of the "Encyclopædia." It is no doubt a misfortune that the publication of the whole work had to be timed a little in advance of a period at which there became available that most important series of statistics, the decennial census returns. But the editors have deliberately disregarded (save in exceptional cases) the often deceptive intercensal estimates of population. In other departments it would probably have passed the wit of man to devise mechanism for the insertion of the latest figure in every statistical statement in twenty-eight volumes published almost simultaneously, even if it had been thought desirable, which (as the "Encyclopædia" is not an annual publication) it was not. But whereas the notices on the divisions and towns of the United Kingdom and the United States have been relieved of a considerable mass of statistics, the two general articles under these titles have been made the receptacle of a large number of figures, brought down to the latest available dates, which, being set in tables or other comparative forms, will probably be of use to a greater number of readers than if they had been distributed through the lesser articles.

The principal conclusion of a general survey of the completed work is that the editors deserve to have it realised that they have made a library—not only a dictionary—not a year-book. The work may contain some errors of detail, whether the result of the march of events during its compilation, or simply of a compiler's human fallibility; it would be beyond human work if it did not. But it appears to be surprisingly free of editorial misjudgment in respect of the selection of article headings and the apportionment of space to every department of knowledge. The existence of the classified list shows that the editors are not afraid of exhibiting their selection, and the reader who finds an apparent gap in it will probably discover on reference to the index that the subject he seeks is really an indivisible part of a wider one. And by following this process he will probably be paying the makers of the "Encyclopædia" the compliment of using it as they intend it chiefly to be used.

COMPARATIVE ANATOMY.

Vorlesungen über vergleichende Anatomie. By Prof. O. Bütschli. 1 Lieferung, Einleitung; Vergleichende Anatomie der Protozoen; Integument und Skelet der Metazoen. Pp. viii+401. (Leipzig: W. Engelmann, 1910.) Price 12 marks.

THE method of studying comparative anatomy that will ever be associated with the honoured names of John Hunter and Gegenbaur appeals strongly to the student of medicine, and those who specialise in human anatomy, as being the most interesting and instructive way of learning the significance of the animal economy. The comparison of homologous structures in the whole range of the animal kingdom and the realisation of their varying development and differing arrangement throw light upon their functions, and in our day explains the process of

evolution of complex from simple structures. John Hunter embodied this method in the arrangement of his museum; Gegenbaur developed it in his lectures and his books.

But many systematists, whose chief aim in life is to study the differences with which they hedge round their multitudes of species, view with suspicion a method of studying zoology which lays chief stress upon the resemblances that help us to link together the various members of the animal kingdom.

Thus Prof. Bütschli's text-book, continuing as it does the best traditions of the famous Heidelberg school, is sure of a warm welcome from the morphologist, whatever view the species-monger and the devotees of the type-system of teaching zoology may think of it.

It was with mixed feelings that those who had been "brought up" on Gegenbaur's great book and had come to revere the great master, read the new edition of the Comparative Anatomy which was issued twelve years ago, after he had passed three score and ten years. When a man has reached that age it becomes impossible to keep in touch with all the manifold ramifications of such a science as morphology, even when, as in the late Prof. Gegenbaur's case, he had grown up with it and taken a principal, if not the leading, part in making the new branch of learning.

It required a younger man to write the new and simplified book that was urgently wanted; and no one was more fitted to undertake this task than Gegenbaur's pupil, who took charge of the course of lectures in zoology at Heidelberg in 1884, when his teacher relinquished the task. It is these lectures which are embodied in the book under consideration. The English student who may have spent weary hours trying to puzzle out the meaning of some of Gegenbaur's cryptic German and involved sentences will appreciate the lucidity of Bütschli's style and the ease with which his meaning can be grasped.

This volume represents only the first part of the text-book, and consists of four sections:—(1) An introduction, explaining terminology, and the scope and general conceptions of comparative anatomy; (2) a very complete, yet concise, summary of the distinctive features of all the considerable groups of animals; (3) the comparative anatomy of protozoa; and, finally (4), more than three-fourths of the volume are devoted to the account of the tegumentary and skeletal systems.

The integument and its various specialisations, scales, hairs, feathers, and glands, receive very full treatment. This is all the more welcome and valuable, as this branch of anatomy suffers from neglect more often perhaps than any other. A great mass of information concerning both invertebrates and vertebrates is crowded into a comparatively small space without any sacrifice of clearness.

After a general discussion of the nature of skeletal structures and the forms they assume in invertebrates, the early forms of the notochord are described, and then a succinct account is given of the forms assumed by each bone of the skeleton in the vertebrata.

One of the great features of this book is the abundance and the excellent educational value of the illustrations. Although they consist of semi-diagrammatic line drawings or half-tone reproductions of simple drawings, they are so free from unnecessary and confusing detail, so clearly labelled and really illustrative of the text, that the reader experiences no difficulty in following and understanding the descriptions.

Prof. Bütschli can be congratulated on having produced the first part of an introduction to comparative anatomy which is both of exceptional scientific merit and singularly well adapted to the needs of elementary students. G. E. S.

THE BENIN GROUP OF NEGROES.

Anthropological Report on the Edo-speaking Peoples of Nigeria. By N. W. Thomas. Part i., Law and Custom. Pp. 163. Part ii., Linguistics. Pp. ix+251. (London: Harrison and Sons, 1910.)

THE Niger Delta, from Yorubaland on the west to the Cross River on the east, is a field of African ethnology which is only very slightly made known to us at the present day, but promises to yield some very interesting and important additions to our knowledge of negro races, when fully worked. Owing to its physical conditions, the area covered by the delta of this river—some 260 miles by 100—is still unexplored in some portions; indeed, down to about fifteen years ago the land everywhere at a distance of one mile from the banks of the navigable creeks had scarcely been seen by a European. Though there are within the delta tracts of undulating, well-drained soil much of the district is excessively swampy or covered with very dense bush, scrub, mangrove thicket, or magnificent but impenetrable forest. Mosquitoes and large Tabanid flies swarm and the former serve to inoculate the blood of the European with the germs of malarial and black-water fever. Yet (I write from old personal experience) where there is no native population at hand to supply from its blood the malarial *bacilli*, the Niger Delta is not necessarily unhealthy to Europeans, and the stinking mud around the mangrove swamps, though it smells mephitically, is not, so far as we know, the cause of any disease.

In addition to the great difficulties of land-transport, which hitherto have limited the routes of the Delta explorers to the water-courses, the disposition of numerous tribes is still very hostile to the European. Consequently from one cause and another, a wholesome fear of savage cannibals and poisoned arrows, of enormous crocodiles, of thunderstorms, lightning, torrential rain and tornadoes of wind, of a sunshine which is sometimes sickeningly hot, of sparsity of food supplies, and dread of fevers and dysentery, we are still very deficient in our knowledge of the tribes of the Niger Delta. Rumours of late from well-informed sources point to the existence in the region between the Forcados and the Nun of a pygmy or dwarfish people said to be yellow-skinned and steatopygous, and speakers of a "clicking" language; from the Rivers Pennington and Middleton comes a singularly savage and prognathous type of negro, so wild and barbarous that it is still (I am informed) difficult to get speech of them.

In addition to these unclassified folk of the least-

known part of the Delta (Forcados to the Nun), the negroes of the Niger mouths and their accessory streams are now arranged in the following ethnic groups. Beginning on the west, the Edo or Benin peoples, treated of in the book under review; the Jekri on the south or south-west of these; the Ijō, south-east of the Edo (Sobo), and especially in the eastern part of the main delta, between the Nun mouth and Opobo; the Ibo, north of the Ijō; the Arō ruling caste (almost semi-Caucasian in their physiognomy and skin-colour), between the Ibo and the Cross river; and the semi-Bantu Kwō and Akwa tribes between the Opobo and the Efik people of Calabar. Some of the Arō men and women resemble the Fula in their clear-cut, delicate profiles, their thin, well-formed lips, and lithe, finely-shaped bodies; and (as already remarked) there are savages from the western part of the delta, which, to the reviewer, seemed of an exceptionally low and brutal type.

The Edo-speaking people of the ancient kingdom or confederation of Benin are mainly the subject of Mr. Northcote Thomas's monograph, though allusions to and some comparisons are made with certain of the other tribes of the Delta and with the Yoruba of Lagos hinterland. Linguistically and racially the Edo group seems to be allied to the Yoruba and also to the E'we family (of Dahome). Their somewhat remarkable civilisation (like that of the Arō and Efik to the east and south, so strikingly superior to the barbarity of the Ijō and Kwō) has come to them from the north and north-east, and may perhaps be traced back to the Songhai culture of mediæval Nigeria.

Mr. Thomas has very little to say about the bronze-casting which has made the culture of Benin famous in ethnology. It seems to have died out almost entirely amongst the Edo people of to-day, who confine themselves to forging brass and iron ornaments and implements.

The work under review deals in part i. first with the affinities of the Edo people and the surrounding tribes, so far as there are any. Then comes a brief sketch of the Edo speech, followed by ethnological notes on this people, between pp. 11 and 123; an appendix on the pronunciation of the Edo speech, together with sample vocabularies for filling up by other inquirers. Also there is an interesting appendix on genealogies and terms and degrees of kinship; and another on suggestions, for other anthropologists, as to the best procedure in photographing African peoples. (Though not without interest these appendices on linguistics and on photography are disappointing to the already trained ethnologist, who expects Mr. Thomas's book to be entirely filled with the results of his own researches.) Part ii. contains (*a*) a number of interlineally translated texts to illustrate the Edo, Ishan, Kukuruku (and numerous dialects), and Sobo languages; (*b*) a grammar of the Edo (Bini, Benin) language; (*c*) a comparative dictionary of the Edo languages and dialects; and (*d*) an Edo-English dictionary.

The index comes near the end of the first part, and is singularly poor and inadequate. It is strange that this should be so in a work which is sufficiently good and important to merit very full indexing. For it may be said without more ado that Mr. Northcote Thomas's study of the Edo-speaking people will take a prominent place in ethnological works dealing with the negro. It is all first-rate, first-hand information, and errs only by omission and not by commission. Particularly valuable are the sections dealing with religion and magic; with marriage and birth customs; with native law and trial by ordeal; and the notes on the native calendar. The texts taken down from the many native informants not only exhibit the exact structure of the different languages, but illustrate very effectively the subject-matter of negro stories, the somewhat gross indecency of speech in regard to certain legends, and in general the outlook on the world around them of negroes that have hitherto been almost entirely uninfluenced by the modern European.

In arranging the English version in his comparative dictionary, Mr. Thomas should have invited the assistance of someone acquainted with African zoology. There are no "pheasants" or "crow pheasants" in Africa, and no "badgers." H. H. JOHNSTON.

COLOUR AND CONSTITUTION.

Die Beziehungen zwischen Farbe und Konstitution bei organischen Verbindungen. By Prof. H. Ley. Pp. viii+246+Taf. ii. (Leipzig: S. Hirzel, 1911.) Price 7 marks.

MANY chemists will welcome Prof. Ley's work on the relations existing between selective absorption and constitution in the case of organic compounds. The subject has attracted considerable attention of late years, and probably more definite conclusions would have already been reached had physicists rather more knowledge of organic chemistry and organic chemists a better acquaintance with physical conceptions.

The work is divided into two parts, 204 pages being devoted to the subject indicated in the title, whilst the remainder of the book deals with the methods of spectroscopic work. Prof. Ley insists at an early stage on the necessity of making no distinction in kind between selective absorption in the visible and ultra-violet regions of the spectrum, and proceeds to a consideration of Beer's law, "extinction-coefficient," and the influences, such as concentration, solvent, and temperature, which cause variation in absorption spectra.

In dealing with the different theories which have been proposed to account for the colour of organic compounds, Prof. Ley starts with the early efforts of Graebe and Liebermann and of Witt, and divides the chromophors into eight groups. One cannot fail to be struck with the universal existence of conjugated double linkages in compounds which show selective absorption, though in the ketenes chromophoric properties seem to be associated with adjacent double linkages. The triple linkage, on the other hand, seems to have little effect, and benzoylphenylacetylene is a colourless compound. The quinonoid constitution of many coloured compounds and H. Kauffmann's more recent development of the auxochrome theory are then discussed, whilst considerable attention is devoted to the influence of the solvent and

the variation of the position of absorption bands which is likely to be produced by association of solvent with solute. Due recognition is given to the importance of the work now being carried out by Purvis on the selective absorption of substances in the state of vapour, in which case the influence of solvent is quite eliminated.

Considerable interest attaches to the attempted physical explanation of selective absorption, and use is made of the mass of experimental material accumulated by Hartley, Baly, and others. Baly's idea of "isorropesis" does not commend itself to the author, who is in favour of an electronic theory.

As may be expected in a book written in the Leipzig laboratory, much attention is given to the quinonoid rearrangement frequently assumed when a change in colour accompanies salt formation. One might gather from this portion of the work that "chinoide Umlagerung" was specially associated with Leipzig; *e.g.* on p. 169 one finds regarding phenolphthalein :—

"Der Beweis, dass den Salzen chinoide Konstitution zukommt, beruht auf der Existenz zweier verschiedener Äther. Neben dem farblosen laktoiden Dimethyläther existiert ein roter chinoider Äther, der zuerst von Green und King dargestellt und eingehend auch von K. H. Meyer und Hantzsch, untersucht wurde."

One would scarcely realise the great importance of Prof. Green's work on the phthaleins by reading this passage; and it may be pointed out (see pp. 176–7) that the hydroxy- and amino-azo-compounds have engaged the attention of several workers.

The colours of complex salts introduces some inorganic chemistry, whilst in the last few pages—devoted to method—spectroscopes, spectrographs, &c., are described, and an outline of the manner of working with these instruments is given. J. T. H.

THE NON-METALLIC MINERALS OF ECONOMIC VALUE.

Die wichtigsten Lagerstätten der Nicht-Erze. By Dr. O. Stutzer. Erster Teil, Graphit, Diamant, Schwefel, Phosphat. Pp. xv+474. (Berlin: Gebrüder Borntraeger, 1911.) Price 16 marks.

THIS work is designed to supplement the treatise of Prof. Beck on "Mineral Veins and their Contents," by giving an account of the deposits of those useful mineral substances which are not classed as "ores." The first volume, now published, is evidently the fruit of a vast amount of labour and bibliographical research, and deals only with four classes of materials, to each of which the amount of space devoted is as follows—graphite, 88 pages; diamonds, 94 pages; sulphur, 81 pages; and phosphates, 198 pages. In the case of each of these materials, the author, after preliminary notices of its mineralogical characters and modes of occurrence, proceeds to compile from the most varied sources descriptions of each of the districts in which it occurs. These descriptions are illustrated by page blocks (of which there are no fewer than 108 in the volume) giving sketch maps, sections, drawings, and photographs. Very miscellaneous information is supplied in these accounts of localities, including statistics of annual yield with prices and total values, and even, in some cases, examples of forms of agreement between sellers and buyers. In the case of the South African diamond fields, however, these statistics are, unfortunately, not brought down to later date than the year 1908.

As a rule, the references to authorities are ample and satisfactory, but we notice some marked exceptions. The author's acquaintance with British scientific literature would appear to be much more limited than his knowledge of German, American, and even Japanese sources of information. Thus a section of the Upware phosphatic beds is stated to be "after W. Keeping-Penrose," and the puzzled English reader is left to find out that the information about British deposits is obtained, at second hand, from a Bulletin of the United States Geological Survey, written by Mr. R. A. F. Penrose, jun., in 1888! We are reminded of the ingenuous remark of a compatriot of the author, who, when it was pointed out to him that a research he had published had been long before anticipated in this country, said, "Ah, that was buried in the catacombs of the Royal Society's Transactions!" In like manner, we find that Mr. Teall's interesting account of the phosphatised trachyte of Clipperton Atoll, published in the Quarterly Journal of the Geological Society in 1898, is ignored, while many less interesting deposits in the Pacific are fully described.

After the discussions of the distribution and statistics of the materials in the various districts, the author proceeds to consider such general questions as their origin, artificial formation, and metamorphoses. The treatment of these more purely scientific problems, however, is quite subordinate to that of economic and statistical questions, and little of novelty or special interest is to be found in these sections of the book.

An exception to this may, perhaps, be found in the useful abstract, on pp. 254 to 262, of the views that have been put forward concerning the origin of beds of sulphur, including the possible production of some of these deposits through the agency of bacteria, like Beggiatoa and Chromatium. On the whole, however, the work is to be commended for its technological rather than its scientific value.

ELECTRICITY AND MAGNETISM.

(1) *Beispiele und Uebungen aus Elektrizität und Magnetismus.* By Prof. R. Weber. Fünfte Auflage. Pp. viii+330. (Leipzig and Berlin: B. G. Teubner, 1910.) Price 4.80 marks.

(2) *Experimentelle Elektrizitätslehre, verbunden mit einer Einführung in die Maxwellsche und die Elektronentheorie der Elektrizität und des Lichts.* By Prof. H. Starke. Zweite Auflage. Pp. xvi+662. (Leipzig and Berlin: B. G. Teubner, 1910.) Price 12 marks.

(1) THIS is a collection of nearly nine hundred examples in electricity and magnetism. They are all numerical in character, and each is completely

worked out. Where required, the exercise is explained by means of a diagram. It is recognised that certain preliminaries are required to enable the student to understand electrical problems, and, to this end, the earlier questions relate purely to mechanics, hydrostatics, and heat. The examples are very varied in type, and include cases of interest, both theoretically and practically. There follows a short section in which the various mechanical, thermal, and electrical units are defined, and the book concludes with numerous tables, in which these units are collected, together with others giving the values of the various physical constants required in the working of the exercises.

It is somewhat doubtful whether the procedure of asking a question and at once giving the answer can be of much benefit to a student. It surely tends to discourage the use of the student's own initiative. A few illustrative worked examples should suffice, the rest being left for the learner to undertake.

The book is well printed, but it may be mentioned that some six of the introductory pages are missing from the copy submitted to the reviewer; it is to be hoped that this mistake does not extend to the whole edition.

(2) The second edition of this excellent treatise on electricity and magnetism, by Prof. Starke, has been brought thoroughly up to date by the addition of numerous paragraphs and chapters. Besides all the experimental and theoretical considerations usually found in text-books on this subject, many special electrical applications are deal with at length. Particular attention is given to the production and properties of electro-magnetic waves and to the practical uses of the latter in wireless telegraphy and telephony. As indicated in the title, the electro-magnetic theory of light is also dealt with, especially the explanations of the various optical phenomena upon the electron theory. In the thirteenth chapter this theory is extended to thermal and electrical conduction, and to the different thermo-electric effects. The section devoted to the conduction of electricity in gases has been largely added to, so that most of the latest work in this department of physics is considered. The new chapter on radio-activity gives a brief general outline of the rapidly progressing work which has been done in this direction, and includes a table giving the various radio-active substances at present known, their life-periods, types of rays, and physical properties. Finally, the author devotes an appendix of considerable length to the theory of moving electrons and the principle of relativity.

In every respect this book has claims to be regarded as a standard work on electro-magnetism. The alterations and additions in this edition have brought it, as far as possible in a general text-book, to the level of modern scientific research. To all those desirous of becoming acquainted with the present state of knowledge in this subject it can therefore be thoroughly recommended. It may also be mentioned that the type, diagrams, and paper are excellent.

CELLULOSE EPHEMERIDES.

Literatur der Zellstoff- und Papier-Chemie und der Papier-Technik im Jahre 1909. In Auszügen dargestellt. By Prof. C. G. Schwalbe and A. Lutz. Pp. 158+xix+94. (Berlin: Gebrüder Borntraeger, 1911.) Price 5 marks.

Zur Kenntnis der Cellulosearten. By Dr. W. Schulz. Nebst einem Vorwort, by Prof. C. G. Schwalbe. Pp. vi+100. (Berlin: Gebrüder Borntraeger, 1911.) Price 3.20 marks.

THESE publications are indicative of the extraordinary specialisation of cellulose chemistry, and at the same time of a tendency to intensive elaboration of detail in investigation, and more particularly of records, which, however interesting to the specialist, are drawn in too narrow a perspective to rank in the general literature of the science.

The former is a bibliographical record, sufficiently defined by its title. It is produced under the auspices of a youthful technical society, the "Verein der Zellstoff- und Papier-Chemiker," which is doing much useful work, and very fully justifying its foundation and existence. The matter of the volume is exhaustive, the records take the form of abstracts, which are duly concentrated and presented under a well-considered scheme of classification, with full indexes.

The second volume is a record of research towards establishing a method of diagnosing the more important industrial celluloses in terms of differentiating factors. This work is evidently inspired by Prof. C. G. Schwalbe, and in a short preface he claims for the author's results at least a definite promise of achievement, a claim which is somewhat at variance with the conclusions recorded *en résumé* on pp. 85–86, 99–100; these are rather of negative import.

The main scheme of investigation is a study of acid hydrolysis, taking as a measure of the degree of hydrolysis the reactions of the products with alkaline cupric oxide (Fehling's solution), and as a first stage (*a*) combination in the cold with cupric oxide (hydrate), and secondly (*b*) reduction to cupric oxide, on boiling.

The quantitative determinations are recorded under a special nomenclature, thus:—"Cellulosezahlen" (*a*) "Korrigierte Kupferzahlen" (*b*–*a*); and after the particular hydrolytic treatment "Hydrolysierzahl" (*b'*) and "Korrigierte Hydrolysierzahl" (*b'*–*a'*).

The numbers recorded for a selection of ten typical marks of sulphite celluloses are, as the author admits (*loc. cit.*), unconvincing. An *a priori* consideration of the method would, we think, have enabled the author to predict the generally inconclusive result. It has been long established that the hydrolytic resolutions of cellulose can proceed very far under the action both of acids and alkalis without liberating CO groups. It is clear therefore that cupric reduction is only a partial measure of cellulose hydrolysis. And generally oxidations by alkaline cupric oxide are highly complex reactions, even the classical reactions with the sugars are by no means well defined, and remain therefore of essentially empirical order. Without detracting in any way from the author's results as quantitative observations, we suggest that they

should have been recorded in simple terms, that is, without the adventitious aid of a special nomenclature, which merely obscures their significance.

A more important section is that devoted to a careful study of the supposed total hydrolysis of cellulose to hexose groups, and the implied problem of fundamental constitutional import. The author rightly recognises that the experimental verifications of the view that "cellulose is a polyhexose anhydride," are wholly defective; indeed, with progress in investigation the actual yields of sugars or their immediate derivatives obtained from (cotton) cellulose are extremely variable and generally much below the statements of the earlier observers, Braconnot, Béchamp, Flechsig.

The later investigations of Ost and Wilkening indicate that the hydrolysis is complicated by the formation of acids of low molecular weight, and their results with the author's present contribution undermine the plausible assumption that cellulose is a close analogue of starch.

In his study of the hydrolysis of the normal cellulose, the author has taken as his starting point the well-known intermediate products obtainable as colloidal hydrates, thus Guignet's "Cellulose Colloide," Flechsig's typical "Amyloid," "Parchmentised Cellulose," and Ekström's so-called "Acid Cellulose." These products, tested in relation to Fehling's solution, and the particular scheme of hydrolysis previously described, gave extremely variable numbers, thus for the "Korr: Hydrolysierzahl" 7·3, 26·7, 17·6, 30·4, for the products in the above-named order. Following the section devoted to a careful study of these proximate products, is the complementary section on "Die Abbauendproduckte der Baumwollecellulose und des Sulfitzellstoffs."

From the preface (Schwalbe) we abstract the important result of these laborious observations, which is that the author obtained from cotton cellulose only 40 to 50 per cent. of its weight of the hexose (dextrose), either as such, or calculated from the yield of ozazone, and from sulphite celluloses less than one-half this yield.

This work we commend to the careful study of those who take a special interest in cellulose chemistry. In this case also we can commend the author's minutely detailed record of experimental conditions, which are quite essential. The only criticism we offer is that the work would have been more fruitful if spread over a smaller range of the intermediate products.

The differentiation of these is relatively unimportant. The concentration of the investigation upon the endeavour to account in any one case for the 100 parts of cellulose taken into work, in terms of the final products of hydrolysis, would have furnished a much more valuable and positive contribution to *the* fundamental problem.

As a further suggestion, the resolution of the acetate or "Acetolysis" of cellulose appears to be more promising of attaining to ultimate hydrolysis, the elimination of OH groups keeping the breakdown of the complex on simpler lines of cleavage (comp. W. Schliemann, *Annalen*, 378, 366, 1911).

Much work is being done in this direction, and we may expect before long to integrate the contributions from the two directions of experimental study into comprehensive schematic constitutional formulæ for the typical celluloses. We may anticipate from this a new light on "organic" chemistry in the full sense of the term.

OUR BOOK SHELF.

The Law of Sex Determination and its Practical Application. By Laura A. Calhoun (Mrs. E. E. Calhoun). Pp. 254. (New York: The Eugenics Publishing Co., 1910.) Price 1.50 dollars net.

THE theory suggested in this book is that "the sex of the embryo in man and the higher animals is determined in the ovary from which the ovum in question is developed. In the normal female the ovary of the right side yields ova which on fertilisation develop as males, and the ovary of the left side yields ova which are potentially female." "The writer is not in a position to furnish absolute verification, through methods of anatomy or physiology, of her theory. She has no laboratories nor methods of precision by which her theory can be directly tested. But she is convinced of its truth from her own extensive experience in its practical application for a period of thirty years." She has instructed her friends, and "the results have always verified the law, which during thirty years of observation and testing have never failed."

We shall not give away the ingenuous author's practical recipe, but the general theory is that the right ovary is responsible for the males. This will be good news for those who believe that men are always in the right. "In normal mothers the right ovary always produces ova that, when fertilised, develop as boys. The left ovary always produces ova that, when fertilised, develop as girls. And the mother determines the sex of her child when she consciously or unconsciously directs the fertilising spermatozoa to her right or left ovary." The evidence in support of the theory consists of references to a relatively small number of cases where obedience to the author's practical suggestions was followed by the appearance of a girl or a boy as desired.

A theory similar to the above was brought forward in 1909 by Rumley Dawson, and in dealing with either of them we are met by the difficulty of applying precise experimental tests in the case of man. The experiments of Doncaster and Marshall, reported in the *Journal of Genetics*, November, 1910, show that "in the rat it is not true that ova determining one sex are produced from one ovary, and those determining the opposite sex from the other, for each rat, with one ovary completely removed, produced young of both sexes. This does not, of course, prove that the "right and left ovary hypothesis" is not true for man, but its definite disproof for another mammal detracts from its probability." It may also be recalled that birds have only one ovary.

The book before us is in great part made up of quotations, mostly from sound authorities, such as E. B. Wilson, W. E. Castle, L. Cuénot, and T. H. Morgan. It is a well-intentioned book, but it does not contribute much to the difficult problem discussed.

New Zealand Plants and their Story. By Dr. L. Cockayne. Pp. viii+190. (Wellington: John Mackay, 1910.)

FOR some years past it has been Dr. Cockayne's endeavour to arouse amongst the settlers in the Dominion a better knowledge and appreciation of their

exceptionally interesting native flora, and with this object he has, in addition to his various official reports, contributed from time to time popular botanical articles to different local journals. The material for several of these articles has been worked up into the more homogeneous ecological account now published by the Government of New Zealand for the benefit of private individuals and for instruction in schools.

The wealth of botanical treasures is truly great. Thus the forests comprise mixed forests—in which the ancient kauri pine, *Agathis australis* and *Beilschmiedia tarairi*, are conspicuous—and pure forests of *Podocarpus dacrydioides* and Nothofagus. The mixed forests are the homes of abundant lianes—to mention only species of Metrosideros, the liliaceous *Rhizopogon scandens* and *Lygodium reticulatum*—many tree ferns and epiphytes. No less interesting are the shrubs, chief amongst which are the subalpine species of Olearia, Cassinia, and Veronica, while the manuka, *Leptospermum scoparium*, and allied species play an important part in the physiognomy of the native heaths. Then again the alpine meadows are rich in floral gems, notably species of Euphrasia, Ourisia, Celmisia, and Ranunculus. Amongst plant curiosities the vegetable sheep, *Raoulia eximia*, is the most unique.

In addition to the ecology, chapters are devoted to an account of the early explorers, naturalised plants, the stories of four common plants—New Zealand flax, manuka, Fuchsia, and *Cordyline australis*—and plant cultivation. The few examples noted above will serve to indicate how rich and unique is the New Zealand flora; Dr. Cockayne's treatment is fully equal to his subject, and one could only wish that he had much more space to enter into greater detail. The numerous illustrations, although imperfectly reproduced, contribute a better realisation of the plant scenery.

De la Méthode dans les Sciences. Deuxième Série. by B. Baillaud, L. Bertrand, L. Blaringhem, E. Borel, G. Lanson, L. March, A. Meillet, J. Perrin, S. Reinach, and R. Zeiller. Pp. iii+365. (Paris: Félix Alcan, 1911.) Price 3.50 francs.

THE first series of studies in the methods of science by distinguished French writers was reviewed in NATURE on September 23, 1909 (vol. lxxxi., p. 361). The present volume has the same general characteristics, though the point of view is more technical and less philosophical. The following branches of science, which were not dealt with in the former volume, receive attention—astronomy, physical chemistry, geology, botany and palæobotany, archæology, literary history, linguistics, and statistics. The essays should assist in providing the reader with a broad general view of scientific methods, and help to correct the narrowness which may result from a too exclusive absorption in a restricted field of scientific investigation.

Essays in Historical Chemistry. By Sir Edward Thorpe, C.B., F.R.S. Third edition. Pp. xii+601. (London: Macmillan and Co., Ltd., 1911.) Price 12*s.* net.

PREVIOUS editions of this valuable work have been reviewed in these columns at some length, the first in our issue for April 12, 1894 (vol. xlix., p. 551), and the second in that of August 14, 1902 (vol lxvi., p. 365). The present edition differs from the last in including the memorial lecture on Julius Thomsen delivered to the Fellows of the Chemical Society on February 17, 1910. We also notice an addendum to the life of Prof. Stanislao Cannizzaro, who died at Rome on May 10, 1910.

School Planning at Home and Abroad. By William H. Webb. Pp. 42. (London: The Sanitary Publishing Co., Ltd., 1911.) Price 1*s.* net.

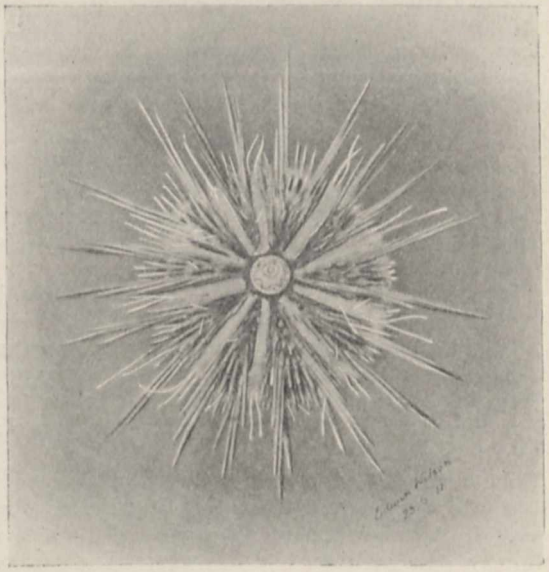
AT the annual congress of the Royal Sanitary Institute, held in September last at Brighton, Mr. Webb read a paper on "Large Public Elementary Schools in Town Districts." The paper is here published in book form, and illustrated by plans and other diagrams. Mr. Webb's inquiries respecting the characteristics of school buildings in various parts of Europe and America enable him to provide those responsible for the design of new schools with many useful hints.

LETTERS TO THE EDITOR.

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

The Rearing of Sea Urchins.

I ENCLOSE a photograph which may interest your readers. It is one of a water-colour painting of a sea-urchin, magnified 4 diameters, which has been reared in my laboratory by Dr. Cresswell Shearer. It is a hybrid, a cross between *Echinus milearis* (male) and *E. esculentus* (female), both obtained from the Plymouth Marine Laboratory. The cross was effected in the early part of March last. It was kept in thoroughly aërated seawater for



some time, but has for the last three months been living in a bell-jar with part of an old crock covered by worm tubes, without the water being aërated in any way. It generally shelters in the day time under the crock. When disturbed, it moves actively away from the light, and still appears thoroughly healthy. It shows what may be done in an inland laboratory with simple appliances.

J. STANLEY GARDINER.

Zoological Laboratory, Cambridge, July 10.

Absorption Markings in "K" Spectroheliograms.

MR. EVERSHED'S remarks in NATURE of May 11 cause me to think that possibly an essential difference in the method employed for reproducing original negatives for journalistic purposes might go far towards explaining the difference of definition and richness of detail in M. Deslandres' plates. Anyhow, we are now assured that the Kodaikánal negatives show in the main the same structures as those taken at Meudon. Yet if the former admittedly permit such a great amount of K_2 radiation to

mingle with K_3, it seems to me risky to base certain reasonings on the appearance of the resulting spectroheliograms. Accepting Prof. Hale's interpretation, given now many years ago, that K_3 represents the highest level and K_2 an intermediate one, I submit that the Meudon plates are more likely to represent the true spectroheliographic aspect of the sun. It may be, as Mr. Evershed says, that the dark concentrations called flocculi are entirely due to variations in the intensity of the narrow absorption line (or, in my opinion, rather the other way about); but is not this variation due, if not entirely, at least to a great extent, to the presence or absence or degree of intensity of the K_2 radiations on either side of K_3? A study of M. Deslandres' spectroheliograms taken on the sectional principle leads one irresistibly to think so. From the preceding remarks anyone can gather why I considered, and still do, the assumption of alternating appearance and disappearance of the large flocculus covering the range of prominences during March and April, 1910, rather unlikely.

As regards the points raised by me about absorptively acting clouds seemingly cutting off the range of prominences sharply at one common level, I must adhere to my statements. They are the result of *repeated* direct observation, and the phenomenon was strikingly on view again only as recently as April 26, when a fine range of prominences on the north-east limb showed it fairly well. I have given in *The Observatory* recently a summary of my observational experiences up to date, and amongst other matters also refer to the often seen phenomenon of dark matter being interposed between solar prominences and the observer at levels attained by the luminous portions of the prominences themselves. Such observations have by no means remained unique, and I possess, through the kindness of Mr. Slocum, a pair of excellent photographs depicting it in a case of some fine prominences seen during October, 1910. As regards my several visual observations of apparently overlying flat and dark clouds (*darker* than the general dark tint of the surrounding sky) abruptly stopping the bright upwards flowing prominence vapours, I feel certain that if Mr. Evershed had been at my side at the time his practised eye would not have failed him to see what I saw, but whether he would have been able to record it on a photographic plate in monochromatic light (Hα) without an eclipse I hesitate to say. I hope, however, that the hypothetical overlying cloud will not be taken as of the nature of "smoke" over a fire. In my opinion it is more a case of the rather abrupt entry of rising hot vapours into a well-defined, more or less horizontal, stratum of considerably less temperature, and that at a comparatively abnormally low solar level. I readily admit that the cases are few where the circumstances necessary for the phenomenon favourably combine with the all too rare cases of the equally necessary perfect definition.

ALBERT ALFRED BUSS.

"Barrowdale," 22 Egerton Road, Chorlton-cum-Hardy, Manchester, May 13.

IF it is true, as Mr. Buss suggests, that variations in the intensity of the components of the emission line K_2 on either side of the absorption line K_3 are sufficient to account for the dark markings occasionally found in spectroheliograms, then the Kodaikánal plates should show them as conspicuously as those taken with a high dispersion instrument, which isolates the central line. Yet this, as Mr. Buss has himself pointed out, is not the case. In studying high dispersion spectrum photographs of the solar disc, one occasionally discovers places where the K_3 line is abnormally dark, and the same thing may also be well observed in the line Hα. When the spectroscope slit chances to cross one of these linear markings, an intensely black spot is seen on the absorption line, and this will usually remain visible or run along the line if the solar image is moved slightly. In the case of the lines H and K, the components of the emission lines H_2 and K_2 are, I think, always weak at the points of greatest darkness in the absorption lines, and for this reason they may possibly contribute somewhat to the final result in our plates.

The intermittent character of the absorption marking described by me in *The Astrophysical Journal* for January is, I think, demonstrable from a careful study of our spectroheliogram negatives, notwithstanding the fact that these plates are of a somewhat composite character, representing the sun in K_2 and K_3 radiations. The disappearance of the enormously extended marking between March 25 and 26, 1910, could be accounted for, it is true, on the supposition that in the interval between these days there was a development of velocity in the line of sight exceeding 15 kilometres per second; this would alter the wavelength sufficiently to throw the dark K_3 line entirely off the camera-slit. But such motion in a prominence usually, if not always, presages a complete dissolution.

Instances of the rapid disappearance of these curious absorption markings are not infrequently met with in Hα spectroheliograms, which show them so much more clearly than do the low dispersion calcium plates. Since completing the construction of the new auto-collimating spectroheliograph of this observatory, I have obtained a nearly continuous daily series of Hα plates during April and May of this year. These are taken with the camera-slit adjusted on the central portion of the line, and represent the highest levels on the sun. The images show most of the prominences as absorption markings on the disc, and some of them are so dark as to appear like clear glass in the negatives. Already in this short series several cases have been noted of the disappearance within twenty-four hours of very large masses of absorbing material.

An interesting example was photographed on May 27 at 2h. 28m. and 2h. 53m. a.m. G.C.T. The disc of the sun in these plates appears to have had a large letter S engraved upon it with great distinctness. If drawn out into a straight line, the S would measure more than 150,000 miles in length. On the following morning we examined the plates with great curiosity to see what the next letter might be! The main portion of the marking had, however, entirely disappeared, and only a few small patches remained. This marking came into being with equal suddenness, for an excellent plate taken on May 26 shows no trace of it.

While agreeing with Mr. Buss as to the occasional presence of small patches of absorbing matter interposed between a prominence at the limb and the observer, I am sorry that both our visual and photographic records are entirely at variance with him with regard to the supposed absorbing clouds overlying certain prominences, which appeared to Mr. Buss to be cut off at one common level. I have before me the K-line negatives and the drawings in Hα of the prominences of March 17 and 18, 1910, and April 26 and 27, 1911, both of which Mr. Buss has cited as instances. These prominences were observed here and photographed under almost as good conditions as can be had at 7700 feet altitude, and the photographs show a mass of detail in the higher parts, especially in the prominence of 1910. Yet there is no trace of any such appearance as Mr. Buss has described; the highest filaments rise to many different altitudes, both on the drawings and photographs.

I may perhaps mention that reproductions of our photographs of the 1910 prominence, as well as some of the solar disc showing the absorption markings, have been sent as an exhibit to the Indian Section of the Festival of Empire.

J. EVERSHED.

Kodaikánal Observatory, June 12.

Hamilton and Tait.

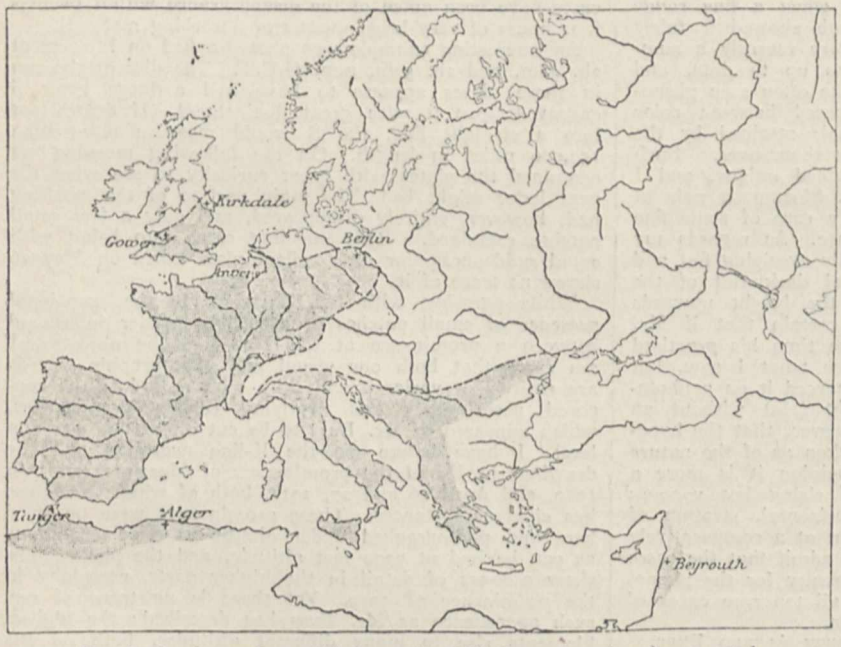
THOUGH I did not miss the passage in his Life of Tait to which Dr. Knott refers in NATURE of July 20 (p. 77), I forgot about it when I wrote my review. The point as to Hamilton's activity in quaternionic work is not of very great importance, but my statement is borne out by Graves's Life of Hamilton, which I read long ago, and have again referred to, as well as by the published correspondence. Tait's introduction to Hamilton took place in 1858; Graves states (vol. iii., p. 97) that Hamilton allowed himself to be diverted *in 1857* from quaternions—the task, he says, of writing the "Elements"—by the subject of definite integrals. According to Dr. Knott, Hamilton did not begin the composition of the "Elements" until a good deal later, and this view would appear from Dr. Knott's statement, and from Hamilton's own language in his letters, to be correct.

A. G.

OTHER CONTEMPORARIES OF MAN AND THE REINDEER AT MENTONE.[1]

IN NATURE, October 10, 1907, appeared a notice of the stratigraphical and anthropological results obtained from the examination of the Baoussé-Raoussé caves at Mentone. In the work at present under review we obtain the no less important geological and palæontological results. It may be said at the outset that this subsequent volume is in every sense a worthy companion to the preceding volumes, which fulfilled in an exemplary manner the many tedious requirements which modern archæology exacts from those who undertake the investigation and description of these valuable and irreplaceable records of the past, Not the least part of the debt which archæologists owe to MM. Boule, Verneau, and de Villeneuve is due to the admirable methods which they have instituted.

The volume at present under review contains a full account of the various animal bones recovered from these caves. The bones of each animal are first carefully considered, and so far as is possible a general idea is obtained of the animal as it is represented in the deposits within these caves. The information thus obtained is next checked, confirmed, and extended by comparing the Baoussé-Raoussé specimens with those contained in the various museums of Europe. A no less interesting comparison is then instituted between these extinct forms and the forms living at the present day. Attention is next directed to the exact stratigraphical position in which the bones were discovered, and from this evidence the order of arrival of the Pleistocene mammals in the Mentone district is deduced. Not content with this, M. Boule furnishes us with a series of most useful maps of Europe and the adjoining parts of Asia and Africa showing the areas from which the remains of some of the larger and more important animals have been reported. The methods employed will thus be seen to be as perfect and exhaustive as they were no doubt laborious. Measurements of bones are almost entirely eschewed, M. Boule believing, with many others, that measurements arbitrarily chosen are in no way superior to simple observation, nor are they likely in his opinion to disclose such specific characters as would be likely to be hidden from the trained and experienced eye. Instead of long lists of measurements of dubious value, the text is enriched with a large number of admirable photographs, which in some respects possess an advantage over the actual specimens themselves.



Map showing the area from which the remains of *Elephas antiquus* have been reported.

The bones recovered were obtained from the Grottes du Prince, des Enfants, and du Cavillon. They comprised parts of the skeletons of the following:—*Elephas antiquus, Rhinoceros merckii, Equus caballus,* Hippopotamus, *Sus scrofa, Bos primigenius, Bison priscus, Cervus capreolus, Cervus elaphus, Cervus samonensis, Cervus tarandus, Cervus alces, Rupicapra tragus,* and *Capra ibex.*

The presence of *Elephas primigenius* was uncertain; *Rhinoceros tichorhinus* was absent. The Equidæ were represented by specimens which, though relatively few in number, were of wide distribution, being scattered through and recoverable from all the beds. M. Boule believes that he can recognise with considerable confidence the remains of *Equus asinus.* The vast majority of the specimens, however, belong to *Equus caballus* and to the subdivision of that species which has been variously named *Equus caballus,* Linn., *Equus caballus typicus* (Cossar Ewart), *Equus robustus* (Frank). Contrary to the expectations of those who have studied the carvings and engravings of the reindeer period, neither *Equus przewalskii* nor the zebra can be shown to have been present.

Pigs were abundant. In the Mentone neighbourhood *Bos primigenius* made its appearance quite as early as *Bison priscus,* if indeed not earlier. *Bos longifrons* was absent. *Cervus capreolus* was present as a vigorous form of the existing animal. *Cervus elaphus* and *Cervus samonensis* were considerably larger than modern specimens. *Cervus tarandus* made its appearance suddenly in Mid-Pleistocene deposits; it was only found in any numbers in the Grotte du Cavillon. *Rupicapra tragus* was of a vigorous type showing affinities to the chamois of the Alps and of the Pyrenees. *Capra ibex* was represented by such a large number of specimens that M. Boule hopes to see some day a complete reconstructed skeleton of this animal at the Musée d'Anthropologie de Monaco. He considers it to be the ancestor of the Alpine goat of to-day.

This most interesting and valuable volume will thus be seen to confirm the opinion which has slowly but surely ripened to a conclusion that there has been no sudden or complete break in the evolution or history of the fauna of western Europe from Palæolithic to Neolithic times. There has further been little if any natural organic evolution in the larger mammalia from the earliest Pleistocene to the present day. Some of the animals of the Pleistocene have disappeared through changes in climatic conditions or under the

[1] "Les Grottes de Grimaldi" (Baoussé-Raoussé). Tome i., Fascicule iii., Géologie et Paléontologie (suite), by Prof. M. Boule. Pp 157–236+plates xiv–xxix. (Monaco, 1910.)

unrelenting hand of man; others have deteriorated in size and vigour as they have gradually come under the yoke. The horse, however, forms a notable exception, having from obvious reasons improved in physique and gained in strength. Such minor changes, changes of degree rather than of kind, are all that evolution can lay claim to have effected in these stubborn mammalia within the compass of some thousands of years during which Mentone has known the two extremes of climate and temperature.

Another great assistance rendered by the work of M. Boule is that he has enabled us with more certitude than was possible before to reconstruct the milieu of certain of our Palæolithic ancestors; for, from the fauna it is not difficult to realise the nature of the flora or the conditions of the climate. With the information thus obtained we can apprach the stone and bone implements which the man of that remote date has left, and deduce more confidently what were the purposes they served. A knowledge of the fauna is thus seen to be the key which will most successfully unlock many of the sealed chambers of man's past. Apart, however, from all this, the study of the extinct Pleistocene fauna possesses in itself great and abiding interest, and dull must be the archæologist or anthropologist who does not desire further knowledge concerning these early companions of man whose bones lie commingled with his in river drift and cave floor.

The book is a most valuable contribution to science, and reflects the greatest credit on everyone concerned.

WILLIAM WRIGHT.

THE TYPES OF WATER WAVES.[1]

DR. CORNISH has produced an attractive and valuable book. The volume is not the less valuable in that it is primarily descriptive, and in that the author shows great caution and reserve as regards speculative explanations. This caution is indeed amply warranted. The mathematical theory of water waves, successful as it is up to a certain point, is limited in its application by the fact that it contemplates only specially simplified conditions. In particular, owing to the restriction to *small* amplitudes, it can at present offer little in the way of explanation of various important natural phenomena, where what is technically called "turbulent" motion comes into play. Laboratory experiments, on the other hand, require elaborate and costly arrangements, which are only provided with difficulty even when a definite practical problem is in view; and in some respects the mere question of scale would impair their relevancy. There remain only observations in the open, such as the author has recorded in the present book. The extreme difficulty of these, from a quantitative point of view, is well illustrated by his discussion of storm-waves at sea.

FIG. 1.—Wave-track of Steamer on Thunersee, showing thwart-ship and diverging waves. From "Waves of the Sea and other Water Waves."

The book is made very readable by the fact that the author's interest in his subject is evidently æsthetic as well as practical or scientific. He is fascinated by the extraordinarily beautiful and varied types of wave motion which are presented by nature, and has recorded a number of these, observed at sea or on land in many parts of the world, in a series of remarkable photographs.

[1] "Waves of the Sea and other Water Waves." By Dr. Vaughan Cornish. Pp. 374. (London: T. Fisher Unwin, 1910.) Price 10s. net.

The book consists of three parts. In the first of these, treating of deep-sea waves, the evidence of various writers as to the dimensions of storm-waves in different ocean basins is collated, and supplemented by the author's own observations. Accurate measurements are from the nature of the case very difficult, but it appears that there is a limit to the height (from crest to trough), which different observers concur in placing at about 40 feet, whilst the limit to the length is somewhere about 600 feet. The waves are longer and higher the longer the "fetch," *i.e.* the extent of water to windward, where the waves are generated. As to the mode in which waves grow under the influence of wind in a storm, we have at present little beyond general indications. Another subject here referred to is that of the much longer and lower waves which constitute the "swell" of the ocean. To the eye this is often scarcely perceptible at sea, and the only method of accurate observations consists in timing the waves as they break on the shore, where they are exaggerated by the shoaling of the water. In this way some inferences can be made, as pointed out by Stokes, as to the distance of the seat of the original disturbance to which the swell is due.

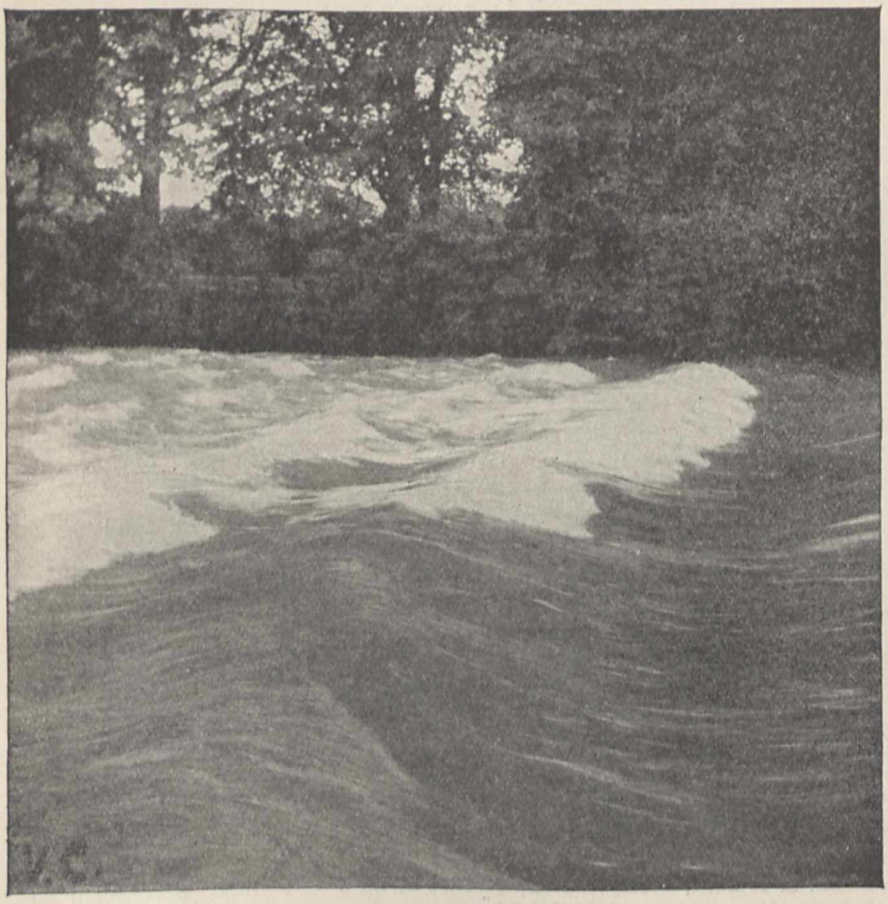


FIG. 2.—Stationary waves caused by a weir on the River Aare, Switzerland. From "Waves of the Sea and other Water Waves."

The second part of the treatise deals with the action of sea-waves in transporting shingle, sand, and mud. This is of enormous practical importance, and can be dealt with to some extent experimentally. From a theoretical point of view it is very difficult, and we shall not attempt here to discuss the contribution which the author makes to speculation on this subject.

The concluding section gives an interesting account, with admirable illustrations, of the "bore" or abrupt tidal wave observed in the Severn and other rivers, and of the stationary waves in flowing water due to fixed obstacles. Finally, the remarkable configuration of "ship-waves," first elucidated by Lord Kelvin, is exhibited in some beautiful photographs. These show clearly the system of "transverse" waves, which were (we believe) unnoticed in the earliest tank experiments until their existence had been pointed out by theory.

FIVE-HUNDREDTH ANNIVERSARY OF THE UNIVERSITY OF ST. ANDREWS.

FROM September 12–15 next, inclusive, this celebration will be held in the ancient ecclesiastical capital of Scotland, with all the ceremony it is possible to have in the circumstances. Though the university was not founded until 1411, yet St. Andrews for centuries previously had various teaching institutions in connection with the learned religious bodies in the monasteries of the Culdees and other sects concentrated in the ancient city, the preceptors of which had been trained in the English or Continental universities, especially those of France and Italy. Steps, indeed, had been taken before this period to further the interests of the Scottish students by the founding of the Scotch College (Balliol) at Oxford by Lady Devorguill, the wife of John Baliol; whilst the good Bishop of Moray had instituted in 1326 the Scotch College in Paris. No university, however, existed in Scotland, so that her students had to study for degrees elsewhere, and in the unsettled state of the times had not infrequently to encounter difficulties and hardships—even to the occasional capture by their then hostile neighbours, the English—on their way to other countries. Such was the condition of things when Henry Wardlaw was appointed to the bishopric of St. Andrews, and as he was a man distinguished for his wide culture, munificence, and great influence, it was not long before he found an opportunity. Eight years after his appointment to St. Andrews, viz., in 1411, the thoughts which doubtless had been revolving in his mind for a long time took shape and were put in action. A *Studium Generale* was at once commenced with the aid of a staff of able teachers in the faculties of law, divinity, and arts. He drew up a foundation-charter of the university, and forwarded it by envoys to the Pope (Benedict XIII.), who endowed it by means of papal bulls with all the powers of a university in 1413—to teach science, philosophy, and medicine, and this was subsequently confirmed by King James, who was throughout a staunch bene-

factor to the young institution. Thus the Scottish youth were no longer compelled to seek higher instruction out of their own country.

At the celebration in September will assemble noblemen, one of whom, the Marquis of Ailsa, is the lineal descendant of Bishop Kennedy (grandson of Robert III.), the founder of St. Salvator's College, whose elaborately carved tomb is one of the sights of the college chapel; delegates from the universities of Britain, and all her Colonies and Dependencies; from America, Austria-Hungary, Belgium, Denmark, France, Germany, Greece, Holland, Italy, Japan, Norway, Portugal, Russia, Finland, Sweden, Switzerland, Spain, and Turkey. Besides others distinguished in science and literature, representatives of the various learned societies in Great Britain and her Colonies, of almost all the foreign countries mentioned, official persons connected with all the churches in Britain, officials of the College of Justice, naval and military authorities, parliamentary leaders and members, sheriffs and heads of various departments, will grace the ceremony, together with former teachers, graduates, and students of the university, and the present staff both of St. Andrews and Dundee.

The programme of the proceedings, as at present arranged, will comprise a reception by the Chancellor of the University, Lord Balfour of Burleigh, in the large temporary hall, St. Andrews, a students' torch-light procession, and a students' symposium on the evening of Tuesday, September 12. On Wednesday, September 13, a procession will be formed in the college quadrangle, and will proceed to the Church of the Holy Trinity, where a religious service will be held. Then, after an interval, the presentation of addresses will be made in the temporary hall, and thereafter an address will be given by the Chancellor. In the evening historical tableaux in the Great Hall, an illumination of the city, and a procession will take place. Lastly, a second students' symposium will conclude the proceedings of the day. On Thursday, September 14, a graduation ceremonial will be held in the Temporary Hall, at which a large number of distinguished honorary graduates in law (LL.D.) and divinity (D.D.) will be capped. Thereafter the rector, Lord Rosebery, who represents the students, and who will be escorted by a guard of honour formed of the Officers Training Corps of the university, will be installed, and will deliver his address. In the afternoon garden-parties will be held at Mount Melville, at St. Leonard's School for Girls, and probably also at the Gatty Marine Laboratory. In the evening a banquet will take place in the Bell Pettigrew Museum, which will likewise be declared open. Contemporaneous receptions by the ladies of the university will further occur, both in St. Andrews and in Dundee the same evening, so as to include all guests and hosts, and especially ladies and students. Friday, September 15, will be mainly devoted to Dundee, commencing with a reception and addresses at University College, followed by a reception by the Corporation of Dundee, and a luncheon in the Art Galleries of the Albert Institute. Thereafter, excursions to Glamis Castle, Rossie Priory, and a sail to Perth, as well as visits to places of interest in Dundee, will occupy the afternoon. The day will be concluded by a graduates' and students' dinner in the Bell Pettigrew Museum, in St. Andrews, and a students' ball in the Temporary Hall.

The fine old ruins, so full of stirring historical associations, in St. Andrews, its old Tower of St. Regulus, usually called the Square Tower, one of the oldest buildings in the land, the home of Sir David Brewster, the most renowned principal of the university, the earliest Marine Laboratory in Britain, the fine Chemical Research Laboratory, the extensive stretch of sand—east and west—with the fringe of rocks, so full of interest to the geologist as well as to the zoologist, the zoological and botanical riches of the well-known bay, and the prominent part it has taken in initiating scientific fisheries' research—all combine to render the old cathedral city, where many Scotch parliaments were held, one of great interest. The unique silver maces, and the archery medals won by the young Scotch nobles who attended the university in the olden time, and many of whom afterwards became famous in the history of the country, are other features (not to allude to the splendid golf links) of interest to the distinguished visitors to the celebration of the 500th anniversary of the university in September.

W. C. M.

NATIONAL ASSOCIATION FOR THE PREVENTION OF CONSUMPTION.

CONFERENCE ON TUBERCULOSIS.

THE conference on tuberculosis, held on July 19–21, organised in connection with the exhibition sent round the country by the National Association for the Prevention of Consumption, stationed at the Caxton Hall, Westminster, was as successful as those held during the past couple of years at Edinburgh, Cambridge, Oxford, and other centres throughout the country. Indeed, in certain respects the conference, recently brought to a conclusion, was more interesting and attracted greater attention than any one of its predecessors. The announced object of the conference was to discuss Mr. Lloyd George's Insurance Bill, or rather those sections and clauses of the Bill dealing with the prevention and treatment of tuberculosis; and at the opening meeting the members had the advantage of listening to an able address given by the President of the Local Government Board, who, as he himself put it, has, amongst his numerous and multifarious interests, specialised somewhat in tuberculosis and infant mortality.

Mr. Burns set himself to describe what has been done to bring down the mortality from tuberculosis during the last few years. As is usual with him, he illustrated his points by telling examples, of which two may be taken as likely to impress those interested in this subject even to the slightest extent. The first of these he drew from military life. A little more than thirty years ago the Guards were a body of eight thousand men—none finer or so fine in the world, maintained Mr. Burns—healthy, picked men, of fine physique, yet the death-rate from tuberculosis was a fraction above twenty. To-day what do we find? A little common-sense sanitation, better ventilation, and greater sobriety amongst the men together have brought down the death-rate from tuberculosis to 3·1. As Surgeon-General Evatt insists: what has been done in the barracks it should be possible to do in civil life. Not so quickly, perhaps, but certainly in the long run.

Coming down to later times, Mr. Burns points out that to-day in London only two persons succumb to tuberculosis where twenty years ago three lives constituted the toll to this disease. Again, for every two lives so lost in London, Berlin loses three and Paris five. This is a serious matter for our French friends, and "gives one furiously to think." How can this be accounted for? Certainly not by a single factor; but Mr. Burns makes a suggestion and gives certain figures that are well worthy of consideration.

During the last ten years the fall in the mortality from consumption has been, in Great Britain, 19; Scotland, 24; Ireland, 24; Germany, 18; London, 30; Berlin, 24; Paris, 3. This period synchronises with that during which the National Association for the Prevention of Consumption has been at work—also with Mr. Burns's term of office at the head of the Local Government Board; but during the same period the drink bill per head of the population in this country has fallen from 4*l.* 12*s.* to 3*l.* 6*s.* 8*d.* In Paris, on the other hand, no such fall has been recorded. Whether this be a cause or a symptom merely, this aspect of the question must receive careful and respectful consideration. Other points were brought forward during the conference, often with great force and wealth of argument. One thing which stamped this conference as something out of the common run of such meetings was the fact that enthusiastically as each man spoke of the special branch of the subject on which he was engaged, there was none of the "pushing of wares" to the exclusion of everything else that has sometimes characterised such meetings.

The optimistic note struck by the President of the Local Government Board in his opening address was sounded again and again by later speakers, the most hopeful of whom looked forward to the extermination of tuberculosis from cattle and man alike within the next thirty-five or fifty years, maintaining that this could readily be effected if a proper apportionment of the resources at the command of those who are dealing with the disease can be arranged. The credit of the sanatorium treatment has suffered in certain quarters from the fact that careless advocates have assigned to it functions that it was not fitted to perform, whilst others, opponents, equally careless and uninformed, have not taken into account the educational function of the well-governed and properly directed sanatorium. All are agreed, of course, that it is impracticable to submit all tuberculous patients to ordinary sanatorium treatment, and that the dispensary system must be brought into play to assist and supplement the work of the sanatorium. This dispensary system has many earnest advocates, and with certain extensions and linking up with the sanatoria on one hand and the hospital on the other there lie within it great potentialities.

In connection with the section of preventive work the optimistic spirit that manifested itself throughout threw into strong relief the feeling that far more might be done in the provision of open-air shelters, for tuberculous patients attending dispensaries and continuing at work, than has yet been done. Several speakers directed attention to the luxurious sanatoria that have been erected in various parts of the kingdom, where, owing to the enormous initial cost and the great expense of administration, the charges must necessarily be prohibitive except to those well endowed with this world's goods. Are these costly buildings necessary or even desirable? they ask. If tuberculosis is to be eradicated within the next thirty or forty years, to what use can such large and solid buildings be put when they have served their primary purpose? Moreover, would not the process of eradication of tuberculosis go on much more quickly if the money spent on these palatial buildings could be directed to the provision of a large number of open-air shelters, in some cases grouped around more solidly constructed administrative blocks, in others placed at the disposal of the dispensaries for the accommodation of single patients at or near their own homes? These shelters might be very inexpensive, and, in many cases, might be destroyed as soon as they had served their purpose. More substantial and comfortable buildings for the reception of patients in the later stages of the disease, where there is little to be hoped for from treatment except alleviation of pain—buildings from which should be dissociated all names and terms likely to depress the patient—may well be provided, even at somewhat substantial outlay, especially as after they have served the purpose for which they are designed they may be converted into hospitals for the reception of other classes of patients.

The question of different methods of medication is not one to be discussed at a public conference, and, very judiciously, was not taken up. Some of the speakers, however, referred to the necessity for the continuance of experimental work. Here the prophecies of the President of the Local Government Board should have some weight in determining the nature of the efforts to be made and the character and mode of financing these efforts. It is certainly unnecessary to make provision for permanent endowments for the carrying on of this work. An immediate liberal subsidy will be of far greater value in ensuring the desired results than a large sum set aside of which only the interest can be used.

As in the case of shelters, &c., the money available should be utilised to cover as much ground as possible and *at once*. Extensive and immediate treatment, both curative and preventive, and well-devised experiments carried out as promptly and on as large a scale as possible, will do far more to stamp out tuberculosis than will efforts extending over a longer period, and in the long run far more costly.

The National Association for the Prevention of Consumption has been working away quietly and systematically for some time; much of its work in the earlier days of its existence was spadework of a very unobtrusive character, and certain critics, perhaps not very kindly disposed, have from time to time been prone to grumble at what they were pleased to call its inertness. For several years past, however, such criticism has been seen to be very much beside the mark, and the London conference, which was the last of a long series, has supplied ample evidence of the valuable work that has been done by the Association, demonstrating to those most directly concerned "what they shall do to be saved" from the white plague. With the facilities now offered by Mr. Lloyd George for putting into force some of the methods recommended by the conference, with a united effort made in matters on which all are agreed, such a shrewd blow may be struck at tuberculosis as it has not received since Koch made the announcement of his epoch-making discovery—the discovery of the tubercle bacillus.

DR. JOHN BEDDOE, F.R.S.

WE regret to have to record that Dr. John Beddoe, the distinguished anthropologist, died on July 19 at Bradford-on-Avon.

Dr. Beddoe, who was born at Bewdley in 1826, was the first to make exact observations on the physical characters of living races over wide areas, and he will always be regarded as the founder of our knowledge of the physical anthropology of the living populations of Europe.

So early as 1846 he began to make observations on hair and eye colours in the West of England, and though he found his first system unsatisfactory and abandoned it, he resumed the work, on the occasion of a visit to Orkney in 1852, and continued these observations to the end of his active life when-

ever his travels brought him in contact with new peoples.

Owing to his delicate health in childhood and youth, he was cut off from outdoor games and sports, but made good use of his time indoors by devoting it to a course of wide and solid reading. The effect of this is seen in the numerous and illuminating historical and other allusions in his anthropological books and memoirs.

Abandoning the study of the law, for which he was at first destined, he found a much more congenial study in medicine. He commenced his medical studies at University College, London, and completed them at Edinburgh University, where he took his M.D. in 1853. He was house physician at the Edinburgh Infirmary for fifteen months under the direction of such distinguished physicians as Christison, Simpson, and Syme.

In 1854 the Crimean War offered him the opportunity of visiting eastern Europe as a member of a civil medical staff sent out by the War Office to supplement the work of the military staff. Here he made good use of spare time to make observations on the Turks and other Eastern races he came in contact with.

On his return from the Crimea he resolved to spend a winter of study in the Vienna hospitals, and in his journeyings to and from Vienna he collected a great deal of anthropological material in Holland, Germany, Austria, Hungary, and Italy.

In 1867 he was awarded by the Council of the Welsh National Eisteddfod a prize of a hundred guineas for the best essay on the origin of the English nation. His essay was afterwards expanded into his well-known book, "The Races of Britain."

In 1868 Dr. Beddoe was president of the Anthropological at the same time that Huxley was president of the older Ethnological Society. The amalgamation of these two rival societies into a single society, the Anthropological Institute (now the Royal Anthropological Institute), which has done so much to promote the study of anthropology in this country, was due to a great extent to the efforts of Beddoe. He also took an important part in the movement which led to the constitution of anthropology as an independent section at the British Association.

Dr. Beddoe was president of the Anthropological Institute in 1889. In 1890 he delivered the Rhind Lectures on "The Anthropological History of Europe," a work which shows his unique knowledge of the physical characters, the migrations, and evolution of the peoples of Europe. In 1905 he delivered the Huxley lecture of the Royal Anthropological Institute, and quite lately he was appointed honorary professor of anthropology in the Bristol University.

When we consider that the large amount of anthropological research done by Beddoe was carried out during the intervals of leisure in a busy professional life, we cannot help being astonished at the amount of very valuable work he has done, nor withhold our admiration for the devotion to science which enabled him to persist in it through so many years. Beddoe was a pioneer in a new line of scientific investigation, and his example has been powerful in stimulating other investigators to carry out similar work. The great survey of the hair and eye colours of the school children of Germany carried out by Virchow was without doubt due to the stimulus of Beddoe's pioneer work, and a great deal of similar work has since been carried out by other investigators. The name of John Beddoe will always occupy an honourable place in the history of anthropology.

DR. H. TIMBRELL BULSTRODE.

DR. H. TIMBRELL BULSTRODE, who died suddenly from heart failure on July 22, was one of the senior medical inspectors of the Local Government Board, having been appointed to that office by Mr. Ritchie in 1892. His death was unexpected and will be widely regretted.

Dr. Bulstrode obtained his medical education at Cambridge University and St. Thomas's Hospital. Since his appointment to the Local Government Board he had, in addition to the more routine work of the medical inspectorate, been engaged under three successive medical officers in work of a more special nature implying exceptional skill in epidemiological investigation. It is in regard to this work that his high reputation was made. Three of his reports to the Local Government Board have been presented to Parliament as command papers. Of the subjects at which he worked, that of the relationship of contaminated shellfish to the prevalence of illness, and especially to enteric fever, is particularly important. Early in the nineties of last century the attention of the Local Government Board was directed to the possible causation of outbreaks of enteric fever, as well as of cholera, by the consumption of contaminated oysters, and Dr. Bulstrode was commissioned to make a comprehensive investigation into the subject. He visited all the districts in England and Wales in which there were oyster layings, and collected all the known literature on the subject of his inquiry. His report, which was presented to Parliament in 1894, was illustrated by a series of charts which indicated the position of all the principal oyster layings in England and Wales, and the positions of sewers in their neighbourhood. The issue of this report necessarily and properly caused much damage to the trade in oysters as then carried on. Its more permanent effect has been to improve the conditions under which a very large proportion of the total oysters in this country are grown and fattened.

Dr. Bulstrode's next investigated several deaths and a considerable number of cases of enteric fever which occurred after mayoral banquets at Winchester and Southampton, and clearly traced these to the consumption of contaminated oysters. Early in the current year a report by Dr. Bulstrode was presented to Parliament dealing with shellfish other than oysters in relation to disease. This report, which is a comprehensive one, brings up to date epidemiology in association with oysters, and contains a detailed account of the principal shellfish beds of mussels and cockles. The volume, like its predecessor on oysters, is illustrated by a valuable series of charts showing the topography of the beds in relation to sewage pollution. Dr. Bulstrode attended many meetings of the Royal Commission on Sewage Disposal which had the oyster and other shellfish difficulties under consideration.

Another public health question with which Dr. Bulstrode was particularly concerned is that of tuberculosis. In 1903 he gave the Milroy lectures at the Royal College of Physicians, choosing the subject of tuberculosis. In 1905 he was associated with Dr. Theodore Williams as a representative of the British Government at the International Congress on Tuberculosis at Paris. In 1908 Dr. Bulstrode's report on sanatoria for consumption was issued and presented to Parliament. This extremely valuable work on sanatoria in England and Wales was republished by H.M. Stationery Office in a cheaper edition, the demand for it having been large.

Dr. Bulstrode, at the time of his death, was engaged in an inquiry, as a representative of the Local

Government Board, with officers of the Home Office into cases of phthisis which had been attributed to "kissing the shuttle," a practice in the cotton mills in Lancashire. His recent report on plague in East Suffolk was a further piece of excellent work, set out with characteristic detail and exactitude. All his reports will remain for a long time valuable works of reference for investigators and examples of laborious and exact inquiry.

Dr. Bulstrode's death in his fifty-third year removes from the medical staff of the Local Government Board not only a very able and conscientious public official, but a colleague who had endeared himself to the officials of his own department, and was held in high repute by local officials in England and Wales with whom his investigations had brought him in contact.

THE PROMOTION OF SCIENTIFIC RESEARCH BY THE DEVELOPMENT COMMISSIONERS.

THE appointment of the Development Commissioners marks a remarkable change in the attitude of the British Government towards research. Not only is the old *laissez-faire* policy thrown over, for the commissioners are charged with the duty of fostering decaying rural industries and trying to promote new, but they are also specifically instructed to promote scientific research and experiment so far as it bears upon agriculture. The funds placed at their disposal are considerable—a capital sum of two and a half million pounds, with an annual grant of 400,000*l.* for the five years for which provision is made in the Act—and though the big grants will be chiefly wanted for such purposes as the improvement of harbours and inland navigation, the reclamation of land, rural transport, and similar works, there should yet be a very considerable margin available for investigation and education in its widest sense.

The first report, which the Development Commissioners have just issued, shows that although they have been at work for less than a year, they have set scientific matters in the forefront of their programme; indeed, they indicate that until they have dealt with research and education they intend to postpone the consideration of projects aiming at the direct creation of employment, such as the reclamation of land, canals and light railways, and afforestation of waste land. Our deficiencies in the scientific direction and control of agriculture and other cognate industries, *e.g.* sea-fishing, are both patent and pressing. In this direction the foundations have to be laid for the future; and, moreover, there can be very little doubt but that the expenditure wil be recouped a thousandfold, because it will take effect upon the mind of the men who have to live by the industry, whereas in the case of works the expenditure is greater and the ultimate benefits to the industry as a whole more doubtful.

The commissioners have already made certain grants for research to institutions like Cambridge University (4,000*l.*), the Rothamsted Experimental Station (2,000*l.*), the Royal Veterinary College (1,390*l.*), Bristol, and other university colleges possessing agricultural departments; but they indicate that these are only interim grants for the maintenance of certain work already going on pending the framing of a general scheme of research applicable to the whole kingdom and intended to secure that every part of the wide field shall receive adequate attention. The commissioners report that they are negotiating with the Board of Agriculture for the preparation of such a scheme, and that they propose to devote about 40,000*l.* a year to carrying it out. In other directions the scientific aspect of the question seems to have been well before the commissioners, for example in the scheme for the improvement of the breeding of light horses; they have insisted that "definite provision should be made for watching and supervising its operation and so far as possible making experiments from the point of view of scientific research in eugenics as applied to horses." Again, in attacking the problem of increasing the variety of production, they "have appointed two gentlemen of scientific training to investigate by inquiry at home and abroad" the cultivation and management of the tobacco, flax, and hemp crops; and, as regards forestry, they report that education and research ought to precede any action in the direction of afforestation on a large scale.

This recognition of the foundation of all development of industries like agriculture, forestry, and fishing upon scientific knowledge and research is very welcome, and must be applauded as a most promising departure from the spirit and methods that have hitherto prevailed in English official circles. We may compare the 40,000*l.* the commissioners propose to spend with the few hundreds a year which represented all the Board of Agriculture was able to devote to the same purpose.

In this connection the British Science Guild may well be congratulated upon its action. A few years back the guild appointed an agricultural committee, which, after making many inquiries and collecting a great deal of information, produced a report showing what Great Britain did in the way of agricultural research in comparison with foreign countries and our own colonies, and giving some examples of the returns which had accrued to the industry from the application of particular investigations. This report was widely and influentially signed and presented to the Government; and the guild may be well content with the manner in which its representations have now been translated into action. Subjoined are a number of extracts from the commissioners' report.

The Development Commissioners were appointed by the King on May 12, 1910, by Royal Warrant. The commissioners include Lord Richard Frederick Cavendish (chairman), Sir Francis Hopwood, K.C.B., and Messrs. Saint-Hill Eardley-Wilmot, H. J. Davies, M. A. Ennis, W. S. Haldane, A. D. Hall, F.R.S., and Sidney Webb. At the beginning of this year the commissioners entered, with the Road Board, into the occupation of permanent offices at Queen Anne's Chambers, Broadway, Westminster.

Since their appointment, the commissioners had held nine official meetings up to March 31 last, and it is with the work done at these meetings and the preliminary business transacted by the commissioners that their first report[1] deals.

General Principles of the Commissioners' Action.

The commissioners are informed that during the period under review about 170 applications for advances from the Development Fund were made to the Treasury. Of these, twenty-four reached the commissioners officially under the Act, so that they could take formal cognisance of them.

It may be useful if they offer some general remarks on the duties entrusted to them by the Act of 1909, and the principles at which they have arrived in considering how best to carry out those duties.

Their prime duty is to consider and report to the Treasury on applications referred to them for advances from the Development Fund. All applications must in the first instance be made to the Treasury. The Act directs that when an application reaches the Treasury it is to be dealt with in different ways, according to its source. If it is from a Government department, the Treasury are to send it direct to the commissioners for examination; if it

[1] First Report of the Proceedings of the Development Commissioners for the Period from May 12, 1910, to March 31, 1911. Pp. 60. (Wyman and Sons, Ltd.) Price 3*d.*

is not from a Government department, the Treasury are to send it to the Government department concerned with the subject-matter of the application, who are required to forward it in due course with their report to the commissioners. When the application reaches the commissioners they have to consider it and state their opinion to the Treasury, with whom rests the responsibility of finally deciding whether to give effect or not to the commissioners' recommendation if it is favourable. If the Treasury approve, the money is advanced as required to the applicant—direct, if the applicant be a Government department; if the applicant be some other body or association, through the department concerned, who are then responsible for supervising the actual expenditure.

From this procedure, as laid down by the Act of 1909, three main results follow. In the first place, the commissioners themselves have no power to make grants or loans from the Development Fund; like other Royal commissions, they can only recommend expenditure, which must be finally authorised by the Government. Treasury approval is required for every penny spent from the fund. Secondly (again like other Royal commissions, or the majority of them), they have no executive power; the schemes recommended by the commissioners must be carried out either by a Government department or by some other body under the supervision of a department. Thirdly, they have no formal and official cognisance of applications from bodies other than Government departments, and cannot report to the Treasury on them, until the applications have been examined by and passed through the departments concerned with their subject-matter.

Such being in general terms the position assigned to the commissioners by the Act, it became incumbent on them to settle at an early stage of their proceedings the main principles by which they would be guided in considering, amending, and framing schemes for expenditure from the Development Fund.

The first of these principles is that, to deal satisfactorily with many of the purposes mentioned in the Act of 1909, it is absolutely necessary to work on a comprehensive policy, which shall provide for and take account of the whole of at least one of the three main administrative divisions of the United Kingdom (viz. England and Wales, Scotland, and Ireland), and shall wherever possible be based on a survey of the position and needs of the whole kingdom in relation to that particular subject. Take, for instance, the very important question of research in agricultural science. Numerous applications for advances from the Development Fund for different branches of research and pieces of research work were expected, and have, in fact, been made by bodies, institutions, and associations all over the kingdom. It seemed to the commissioners that there would inevitably be waste of energy and money if these applications were simply taken one by one as they arrived, and advances recommended to those institutions which made out a good case for themselves, irrespective of other institutions and the work done by them. It is probably neither desirable nor possible to prevent all overlapping and duplication of work, and the commissioners realise that individual investigators and institutions cannot and ought not to be dragooned into uncongenial tasks. But looking to the vast amount of work still to be done, they think that any advances from the fund for this purpose should be made on a coherent and comprehensive scheme, covering as wide an area as possible.

Agricultural research has been taken as an example, but it will be obvious that similar considerations apply to other purposes for which advances may be made from the fund. The commissioners do not lay it down as a hard-and-fast rule that in no circumstances, however special, will they recommend an advance from the Development Fund apart from an examination of all possible or probable applications of the same nature, or apart from a general scheme applicable to the whole country or a large part of it; and the necessity of such a scheme varies with the purpose for which advances are desired. But for the reasons briefly indicated above, they feel that as a rule an application should be considered not simply and entirely as a disconnected unit, but in the light of a policy which takes account of the requirements of a wider area than a single district or institution.

From the adoption of this attitude, certain practical consequences follow. In the first place, it is impossible to deal with individual applications as quickly as if they were taken one by one, without reference to general considerations. To recommend even a large number of disconnected advances is obviously a very different thing from working out or examining in detail a coherent and organised scheme which is meant to be applicable to the whole country or a large part of it—a scheme in which existing bodies and institutions would each find a place consistent with its possible contribution to the general advancement.

It follows, secondly, that the relations of the commissioners with Government departments must necessarily be of the closest nature. In any event they must be close, for all applications come either from or through a department, and all advances from the fund must be made either to or through a department. But the commissioners' policy of proceeding by general schemes necessarily means that they welcome such applications as the departments themselves may make; and for reasons similar to those which have influenced the commissioners, the departments, when confronted with the duty of reporting on a large number of disconnected applications, have perhaps felt that they would best discharge that duty by themselves putting forward a general scheme which would cover and include so far as possible the schemes of the individual applicants. The commissioners cannot consistently with their statutory duty accept such schemes without consideration, and it is not a matter for surprise if they do not always find themselves in entire agreement with the applying department. In such cases, discussion between the two bodies is the only way of settling a scheme: for on the one hand it cannot be financed without the commissioners' recommendation, and on the other (the commissioners having no executive authority) it cannot be executed apart from the department. The commissioners are happy to say that they have hitherto encountered no difficulties with public departments which full discussion has proved unable to solve.

In the third place, procedure by general schemes involving large advances to Government departments brings into clear view the difficulties and delays caused by the inevitable complication of the administrative machinery of the United Kingdom. The nature of some subjects is such as to permit of their being considered separately for separate parts of the country; yet even with such subjects more than one department may be concerned—for instance, agricultural education (as distinct from scientific research) is in different branches within the purview of both the Board of Education and the Board of Agriculture. With some subjects, on the other hand, the commissioners might wish to deal, if possible, on a scheme or schemes taking account of all parts of the United Kingdom; and in that case they might be concerned at the same time with one or perhaps two authorities for England and Wales, another for Scotland, and another one or two for Ireland.

It will not escape observation that the one case (viz. the encouragement of horse-breeding) in which during the first few months of the commissioners' existence Government departments were able to submit, and the commissioners to recommend, comprehensive schemes, is precisely a case in which some of the difficulties mentioned have been absent. There is only one authority for the whole of Great Britain. The Irish scheme had been in existence for some years, and by common consent worked well, needing only money for its extension; and the British scheme followed, generally, similar lines.

The other principles on which the commissioners proceed may be explained more briefly. In the first place, they do not think that it would be consistent with their duty to recommend an advance from the Development Fund until a fairly detailed scheme for the expenditure of the money is framed and approved.

Secondly, they do not propose, as a general rule, and subject in certain cases to considerations of practical convenience, to recommend advances from the Development Fund in relief of existing expenditure, whether from Parliamentary votes, local rates, or other sources. In their view, it was the intention of Parliament that the fund should be used to promote new work, so to speak, not to pay for work already financed from other quarters.

Thirdly, the commissioners will, in general, recommend

advances only by way of loan for schemes which are expected to be directly remunerative sooner or later.

Fourthly, the commissioners take note of the provision in the Act of 1909 (s. 18) which directs that in approving, executing, or making advances in respect of the execution of any work under the Act involving the employment of labour on a considerable scale, regard shall be had, so far as is reasonably practicable, to the general state and prospects of employment.

Last, and by no means least important, the commissioners feel it incumbent on them to ensure, so far as it lies in their power, that the fund shall not go into the pockets of private individuals, and they propose to recommend no applications or schemes likely to have that effect.

Policy in regard to Agricultural Development and Forestry.

The main lines of the policy by which they propose to be governed in considering schemes for two of the most important purposes mentioned in the Act, viz., first, the development of agriculture and rural industries, and secondly, forestry and afforestation.

Having regard to the amount of the Development Fund, they propose to deal with the first of these problems by devoting their attention principally to three lines of action. They aim first at increasing the amount and quality of the product of agriculture by assisting the extension of a system of scientific investigation and research, and with it of a system of education which will, so far as possible, ensure that the results of investigation and research are known and utilised in practice; and, secondly, they aim at increasing the variety of production by placing the cultivator in a position to know whether he can add certain new crops and industries to the existing number with a reasonable probability of profit. Finally, looking at the problem from a rather different and more strictly commercial point of view, they propose to encourage, in particular, the organisation of cooperation—a subject which is expressly named in the Act.

Nothing has impressed the commissioners more than the clearness with which the fact has appeared that the first condition of any considerable progress in these ways is the creation of a trained staff. It is useless to expect that immediate results of real value can be obtained on a large scale merely by expenditure. One example is sufficient: the number of men really qualified to conduct agricultural research in this country is at present exceedingly small, and it obviously cannot be increased at a moment's notice.

The problem of increasing the variety of production is likely to raise difficult questions both of principle and practice. It is enough at this early stage to name flax, hemp, tobacco, and beet as particular crops to which the commissioners propose to give attention with the view of ascertaining whether they can be grown in this country on a commercial basis, and to possible schemes for advances from the Development Fund for that purpose. They have appointed two gentlemen of scientific training to investigate by inquiry at home and abroad, and to systematise for their use the information available in regard to the first three of these crops. In regard to beet, they propose to consider in consultation with the Government departments concerned the question whether it is possible to make an experiment on a fairly large scale designed to show, not whether beet of good quality can be grown in this country (a point which they think may be regarded as settled), but whether it can be grown at a profit.

On the subject of forestry development, the commissioners have formulated for their guidance in considering British schemes and applications the following principles:—

(*a*) That the first requirement for such development is effective education in forestry at suitable centres, regulated by organised research and demonstration.

(*b*) That no scheme of State afforestation on a large scale can be considered until investigation has shown where State forests might be economically and remuneratively provided (regard being had to the interests of other rural industries), and until a trained body of foresters has become available.

(*c*) That for the present applications for grants for the above purposes should include provision for the creation and maintenance of such staff as may be necessary to give practical advice and assistance to those who desire to undertake afforestation or to develop existing afforested areas.

It will be gathered that in considering their action in this, as in other directions, the commissioners have been faced at the outset with the difficulty that the number of trained men in this country capable of directing forestry operations on any large scale is at present very small. Before all else they think it necessary that this difficulty should be overcome.

Applications and Schemes.

The twenty-four applications which reached the commissioners contemplated an expenditure of 210,829*l.* annually and 208,030*l.* capital sums. Among the applications, which have been grouped by subjects, may be mentioned:—

AGRICULTURAL RESEARCH AND EDUCATION.

I.—*England and Wales.*

The Treasury forwarded to the Development Commissioners on September 2, 1910, an application by the Board of Agriculture and Fisheries for an advance of 50,000*l.* per annum for the organisation of a system to aid and develop agriculture by the provision of technical advice for farmers and by promoting scientific research and experiments in the science, methods, and practice of agriculture.

The commissioners decided to recommend that the following grants, or such proportion as might be required for the financial year, should be paid to the Board for the benefit of the institutions named below, and for the purposes indicated:—

	£
Cambridge University.—Research work	4000
Bristol University.—(1) Bio-chemical investigations on cheese; (2) Investigations on teart land... ...	500
Yorkshire Council for Agricultural Education (Leeds University).—Investigations of atmospheric impurities	210
University College, Reading.—General work on (1) Microflora of cheese; (2) Cereal selection	250
South-Eastern Agricultural College, Wye.—(1) Investigations on tobacco; (2) Mycological Department; (3) Entomological Department; (4) Investigations on hop resins	350
University College of Wales, Aberystwyth.—Botanical survey of Aberystwyth, and subsidiary inquiries ...	156
Harper Adams Agricultural College.—Research on wart disease, and finger and toe	190
Royal Veterinary College.—Investigations in respect of vaccination	1390
The Incorporated Society for Extending the Rothamstead Experiments	2000
The British Dairy Institute, Reading	60
Woburn Experimental Station	600

The commissioners further intimated to the Board that they would be prepared to recommend additional interim grants, not exceeding in the aggregate a sum of 3000*l.*, to such other of the institutions as had applied for grants, but had not at that time been dealt with by the Board. They also informed the Board that they would be ready to recommend a grant of 1000*l.* to make provision for scholarships during the financial year so soon as they were favoured with a scheme embodying the conditions under which the Board proposed the scholarships should be given. The commissioners further contemplated recommending a grant of 1000*l.* for expenses of administration when the heads of estimated expenditure, and the amounts required under each head, were supplied to them.

It may be added that the commissioners have stated to the Board that they are willing to contemplate an expenditure of 40,000*l.* per annum for research alone, apart from advisory and other work.

II.—*Scotland.*

The Scotch Education Department forwarded to the commissioners on November 14, 1910, applications from each of the three agricultural colleges in Scotland for capital grants amounting in all to 137,425*l.*, made up as follows:—

Edinburgh:	£
College buildings	35,000
Farm	12,500
Forest garden	1,225
	48,725

Glasgow:	£
College buildings	35,000
Farm	15,000
Research	2,500
Forest areas	5,200
	57,700

Aberdeen:	£
Purchase of estate	18,500
Alterations for farm purposes... ...	6,000
Forest garden	1,500
Research (buildings, &c.)	5,000
	31,000

On March 2, 1911, they informed the Department that they would be prepared to recommend the Treasury to grant a capital sum not exceeding 60,000*l.* on the following conditions :—

(1) That only one half of the expenditure ultimately approved is defrayed from the Development Fund, the other half being met by fresh contributions of local authorities and persons interested, and by a contribution from the Education (Scotland) Fund (one quarter from each source).

(2) That a revised scheme and estimates of expenditure relating to each individual college should be placed before the commissioners for consideration before they report to the Treasury.

They also informed the Department that they would be prepared to recommend an annual grant of one half of the excess of the expenditure of the colleges on what may be called "extension" work (*i.e.* instruction to agriculturists in the colleges' provinces by such means as lectures, visits, &c., and similar work), over the corresponding expenditure of the year 1908–9, on the following conditions :—

(*a*) That the grant from the Development Fund shall not in any year exceed the total contributions to the colleges from the Education (Scotland) Fund.

(*b*) That it shall not in any case exceed 5000*l.*

(*c*) That the commissioners are satisfied, when the formal application is made, as to the nature and scope of the work proposed; that it comes within the terms of the Development and Road Improvement Funds Act, 1909; and that it will be properly carried out.

III.—*Ireland.*

The commissioners received on July 18, 1910, an application by the Department of Agriculture and Technical Instruction for Ireland for a grant of 15,000*l.* a year for five years for the establishment and maintenance of an agricultural station for a system of general investigation and scientific research in Ireland.

It was proposed that the station should be established in the vicinity of Dublin, the capital expenditure being estimated at 20,000*l.* and maintenance at 15,000*l.* a year.

The commissioners determined to intimate to the Department that they would be prepared to consider schemes based on an expenditure of—

(*a*) 4000*l.* per annum for a central institution for investigations and technical advice of a local character.

(*b*) 5000*l.* per annum for scientific research in animal breeding or some other subject undertaken in Ireland as part of a general scheme of scientific research for the United Kingdom.

At the end of the year the commissioners were awaiting an amended application on the terms thus indicated.

Horse and Livestock Breeding.

The commissioners received on July 26, 1910, an application by the Board of Agriculture and Fisheries for a grant of 50,000*l.* per annum, of which 5000*l.* was to be devoted to livestock other than horses, and 45,000*l.* to the encouragement of light-horse breeding in Great Britain. On November 23 the commissioners recommended the Treasury to advance 36,000*l.* for one year to the Board by way of grant, to be expended generally as follows :—

	£
(*a*) Payment of premiums to the owners of stallions	13,000
(*b*) Encouragement of the keeping of brood mares	10,000
(*c*) Free nominations for the service of mares by premium stallions	3,000
(*d*) Purchase of stallions	5,000
(*e*) Registration of stallions	5,000

The report recommended advances not exceeding 3800*l.* to cover travelling expenses, the expenses of local committees, payment of local secretaries, &c., and not exceeding 1250*l.* to cover other administrative expenses up to March 31, when the sum previously voted by Parliament to the Royal Commission on Horse-breeding was expected to become available for the Board.

As regards horse-breeding in Ireland, the commissioners received on July 18, 1910, an application from the Department of Agriculture and Technical Instruction for Ireland for a grant of 10,000*l.* per annum for five years for the extension of the Department's existing schemes. On October 29, 1910, they reported to the Treasury, recommending a grant of 10,000*l.*, to be expended roughly in the following proportions :—two-fifths on the extension of the existing schemes for the registration and purchase of stallions, two-fifths on the extension of the existing schemes of service nominations to mares, and one-fifth on a new scheme to encourage the keeping and breeding of better mares of the Irish draught type.

Forestry.

It is provided in section 1 (*b*) of the Act that forestry, as one of the purposes for which the commissioners may recommend advances, shall include :—

(1) The conducting of inquiries, experiments, and research for the purpose of promoting forestry and the teaching of methods of afforestation.

(2) The purchase and planting of land found after inquiry to be suitable for afforestation.

Believing that forestry is one of the purposes of the Act which require to be dealt with on comprehensive and national lines, the commissioners at an early stage appointed four of their number to report on the broad principles to be applied to all applications bearing on the subject.

Various schemes and applications were considered, and the situation on March 31 is summed up as follows :—

In regard to England and Wales, the commissioners have just received a comprehensive scheme from the Board of Agriculture and Fisheries.

In regard to Scotland, they have agreed to the provision of a central demonstration area—for the acquisition of which preliminary steps are being taken—and of a forestry school in connection with it, and also to the provision of small forest gardens for the local use of the agricultural colleges.

In regard to Ireland, they have agreed to advances of 25,000*l.* or 30,000*l.* for the purchase of land, and to further advances, so soon as formal and definite applications are made under the Act, for additions to staff and for the maintenance and management of small woodlands in the hands of county councils.

The Development and Improvement of Fisheries.

Among the applications from the Department of Agriculture and Technical Instruction for Ireland which the commissioners received on July 18, 1910, one dealt with the development and improvement of fisheries. For this purpose the Department asked for a sum of 50,000*l.*, made up as follows :—

	£
For the development of six specified harbours	32,500
Removal of wrecks	1,000
Motor boats	5,000
Inland towns—supply of fish	1,000
Dredger	8,500
Shell-fish	2,000
	50,000

An interim application was considered by the commissioners at their meeting held on March 15, when it was resolved :—

(*a*) To recommend an advance of a sum not exceeding 4000*l*. for the purchase of a dredger, on the production of satisfactory tenders for the approval of the commissioners.

(*b*) To postpone consideration of the application in respect of Ballinagoul until the next meeting, for the production of plans of the proposed works.

Summary and Conclusion.

It will be gathered from this brief review of their action that during the first nine months of their operations the commissioners (and also, they believe, the Government departments most concerned with the Development Fund) have been largely occupied in necessary preliminary work. Although they have received under the Act but a small proportion of the applications actually made to the Treasury, yet it must be remembered that the settlement of a comprehensive scheme for such a purpose as agricultural research is in practice equivalent to disposing of many individual applications; and for reasons already stated, that procedure, though apparently slow, is, in the commissioners' view, the only ultimately satisfactory method of dealing with schemes for several at least of the purposes mentioned in the Act.

The sums of which the commissioners have either recommended the allocation, or agreed to recommend it so soon as satisfactory schemes are framed, amount roughly to 165,000*l*. per annum, and 100,000*l*. non-recurring advances. By far the larger proportion of this expenditure, if ultimately approved by the Treasury, will go in agricultural research and instruction, viz. England and Wales 105,000*l*. per annum, Scotland a lump sum of 60,000*l*. and 5000*l*. per annum, Ireland 9000*l*. per annum.

These figures do not take account of the considerable sums, of which no definite estimate can yet be given, but for which schemes were either being prepared or were under examination by the commissioners at the close of the year, *e.g.* forestry in England and Wales, the purchase of a demonstration area in Scotland and the establishment there of a central school of forestry, the development of Irish fisheries and fishery harbours, and the encouragement of the organisation of cooperation throughout the United Kingdom. Nor do they take account of applications which had not reached the commissioners, though known as having been made, or about to be made, to the Treasury—as, for instance, schemes for the development and improvement of British fisheries and of Scotch harbours; nor, again, of possible expenditure on such projects as the revival of the flax and hemp industries, the encouragement of tobacco and beet cultivation, or the establishment of an institution for the study of rural economics.

In the first nine months of their work the commissioners, so far as they are concerned, have allocated and, as they think, rightly allocated, one-third of the annual income guaranteed to the Development Fund for five years. Out of the two-thirds which now remain they hope to provide during the coming year for considerable annual expenditure on such purposes as forestry and forestry instruction and the organisation of cooperation; and it cannot be supposed that expenditure on the purposes with which they have already dealt ought to or will remain stationary at the amounts provisionally fixed. Looking to these facts, they cannot but feel some apprehension that unless Parliament comes to the aid of the fund its position in a very few years will not be a strong one. They will, however, be far more able to form an opinion on this important question at the end of the financial year 1911-12, by which time they hope that all the applications hitherto made to the Treasury will have reached them from the Government departments, that considerable schemes known to be in preparation will have been submitted, and that the inquiries which they are making into such subjects as flax, hemp, and tobacco cultivation will have been completed, or be on the point of completion.

NOTES.

On Saturday last, July 22, nineteen aëroplanes started from Brooklands, near Weybridge, in a race for which a prize of 10,000*l*. was offered by *The Daily Mail*. The specified route was a circuit of Great Britain, with a number of landing-places, or control stations, at each of which a descent had to be made; these places, with their distances in miles from one another, were :—Brooklands to Hendon, 20; Hendon to Harrogate, 182; Harrogate to Newcastle, 68; Newcastle to Edinburgh, 93; Edinburgh to Stirling, 31; Stirling to Glasgow, 22; Glasgow to Carlisle, 86; Carlisle to Manchester, 103; Manchester to Bristol, 141; Bristol to Exeter, 65; Exeter to Salisbury Plain, 83; Salisbury Plain to Brighton, 76; Brighton to Brooklands, 40; total distance, 1010 miles. The first section of the race was covered by J. Védrines in 19m. 48s., and ten other airmen accomplished the journey in less than half an hour. On Monday morning the following machines and pilots started from Hendon for Edinburgh, with official control descents at Harrogate and Newcastle :—J. Védrines, Morane-Borel monoplane; Lieut. Conneau (" Beaumont "), Blériot monoplane; J. Valentine, Deperdussin monoplane; G. W. Hamel, Blériot monoplane; S. F. Cody, Cody biplane; H. J. D. Astley, Birdling monoplane; C. Howard Pixton, Bristol biplane; Lieut. R. A. Cammell, R.E., Blériot monoplane; O. de Montalent, Bréguet biplane; C. T. Weymann, Nieuport monoplane; C. P. Pizey, Bristol biplane; G. Blanchet, Bréguet biplane; B. C. Hucks, Blackburn monoplane; Lieut. H. Bier (and passenger), Etrich monoplane; Lieut. H. R. P. Reynolds, R.E., Howard Wright biplane; E. Audemars, Blériot monoplane.

Yesterday afternoon, when we went to press, two airmen, namely, " Beaumont " and Védrines, had reached Brooklands, having completed the circuit, and it was announced that the prize had been awarded to " Beaumont." The race was a severe test of the efficiency of aëroplanes and their control by the pilots. The circuit of 1010 miles had to be completed without any airman changing his engine or aëroplane. Five parts in each aëroplane and five in each engine were stamped, and at least two parts in each case had to be in place at the end of the race, the object of the contest being to encourage the construction of trustworthy and enduring flying machines. That it should be possible for airmen to travel over such an extended course of strange country with nothing but maps and compasses to direct them is, however, a remarkable achievement, independent of the capabilities of the aëroplanes. No doubt much experimental data and mathematical investigations will be required before aëroplane architecture can reach the position of naval architecture, but meanwhile aviation engineers and pilots are bringing us nearer that conquest of the air which will be the distinguishing characteristic of the present century; and one of the historic events of this era of aërial navigation will be the trying contest which has just been concluded.

We gather from a circular lately received that a testimonial is contemplated in honour of Sir Patrick Manson, K.C.M.G., F.R.S. The international memorial was an inception by Prof. Blanchard, of the Faculty of Medicine, Paris, and with him are associated the names of men best known in tropical medicine. It was felt, however, that it would ill become Sir Patrick's British *confrères* did they not come forward and show their special appreciation of the work he has done in the field of tropical medicine. The international testimonial is proposed to take the form

of a plaquette in gold to be presented to Sir Patrick, and bronze plaquettes to subscribers, to bear an impression of Sir Patrick by a well-known artist. The British testimonial is in the first place to be the presentation of a portrait in oils, of which each subscriber of one guinea and over will receive a black-and-white reproduction; but it is hoped that, in addition, a Manson prize will be founded for bestowal as a reward for good work accomplished in the sphere of tropical medicine and hygiene. Of the success of these testimonials there should be no doubt, for the benefits conferred upon mankind by Sir Patrick Manson as the "father" of modern tropical medicine is incalculable. A new field of scientific investigation has been opened by him; the formulation of the mosquito-malaria theory has had consequences which have extended far beyond even the widely flung malaria, and opened up new channels of thought in every direction. Knowledge of the part played by vermin in the spread of disease is being extended daily as the result of Manson's work, and a new school of thought, giving a fresh direction and impetus to inquiry, has advanced science generally, and will go on bearing fruit so long as time extends.

THE organising committee of the Fourth International Conference of Genetics, to be held in Paris on September 18–23, met recently under the presidency of Dr. Viger. M. Philippe de Vilmorin, secretary of the committee, reported what had been done up to that day in preparation for the conference. Not counting the names of the principal French biologists who are members of the committee, the secretary was able to give the names of the following foreigners who have subscribed:—Baur, Giesenhagen, Goldschmidt, Pfitzer, Poll, &c. (for Germany); Agar, Bateson, Darbishire, Gregory, Miss Durham, Hartog, Laxton, Lynch, Nettleship, Paton, Punnett, Miss Saunders, Staples-Browne, Sutton, Miss Wheldale, &c. (for Great Britain); Bradley (for Australia); Fruwirth, Strakosh, Tchermak, &c. (for Austria); W. and Chs. Saunders (for Canada); Johannsen (Denmark); Balls (Egypt); Davenport, Hays, Howard, Swingle, Tower, &c. (United States); Hagedoorn, Houwink, Lotsy, Noordnijn (for Holland); Leake (for India); Strampeli (for Italy); Nilsson-Ehle, Rosenberg (for Sweden); Chodat (Switzerland); Boris de Fedtschenko (Russia); and Arechavaleta (Uruguay). Many universities and scientific societies will be officially represented. Numerous communications have been promised; short descriptions of them will be published before the meeting of the conference, and they will be published in full in the proceedings, a copy of which will be sent to each subscriber. The meetings of the conference will depend upon the number of the communications, but it seems probable that five sittings will be sufficient. The remaining time will be devoted to visits to the Museum of Natural History, the Pasteur Institute at Garches, to Verrières, the laboratories of the Sorbonne, &c. Probably there will be a reception by the French National Society of Horticulture on September 18, and one at the Hôtel de Ville on September 23.

IT has been decided to publish from the Sleeping Sickness Bureau a quarterly bulletin dealing with the Leishmania group of diseases. Dr. C. M. Wenyon, protozoologist to the London School of Tropical Medicine, will undertake this part of the work. A list of references is now in preparation and will form the first number.

REUTER'S correspondent at Washington announces that on July 24 the Senate ratified the agreement between the United States, Great Britain, and Russia for the suspension of pelagic sealing for fifteen years. An article upon the fur-seal and the convention, which has now been accepted by the United States Senate, appeared in NATURE of July 13.

WE learn from *Science* that the earthquake of July 1 is reported to have done considerable damage at Lick Observatory, on Mount Hamilton. The 36-inch telescope is said to have been moved three-quarters of an inch out of place on its concrete pier, but was restored without trouble. The case of the Riefler clock was wrecked, and minor damage was done to the working parts. The chimneys of the observatory buildings were injured, and a brick structure which houses a number of astronomers was cracked so as to be unsafe for occupancy.

IN the obituary notice of the late Dr. H. Bolus in NATURE of June 8, reference was made to "his generous support of the Cape University, which owes to him the foundation of its chair of botany." Prof. H. H. W. Pearson writes to point out that though the establishment of the "Harry Bolus chair of botany in the South African College in 1903 was due in a large measure to the munificent support which Dr. Bolus gave it, there is no botanical chair in the Cape University, which is not a teaching institution."

REFERRING to the inauguration of a fund to honour the memory of the late M. J. Joubert, to which attention was directed in our last issue (p. 101), we are able to state that an influential committee has been formed, including representatives of the Pasteur Institute, the French Physical Society, and the International Society of Electricians. Joubert's collaboration with Pasteur, his work for the French Physical Society, of which he was once president and for ten years general secretary, and his researches and writings, have all made his name widely known and respected. The idea of founding a Joubert scholarship should appeal to all old colleagues, pupils, and friends of Joubert. Subscriptions may be sent, as has been stated, to M. Gauthier-Villars, 55 quai des Grands-Augustins, Paris.

THE present month is establishing a record both for the long and persistent drought and also for its high temperature. In London, July 25 was the twelfth day during the month with the thermometer above 80°, and on two days, July 21 and 22, the temperature exceeded 90°. There has been no temperature in London so high as 90° in July since 1900, and none at any period of the summer since 1906. At some places in the east and south-east of England the thermometer rose higher than in London. In France and Germany the temperature has also been excessive, shade readings of 100° being reported in places. The month was absolutely rainless in London and over the southern portion of England until July 24, when slight rain was experienced, which was followed by a thunderstorm on July 26; so long a period of drought has not occurred in July since 1887.

THE recorder of Section C (Geology) of the British Association sends the following statement of the provisional programme for the Portsmouth meeting:—Joint meetings have been arranged with Sections E (Geography) and K (Botany). The subject for discussion with Section E is "The Former Connection of the Isle of Wight with the Mainland," and with Section K, "The Relation of the Present Plant Population of the British Isles to the Glacial Period." Presidential address by Mr. Alfred Harker, F.R.S. The address on the local geology will be delivered by Mr. Clement Reid, F.R.S. The following papers have already been promised:—"On the Discovery of Remains of *Iguanodon bernissartensis* in the Wealden Beds of Brightstone Bay, I. of W., and the adaptation of the pelvic girdle to an erect position and bipedal progression,"

R. W. Hooley. (1) "Siliceous Oolites and other concretionary structures in the vicinity of State College, Pennsylvania," (2) "On the Pre-Cambrian Beds of Ontario," Prof. E. S. Moore, of State College, Pennsylvania. "Further Work in the Silurian Rocks of the Eastern Mendips," Prof. S. H. Reynolds. (1) "On some New Rhætic Fossils from Glen Parva, Leics," (2) "On the Shell-layer in Mollusca," A. R. Horwood.

IN *The Times* of July 12 Mr. W. E. Roth, now Commissioner of the Pomeroon district, British Guiana, discusses modern men of the Stone age in New Guinea and North Australia. From a comparison of Mr. Goodbody's account of the strange race found in the hitherto unknown interior of Dutch New Guinea with the natives of North Australia, Mr. Roth comes to the conclusion that the latter are "undoubtedly the more primitive, in that they are nomadic and ignorant of any native fermented drink. They are certainly on a level with regard to the treatment of their women and in their eating human flesh; this, however, can hardly be regarded as true cannibalism, in that all the cases that I have met with in North Queensland were due rather to sentiment and affection, nor, indeed, did I come across a single instance where the individual—man, woman, or child—was purposely killed to be eaten."

ARTISTS and students of anatomy will welcome the elaborate paper entitled "Les proportions du corps pendant la croissance de 13 ans ½ jusqu'à 17 ans ½ ainsi qu'à la naissance, à 6 ans ½ et à 23 ans ½ représentées en milliémes de la taille," published in parts iv.–v., for 1910, of *Bulletins et mémoires de la Société d'anthropologie de Paris*. These series of elaborate measurements of the relations of different parts of the human body are illustrated by statistical diagrams. The memoir is a fine example of the best class of anthropometrical work in which French *savants* have gained a well-merited reputation. Another similar memoir, contributed to the same journal by Drs. Chaillou and Léon Mac-Auliffe, entitled "Le type musculaire," starts with the examination of cerebral characteristics, and passes on to the consideration of living types and sexual variations. The paper deserves study by all who are interested in physical culture. After pointing out the diseases due to the sedentary life, the authors arrive at the conclusion that its hygiene resolves itself into two words—exercise and rest.

IN the July issue of *Man*, Messrs. N. F. Robarts and H. C. Collyer continue their report on the excavation of the British camp at Wallington. The numerous loose unbroken flints found on the inner side of the ditch seem to have been used as missiles, and round Tertiary pebbles were employed as sling-stones. A large collection of implements used in the preparation of food was made, the most common, probably because they were the most indestructible, being saddle-back mealing stones, made of the Lower Greensand sandstone. Many tiles, resembling those from the Swiss Lake dwellings, were discovered. Though there were many flakes and cores, stone implements were scanty in number. A broken axe of diorite indicates foreign commerce. Further exploration of the large remaining portion of the ditch will doubtless provide many other similar articles, but the specimens already unearthed are sufficient to give a tolerably clear idea of the civilisation, arts, and industries of the inhabitants of this Surrey town in the first or second century B.C.

WE have received a copy of No. 3 of the *Nature Photographer*, which contains excellent photographs of a merlin and her young, and of a group of the tree-fungus known as the "oyster of the woods."

THE first part has reached us of a "Lepidopterorum Catalogus," edited by C. Aurivillius and H. Wagner, and published by W. Junk, of Berlin. The catalogue, of which this part deals with the Chrysopolomidæ, purports to give the name of every genus and species, with references.

AFTER financing a natural history collecting expedition to Alaska, Miss A. M. Alexander recently supplied funds for a similar undertaking in Humboldt County, Nevada, which was duly accomplished in the summer of 1909. The results, so far as mammals are concerned, are recorded by Mr. W. P. Taylor in a report issued as No. 7 of the seventh volume of the University of California Zoological Publications. One short-tailed field-mouse is described as new.

AMONG the more important papers recently published in the Proceedings of the Academy of Natural Sciences of Philadelphia, reference may be made to the third portion of Mr. J. P. Moore's account of the polychætous annelids, dredged off southern California by the *Albatross*, which appeared in the April issue. The number of new forms described indicates the richness of the fauna. Later on in the same issue Messrs. Brown and Pilsbry describe the molluscs of the Tertiary Gatun beds, Isthmus of Panama.

IN describing a batch of fourteen newly-born young of an electric ray (*Narcine brasiliensis*) from Florida, Messrs. Bean and Weed point out, in No. 1816 of the Proceedings of the U.S. National Museum, that these differ in colouring from their parents. The young, as shown in a striking plate, are spotted as conspicuously as a leopard, whereas in the adult the spots are much less distinct, and in some cases are formed by the agglomeration of pin-like dots. In No. 1824 of the publication cited, the same authors reclassify the so-called freshwater American sunfishes of the genus Lepomis, belonging to the peccoid family Centrarchidæ. The pharyngeal bones and teeth are largely taken as the basis of classification, and a number of examples of this part of the skeleton are figured.

IN an article on the Morocco-Algerian frontier, contributed to the *Field* of July 15, Sir H. H. Johnston reproduces two outline figures of the extinct north African buffalo (*Bos* [*Bubalus*] *antiquus*), incised on rock-faces near Tiout, southern Algeria. The sketches, the age of which is unknown, appear to have been made by a people related to the modern Berbers, but living under conditions similar to those prevalent during the Neolithic or early Metal age in Europe. The horns of the buffalo seem to be of the type of those of the Indian, as distinct from the African, species, and are of immense size. On the other hand, it has been stated that the skeleton, apart from the skull, is more like that of the African buffalo; and the nasal bones appear to be of the short type distinctive of the latter. Sir Harry Johnston states that he was informed by one of the professors at the University of Algiers that other rock-pictures show this buffalo domesticated by a tribe acquainted with the use of metal; a circumstance which renders it all the more remarkable that the species should have become extinct before the time of Carthaginian and Roman history. It may be added that the intermediate characters presented by the extinct Algerian species tend to show that the proposal to separate generically (or subgenerically) the African from the Indian buffalo is unnecessary.

SYSTEMATIC contributions to the *Kew Bulletin* (No. 5) comprise a list of Balsaminaceæ from the State of Chitral determined by Sir Joseph Hooker, a series of new African

euphorbiaceous plants, including a new genus, Cyrtogonone, defined by Dr. Prain and a collection of new exotic fungi described by Mr. G. Massee; of the latter, two species of Balansia, *Æcidium osyridocarpi* and *Ustilago trichopterygis*, are figured, and *Æcidium cymbopogoni* is noted as a destructive pest on lemon grass in the botanic gardens at Entebbe. An article on persimmons, communicated by Mr. W. B. Hemsley, furnishes evidence for separating *Diospyros roxburghii*, a species native to east India and western China, from *Diospyros kaki*.

An appreciable supplement to what was considered to be a fairly complete list of plants for Monroe County in New York State and adjoining territories, published in 1896, has been issued in the Proceedings of the Rochester Academy of Science (vol. v.). The additions amount to more than two hundred species, of which two-thirds are native and one-third alien. No fewer than seventy-seven of the native species represent determinations made by Dr. Sargent for the genus Cratægus, as this county supplied him with a large number of critical forms; under Viola, eight new native species are scheduled. An alien that was expected and duly arrived along the railroad track is a variety of *Salsola kali*, that receives the name of Russian thistle. *Lysimachia nummularia* is noted as a weed growing on lawns.

The announcement is made in the May number of *The Indian Forester* that the responsibilities of editorship have been transferred to the president of the Research Institute at Dehra Dun, with whom, as heretofore, a board of management is associated. Among the contents is a concluding article on paper-pulp testing, contributed by Mr. W. Raitt. Dealing with grasses, two new sources are indicated as pulp prepared from "ulla," *Anthisteria gigantea*, and a Burmese consignment of "kaing" grass, *Phragmites karka*, both gave satisfactory results in the matter of colour, strength, and toughness; being in these respects superior to "bhabur," *Ischaemum angustifolium*, that is now worked in the factories. Summarising the prospects of the pulp industry in the United Provinces, the author is of opinion that large reserves of material exist, that ulla, bhabur, and spruce promise to yield the best material, while a number of trees, notably *Bombax malabaricum*, would furnish a pulp of inferior but serviceable quality.

Central America is following the excellent example set by the United States in agricultural education, and from Costa Rica we have received the first two numbers of the *Boletin de Fomento*, the organ of the Department of Agriculture. Hevea and coffee naturally come in for a good deal of attention, and sections are devoted to horticulture and agriculture; there is also a geological section. A list of Spanish works on water in relation to agriculture is given, which, though small in comparison with other lists, is much more extensive than one would have expected. The bulletins are well illustrated, and will, we hope, be found to serve a useful purpose.

The Agricultural Statistics of India for the years 1904–9 are now published in two volumes, vol. i. relating to British India and vol. ii. to the native States. The statistics are not discussed, but are given without comment; for the native States they are not always as accurate as might be desired, but the best available information has been used. For the historian and the administrator these records are invaluable, and all interested in Indian agriculture will find complete *data* as to crops, irrigated and unirrigated areas in the numerous districts, for each of the five years under consideration.

The growing importance of rice in India has necessitated a careful study of the numerous races cultivated by the natives, and as a preliminary these races have been enumerated in *The Agricultural Ledger* (1910, No. 1). The list is very extensive, and extends over two volumes, each of nearly 300 pages, but it is believed to be as complete as is at present possible. Under each variety is given a very brief description, together with references to papers or books where a fuller account may be found: thus the list is also a guide to the literature. An enormous amount of work has evidently been involved in its preparation, but the authors, Messrs. R. Abbey-Yates and E. F. Vieux, will have the satisfaction of knowing that they have saved subsequent workers much weary searching through literature that is not always easily accessible.

The report of the Egyptian Survey Department, dated July 3, states that the White and Blue Niles had been rising throughout June at a normal rate, but the level at Wadi Halfa was then 25 cms. below normal, owing to a check in the rains in Abyssinia. The forecast for the Nile flood indicated that it will probably be about 10 per cent. below the average.

The Cairo Scientific Journal for June contains two articles on the silt which is carried and deposited by the flood waters of the Nile, relating especially to the Ibrahimia Canal, one of the great artificial waterways which irrigate Middle Egypt to the north of Assiut. Samples were taken at varying depths, and seemed to show that the scour caused by a bridge unsuitably placed increases the silt which is deposited in the canal downstream of it to a considerable extent. The matter is one of great importance to irrigation in Egypt, and too little attention has hitherto been given to obtaining accurate results, so that the work of Messrs. Bury and Pollard is of definite value.

In the same number Mr. A. Lucas treats of "hashish," or Indian hemp, *Cannabis indica*, the forms in which it finds its way into Egypt; the manner in which it is consumed, and the methods of detecting it with certainty. Its introduction into Egypt is prohibited, and very large quantities (amounting to 23,000 kilog. in 1909) are seized every year by the Custom House officials and the coastguard officers, but the demand is widespread, and it is obtainable practically in every village. From the number of ways in which this injurious drug is prepared for consumption, in the form of sweetmeats or confections, and the large amount that is still introduced into the country, such investigations are of the highest importance, especially in a country where the adulteration of foods is not controlled, as in Europe.

In the July number of *Petermann's Mitteilungen*, Dr. Peucker gives an account of the proceedings of the International Aëronautical Conference, held at Brussels on May 26 and 27, in so far as they affected maps. Resolutions were passed in favour of the scale of 1 : 200,000 as far as possible, though in special circumstances other scales might be desirable; each sheet should include a degree square, and the sexagesimal system should be employed; geographical names should be in the language of the country represented. In the compilation of detail and employment of conventional signs full latitude was given, but some delegates expressed the desire that high-tension electric cables should be indicated.

The Hydrographer's report for 1910 has been issued, containing a brief summary of the surveys which have been carried out by the Admiralty during the year. Five ships were employed in home waters and seven abroad, off

British Columbia, Australia, Borneo, the west, south, and south-east coasts of Africa, the Straits Settlements and Australia, and off Newfoundland. Two ships of the Royal Indian Marine were employed on the Marine Survey of India, off Burma, and the west coast of India. Among much work classed as miscellaneous, a systematic determination of the magnetic variation in the North Sea was carried out in March by the officers of four cruisers, which resulted in obtaining good values at sixty-two positions. Considerable irregularity was also located near the Shetland Islands, and also near the coast of the British Isles. Further experiments were carried out at Chatham with the Field-Cust tide-recording apparatus for use at sea, and very satisfactory results were obtained.

THE Journal of the Meteorological Society of Japan for May contains, in addition to several articles in Japanese on interesting subjects (*e.g.*, "Fogs on the Korean Coast," "Variation of Barometric Pressure in Japan," &c.), original articles in other languages. One of the latter is on "Wireless Telegraphy in the Service of Japanese Meteorology," by Mr. T. Saki. Japan is frequently visited by typhoons, and the most dangerous are those which originate in the Pacific. By arrangements made since May, 1910, the central office at Tokio receives ordinary and special codified radiograms from men-of-war and vessels of the great Japanese shipping companies, from distances even as far off as 180° E. longitude (40° E. of Tokio), and dispatches warning telegrams to ships at sea. These messages will be of great value both for storm-warning purposes and for improving our knowledge of the behaviour of those destructive storms.

IN *Climatological Service* of the U.S. Weather Bureau (District No. 11, California), Prof. A. G. McAdie publishes a paper on forecasting the supply of water for the summer from the depth of snow, which is of considerable interest to engineers, farmers, and others. Observations of the depth of snow and of rainfall have been made since 1870 at Summit, a station on the Southern Pacific Railway, at a height of 7017 feet, where 86 per cent. of the precipitation falls as snow. The average depth of snow (mean of ten seasons), the average rate of its melting, and the depth for the present season, are shown by a diagram. A model (shown in the paper) is also made use of for comparing the actual curve of melting snow for any given season with the mean curve. By means of this design and the tables, the probable date of the snow's disappearance, and the consequent cessation of water supply from this source, may be determined. The author points out that the wind is probably the greatest factor in reducing the depth of snow, and he refers to the difficulty of determining the water equivalent for given depths. The "packing" process plays an important part; samples taken near the top and bottom of a snow bank give very different results.

DR. H. A. MIERS, F.R.S., principal of London University, delivered the eighteenth Robert Boyle lecture before the Oxford University Junior Scientific Society on May 20, and selected as his subject the growth of a crystal. The lecture has just been issued by Mr. Henry Frowde, price 1*s.* net. To the elucidation of the problem of crystallisation nearly the whole of the researches which Dr. Miers had carried on with the aid of a small but zealous band of students during his tenure of the Waynflete chair of mineralogy at Oxford had been devoted, and his lecture, therefore, took largely the form of a valedictory address, in which he recounted the nature of those researches and summed up the progress made in our comprehension of the constitution of crystallised matter as the result of them. Dr. Miers had early realised that mere idle speculation was futile, and that it was of primary importance to observe a crystal while actually growing, and had devised for the purpose apparatus which he brought with him to Oxford; with it he made the interesting discovery that the layer immediately in contact with the crystal is denser than the liquid as a whole. In conjunction with Miss Isaac he investigated the conditions governing crystallisation from a saturated solution, and at his instigation Mr. Barker studied the growth of one crystallised substance on another, and found that congruence of molecular structure was the factor that determined parallelism of growth. Dr. Miers referred to Prof. Lehmann's discovery of liquid crystals, and to the theory of crystal structure put forward by Mr. Barlow and Prof. Pope, and, in conclusion, pointed out that advance in a subject such as crystallisation, which lay near the confines of several branches of science, depended to no small extent upon the assistance of other workers beyond the fence.

UNDER the title "Men of Note in Aëronautics," the July issue of *Aëronautics* gives a biographic notice of Mr. R. F. Macfie which should do much good in bringing home to English readers the side of aviation to which little attention is given in daily papers. The extracts from Mr. Macfie's diary will, indeed, be a revelation to the uninitiated reader of the difficulties encountered by the early pioneers of artificial flight, which include destruction of aëroplanes, repeated interviews with War Office officials, followed by refusal of permission to fly, delays of three days at Custom houses, permission refused at Pau after having previously been granted, interviews with municipal authorities resulting in further refusals, loss of machine in transit, its recovery in a terrible state of ruin, delay in sending engines, short flights, then permission withdrawn, machine damaged by bad weather, then partially burnt. In spite of the present popular enthusiasm, there are many workers in aviation who not only do not receive the recognition they deserve, but are, on the contrary, handicapped by every kind of discouragement.

THE Circolo Matematico di Palermo is a society which during the twenty-seven years that have elapsed since its foundation in 1884, has gradually developed into an international mathematical society. It is interesting to note how different nationalities were represented at the time when its last report, for 1910, was drawn up. Out of a total of 745 members, we find that the countries contributing not fewer than 10 members may be classified as follows:—Italy, 275; United States, 119; Germany, 111; France and colonies, 54; Austro-Hungary, 49; Russia, 24; Great Britain and Ireland, 17; Sweden, 16; Denmark, 13; Belgium and Switzerland, each 11. The membership for the whole British Empire, including India, only numbers 24, the same as for Russia. It need scarcely be pointed out that the large preponderance of Italian members is in great measure attributable to the local character of the society, but leaving the figures for Italy out of account, the remaining statistics may afford some indications of the relative importance attached by different countries to an international movement for the advancement of higher mathematics.

THE annual report of the Royal Prussian Meteorological Institute ("Bericht über die Tätigkeit des königlich Preussischen Meteorologisches Instituts, 1910") has been issued. The administrative report shows that satisfactory progress has been maintained with routine work both at the institute and at the Potsdam Observatory. A number of scientific papers by members of the staff or by observers

in connection with the institute are printed as appendices. Several of these deal with questions of thermometer and rain-gauge exposure. Among the remaining papers we may mention a detailed summary of the observations of cloud motion over Hildesheim, extending over the period 1904–8, by Th. Bötel, observer at Hildesheim, and a report by W. König of the heavy rainfall experienced in Germany during the first few days of August, 1910. Appendix xi. reports on the comparison of the standard barometers and magnetic instruments of Potsdam Observatory with those of de Bilt, Paris, Val Joyeux, and Pavlovsk, carried out by Dr. W. Kühl in conformity with resolutions of the International Meteorological Committee. Further papers on magnetic comparisons are contributed by Prof. Ad. Schmidt and Dr. O. Venske. Prof. Schmidt also contributes a paper on the detailed magnetic survey of east Prussia, a region of great magnetic disturbance. This is accompanied by a chart of isogonic lines for the epoch 1911·0.

IF the collimator and telescope of a spectrometer are so placed that their axes coincide, and a block of plane parallel glass is placed between the collimator lens and the telescope lens, no deviation of the image of the collimator slit is produced. If the upper part of the glass block is provided with a prism-shaped cavity which contains a liquid having an index of refraction which differs from that of the block, the upper part of the image of the slit will be deviated by an amount proportional to the difference of the two indices of refraction. Now the deviation of a narrow pencil of homogeneous light on passing through a lens is proportional to the distance of the point of the lens on which the pencil falls from the axis of the lens. By making the light which has passed through the liquid pass through a lens at the proper distance from the axis, the deviation due to the liquid may therefore be compensated. It is on this principle that the Féry refractometer is constructed. The block of glass containing the prism-shaped hollow for the liquid the index of refraction of which is required, is enclosed in a small water tank the sides of which are plane convex lenses. The tank and contents can be moved horizontally across the field by means of a screw, and the distance through which they have to be moved to make the resultant deviation zero, is found to be proportional to the difference of refractive indices of glass and liquid. In the instrument as constructed by Messrs. Hilger, the range of refractive index is from 1·3300 to 1·6700, with a degree of accuracy of nearly 0·0001. The reading is direct, and by heating the water in the tank to different temperatures the effect of temperature on the index of the liquid may be determined. A measurement can be obtained with 1 c.c. of liquid.

THE second issue of *Le Monde*, which is described as a monthly illustrated encyclopædia, being an anthology of the reviews of all countries, has reached us. Copies may be obtained in this country from Messrs. Nilsson and Co., 16 and 18 Wardour Street, London, W., at the price of three francs. Among other contributions to this issue we notice translations into French of Mr. H. H. Suplee's article in *Cassier's Magazine* on the determination of altitudes reached by aëroplanes, and an article from *The Times* on the great ocean liners which now connect Europe and America.

WE have received from Prof. C. Ulpiani a reprint of a paper from the *Atti della Società Italiana per il Progresso delle Scienze*, 1910, discussing the work of the United States Bureau of Soils, especially the applications of physical chemistry to the soil.

OUR ASTRONOMICAL COLUMN.

ASTRONOMICAL OCCURRENCES FOR AUGUST:—

Aug. 1. 7h. 11m. Jupiter in conjunction with the Moon (Jupiter 1° 13′ N.).
7. 22h. 46m. Uranus in conjunction with the Moon (Uranus 4° 28′ N.).
8. 18h. 0m. Mars at quadrature to the Sun.
10. 1h. 0m. Venus at greatest brilliancy.
10–12. Maximum of the Perseid Meteors.
12. 21h. 0m. Mercury at greatest elongation E.
13. 6h. 0m. Saturn at quadrature to the Sun.
16. 15h. 53m. Mars in conjunction with Saturn (Mars 0° 21′ N.).
16. 20h. 2m. Saturn in conjunction with the Moon (Saturn 4° 2′ S.).
16. 20h. 12m. Mars in conjunction with the Moon (Mars 3° 40′ S.).
19. 19h. 0m. Venus in Aphelion.
21. 1h. 20m. Neptune in conjunction with the Moon (Neptune 5° 36′ S.).
22. 14h. 0m. Venus stationary.
25. 11h. 50m. Venus in conjunction with the Moon (Venus 10° 23′ S.).
28. 22h. 0m. Jupiter in conjunction with the Moon (Jupiter 1° 41′ N.).

DISCOVERY OF ANOTHER COMET (1911*c*).—A telegram from the Kiel Centralstelle announces the discovery of a comet at the Geneva Observatory (U.S.A.) on July 20. At 9h. 52m. (Geneva M.T.) the comet's position was

R.A. 22h. 13·6m., dec. 20° 57′ N.,

and it was moving in a north-westerly direction. A second observation was made on July 21 at the Lick Observatory, and at 9h. 53·1m. (Lick M.T.) the position was

R.A. 22h. 13m., dec. 21° 34′ 40″ N.

This position precedes the Great Square, and forms, roughly, an equilateral triangle with α and β Pegasi; it transits at about 1 a.m. According to the Lick observers, the comet was of about the tenth magnitude, and was moving in a N.N.W. direction.

THE KIESS COMET, 1911*b*.—A number of observations of comet 1911*b* appear in No. 4512 of the *Astronomische Nachrichten*, where the magnitude is variously recorded with values varying from 4·0 to 8·5. The object is blue or green, and has a faint tail, which on a photograph taken at Simeïs on July 9 was 0·5° long, in position angle 285°.

Later observations have made it possible for Dr. Kobold to improve his elements and obtain an ephemeris which practically agrees with the observations; these he publishes in a supplement to No. 4513 of the *Astronomische Nachrichten*.

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

1911	α (true) h. m.	δ (true) ° ′	log *r*	log Δ	mag.
July 26 ...	4 15·0 ...	+30 3·3			
,, 28 ...	4 9·9 ...	+28 57·7 ...	9·9515 ..	9·8582 ...	5·8
,, 30 ...	4 4·2 ...	+27 40·2			
Aug. 1 ...	3 57·5 ...	+26 3·5 ...	9 9755 ...	9·7742 ...	5·4
,, 3 ...	3 49·7 ...	+24 5·6			

Perihelion occurred on June 30, so that the comet is now receding from the sun; but it is approaching the earth, and later, in August, will come within 0·2 of an astronomical unit. It should then provide a striking spectacle, especially to those situated in the southern hemisphere, in the early morning sky. At present its calculated magnitude is about 6·0, but when nearest the earth the comet should increase in brightness to about magnitude 3·5. The present position lies about half-way between 1 Aurigæ and the Pleiades, and on August 3–4 the comet should be very near to the latter asterism.

WOLF'S COMET, 1911*a*.—Observations of this faint comet are recorded in No. 4512 of the *Astronomische Nachrichten*. M. Javelle, observing at Nice on July 5, found it to be a star-like object of less than magnitude 14·0, having a faint nebulosity about it. M. Kamensky finds that the correction to his ephemeris is about −0·5s. and −6·3″, and asks observers to communicate their positions to him.

THE RADIAL VELOCITY OF THE SUN, AND DOPPLER'S PRINCIPLE.—In No. 5, vol. xxxiii., of *The Astrophysical Journal* Mr. A. Cotton has a paper dealing with the legitimacy of applying Doppler's principle, purely and simply, to determine the radial velocity of the sun's parts from the measured displacements of the lines in the solar spectrum. He shows that the fact that the sun is surrounded by an extensive, turbulent atmosphere, in which densities and thermic qualities of vastly different magnitudes coexist, is sufficient to call for prudence when applying a simple, single interpretation to the displacements.

PECULIAR STELLAR SPECTRA AND SELECTIVE ABSORPTION IN INTERSTELLAR SPACE.—We have just received No. 51 of the Lowell Observatory Bulletins, in which Dr. Slipher discusses evidence for the existence of some material in interstellar space which differentially absorbs star radiations.

A spectrum of β Scorpii displayed a sharp K line, whereas all the other lines in this "Orion"-type spectrum were diffuse and broad; and while the latter show a Doppler displacement equivalent to a range of 240 km., the K line gives no sign of shift.

Further research indicated that σ, δ, and π Scorpii exhibit the same phenomena, and in this are like δ Orionis, ζ Ophiuchi, ι and η Orionis, o Persei, and other binaries. Apparently the matter wherein this calcium absorption takes place is, in each case, independent of the star, and the theory at once suggests itself that it takes place in an absorbing medium lying between us and the stars. Evidence for this accumulates in other directions; and the matter is one of fundamental importance to which the attention of astrophysicists must soon be directed. Dr. Slipher asks for cooperation; as a preliminary, the examination of all the spectra of "Orion"-type stars in existence would indicate those in which the independent behaviour of the calcium, and maybe the sodium, lines was marked.

FRENCH ASTRONOMICAL WORKS.—Readers of French will find that "Quelques Heures dans le Ciel," a franc "paper back," by the Abbé Th. Moreux, gives a very complete, lucid, and well-illustrated *résumé* of present-day astronomy. The chatty freedom with which the various points are explained will attract the beginner, and the illustrations will considerably assist his comprehension.

Those who wish to practise astronomy will find the Commandant Ch. Henrionnet's "Petit traité d'Astronomie pratique" a useful summary and guide. The author describes the books and the instruments used, the simpler methods employed, and gives a brief statement of the interesting things in various constellations. Gauthier-Villars publish the book at 1.75 francs.

THE MANCHESTER MEETING OF THE INTERNATIONAL ASSOCIATION OF SEISMOLOGY.

THE meeting of this association, which was held in Manchester on July 18–22, proved to be one of considerable interest and importance. The time spent on business and administration was less than at preceding meetings, so that more was left for original communications and discussions.

On the opening day, the Vice-Chancellor of the University of Manchester received the delegates in the Whitworth Hall, and during the day a telegram was received from the President of the Board of Education in the following terms:—

"His Majesty's Government heartily welcome your association, and wish success to their deliberations. They rejoice to see the attempt to organise seismology internationally, which was initiated by the British Association under the influence of Dr. Milne, bearing fruit, through your proceedings on British soil."

Amongst the communications received, probably the most important was the description by Prince Galitzin of his new instrument for measuring the vertical component of the motion of the soil. The instrument shown at the meeting has been acquired for the observatory at Eskdalemuir, where it will be set up as soon as a proper foundation can be built.

Mr. Oddone showed an ingenious and simple apparatus for measuring the elasticity of rocks, and Mr. Wiechert's communication on the constitution of the interior of the earth gave rise to an interesting discussion.

An instrument was also shown at the meeting constructed by the Cambridge Scientific Instrument Company, with which it is intended to count the number of waves which strike the shore in a given time in order to test whether the period of these waves is the same as the period of the microseismic disturbances. This instrument has already been taking records on the coast of Northumberland, under the superintendence of Mr. Morris Airey.

There was a reception in the Town Hall on one of the days of meeting, which was well attended, and a dinner was given by the university on the last evening.

Saturday, July 22, was given up to excursions, and at the invitation of the director of the Meteorological Office and of Mr. and Mrs. J. Walker, nearly twenty foreign delegates visited the new magnetic and meteorological observatory at Eskdalemuir.

The foreign delegates both privately and publicly expressed their gratification at the presence of Dr. Milne, and, in addition, British men of science were well represented, amongst others by Sir George Darwin, Profs. Lamb, Love, Knott, Mr. Oldham, and Dr. Shaw.

Prince Galitzin was elected president, and Mr. Lecointe vice-president, for the next period of three years, dating from April, 1912.

The opening address delivered by Prof. Schuster on July 18 is subjoined.

Some Problems of Seismology.

Since our last meeting important changes have taken place in our Central Bureau. Increasing age has compelled Prof. Gerland, to whose strenuous efforts the foundation of this association is mainly due, to resign the directorship of the seismological station at Strassburg. Prof. O. Hecker, who has been appointed in his place, has thereby become the director of the Central Bureau, and you will agree with me that no better choice could have been made. The excellence of his work is well known to you, and since he has entered into his new office he has with characteristic energy already done much to make the bureau more efficient for its international work. You will have an opportunity of showing your confidence in him when we decide on the locality of the Central Bureau for the next period of four years, as though we have no official voice in the choice of the director, it lies in our power to move the seat of the Central Bureau at any meeting of the general assembly if such a course seems desirable in the interests of our work.

Our association primarily deals with the study of the causes of earthquakes and of their effects, but the interest which the public shows in our investigations is mainly due to the sympathy roused by the human suffering which follows the trail of these seismic catastrophes. At present we feel helpless, though perhaps not altogether hopeless, in the face of the destructive convulsions of the earth. The problem of constructing buildings which can withstand shocks of earthquakes does not enter into our programme, but it has been asked, and the question will be raised during the present meeting, whether there are any preliminary indications which would allow us to predict the occurrence of a dislocation of the soil and take precautions to mitigate to some extent its power of destruction. Remembering how meteorologists have succeeded in preventing loss of life at sea by predicting the course of cyclones in the Indian Ocean or the Gulf of Mexico, we might be tempted to hope that similar warnings may help us to fight the dangers of an earthquake. I am afraid that the cases are not quite analogous, and even if our knowledge should allow us in the future to form predictions of equal certainty, the dangers accompanying such predictions may overbalance its benefits. The precautions which can be taken in a harbour against an approaching storm are of a comparatively simple character, and the meteorologist is therefore justified in warning us against a probable storm which does not appear; but would the seismologist be justified in creating a panic and dislocating trade by predicting an earthquake which failed to take place? We can easily forgive the meteorologist who fore-

casts the weather as "fine to doubtful and stormy"; but should we forgive the seismologist when he forecasts the approaching seismic condition of our town as "calm to unstable and collapsing"? Perhaps it may seem to you that I am wandering beyond the range of practical science even in alluding to this subject; nevertheless, the fear of creating panics by premature forecast is one which has already cast its shadows in advance, and I am informed that insurance companies in this country have shown some irritation by the early publication of the indications of a destructive earthquake which has taken place in a distant part of the world.

To the man in the street the question whether a thing is large or small is all-important; to the scientific man it matters not at all; and a great part of our deliberations will deal, not with catastrophes, but with microscopic movements of the soil, movements so small that the vibrations due to the traffic in a city compare with it as the waves of the ocean with the ripples on a pool. At the last meeting of the general assembly, four years ago, you appointed a committee to investigate these microseisms. I need not remind you that there are two types of short waves which are frequently observed. One of them has independently been traced in different countries, and by several observers, to the action of the wind, which seems to create waves over an extended land surface just as it does over the ocean. The second type of vibration, which occurs in periods of from five to ten seconds, is more difficult to trace. It has been suggested that the vibrations are due to the impact of waves on the shore against which the wave strikes. For the purpose of testing this hypothesis, an instrument has been set up on the coast of Northumberland (partly paid for by the funds of this association) which automatically counts the number of waves which in a given time strike the shore. The instrument, which was designed by the Cambridge Scientific Instrument Company, Ltd., will be exhibited at this meeting. It has been set up and looked after with great ability by Mr. Morris Airey, and we are already able to say that it will fulfil its object, though the observations at present are too few to allow us to draw any conclusions.

While we rightly attach much value to the systematic investigation of minute disturbances, we must not forget to keep in mind the source and origin of all dislocations of the soil. The recent advances in physical science render it imperative to review our position with regard to this fundamental question.

In our youth we were taught that the earth, once a molten and fiery globe, had gradually cooled down, leaving the inside still hot, but gradually cooling and contracting. This contraction of the nucleus was looked upon as the primary cause of geological dislocations. But now do we stand at present? In the breaking up of radio-active products we find a source of heat which—if the amount of radium and thorium in the interior of the earth is not decidedly less than that which is found near the surface—would not only balance the earth's loss of heat by radiation, but actually increase its average temperature. Though reasons may easily be found why the surface layer of the earth may be richer in radio-active products than the core, I think that we are nevertheless driven to the conclusion that the earth is now, and has been for a long time, in thermal equilibrium, and that shrinkage by cooling does not account for any of the more recent displacements. Why, then, should not the earth long ago have settled for itself all seismic questions, and have come to rest in a comfortable state of equilibrium? After the four or five million years which it has had to calm down, we might have expected that everything should be quietly arranged in uniform layers round the centre of the earth Instead of this regular distribution of matter, we have not only mountain chains, but also the depressions and elevations which cause the distribution of land and water over the globe.

The causes of these inequalities have long interested geologists and mathematicians, but the wider discussion of the stability of the whole structure on which we live has only recently come into prominence. The subject is a most difficult and intricate one, and a most important contribution towards its elucidation has appeared within the last few weeks. In an essay to which the Adams prize of the Cambridge University has been adjudged, and which, I think, will become a classical guide to all who intend to pursue the subject, Prof. Love has treated the problems of geophysics with masterly ability and lucidity. I wish it had been possible to arrange—perhaps it is still possible—for Prof. Love to give you an account of his investigations, and in his presence it would be impertinent in me to explain, as otherwise I might have been tempted to do, the main conclusions at which he has arrived. I must therefore content myself with directing attention to the great importance of this work, and alluding to one suggestion contained in it which more particularly touches a subject with which this meeting is concerned.

The important work of Prof. Hecker, confirmed since by others, has allowed us to trace the tidal deformation of the earth, and has brought to light the curious result that the earth appears to resist a change of shape less in the north and south than in the east and west direction.

Prof. Love, having failed to account satisfactorily for the effect in other ways, suggests that the want of symmetry in the rigidity is apparent only, and that the observed effects are caused by the attraction of the tide wave in the North Atlantic and its accompanying excess pressure on the sea bottom. In the investigation of the tidal deformation of the earth, our work overlaps that of the International Geodetic Association, and a communication from that body will have to be considered by us. In other directions our work closely touches that of the geologist, and there may be points of contact with other parts of geophysics, such as meteorology and terrestrial magnetism. This interdependence of different branches of science will force us before long to consider our relationship to other international associations.

The extreme specialisation which finds expression in the formation of so many different societies and associations is an evil which may be a temporary necessity, but which we should try to mitigate so far as possible. There ought to be a connecting link which draws us away from the minute elaboration of detail and towards the great problems that ought never to leave the mind of a man of science. But what is this connecting link to be, and what are the bonds which are to unite it to bodies of such varied interests and constitutions? I have formed my own opinion, but I am afraid on this occasion to enter on to ground which may be controversial.

In concluding these few words of introduction, I feel that I express your wishes by thanking the Vice-Chancellor, who has found time among his many heavy duties to come here to welcome you.

THE PROGRESS OF CANCER RESEARCH.

THE tenth annual meeting of the Imperial Cancer Research Fund was held on July 20 at the Royal College of Surgeons, the Duke of Bedford presiding. The presidents of the Royal Colleges of Physicians and Surgeons, Sir Wm. Church, Sir Douglas Powell, Sir John McFadyean, Sir Henry Morris, Sir John Tweedy, Dr. Sidney Martin, Mrs. Bischoffsheim, and many other supporters of the fund were present. Sir Wm. Church, in moving the adoption of the annual report, gave an outline of Dr. Bashford's statement of the progress of knowledge of cancer, from which we give some extracts below. In seconding the resolution, Sir Henry Morris directed attention to the widespread influence exercised by the investigations of the scientific staff. This was evidenced in one way by the number of distinguished voluntary workers attracted to the laboratory from abroad, not only from all European countries, but also from America, Australia, and Japan, and in another way by the number of learned societies at home and abroad which invited the director to address them. Thus Dr. Bashford had visited, among other centres, Berlin, Heidelberg, Toronto, Paris, Budapest, Christiania, and Utrecht. Its influence was felt in a third way by the large increase in the number of centres engaged in the investigation of cancer in the laboratory. The other business was purely formal.

A feature of this year's work is the extension of experimental investigation to rabbits, in which animal a carcinoma of the mamma and a sarcoma of the sub-

cutaneous tissue have been discovered, the latter being capable of propagation.

Statistics.

It will be remembered that the policy pursued in regard to the statistical investigation of cancer has been to supplement the national statistics, and, if possible, to add to their utility by special inquiries, but not to endeavour to overlap or in any way to replace them. This collaboration and coordination, which does not exist in the case of organisations for the investigation of cancer in other countries, where independent statistical inquiries have been undertaken with the voluntary assistance of the medical profession, has been of the greatest importance in England and Wales by preventing profitless overlapping, and in effecting real advances in the accurate statistical knowledge of the incidence of cancer.

The application of the law of age-incidence for cancer to short-lived as well as to long-lived animals reinforced the other reasons for obtaining it, and suggested that knowledge would be advanced by more detailed information about the age-incidence of cancer in the several organs of man as distinct from its dependence on the age-distribution of persons. The tabulation of the new data for the years 1901–9 brings out the fact that the increase during this period is referable to certain anatomical regions and not to others. Thus, for males, the main increase falls on the alimentary tract, especially the stomach. The liver and gall-bladder and the skin show no, or only a slight, increase. For females, the increase, although it falls mainly on the alimentary tract (stomach and intestines), affects also the mamma, while the uterus, ovary, liver and gall-bladder, rectum and skin, show little or no increase. It is also of importance that the recorded mortality from cancer of the generative organs has not increased at the same rate as that for other organs, and that most of the increases affect the higher age-periods predominantly. For the first time it is fully demonstrated that it is wrong to make statements of a disquieting nature about the increase of cancer in general. While it is evident that several of the differences brought out by the figures can be explained by more accurate diagnosis and by transference of the seat of the disease from the secondary to the primary situations, as illustrated, *e.g.*, by the relation revealed between cancer of the liver and gall-bladder and the alimentary tract, this may not account fully for other features. In particular, the increase recorded for the mamma in women and the tongue in men requires further study and elucidation.

The analysis also shows that the incidence is very unequally distributed among the several situations, and, indeed, that the whole curve of incidence may be different for different organs. A progressive increase up to the highest age-periods is characteristic of the face, lip, mouth, bladder, urethra, and breast only. The other organs show a distinct diminution in the highest age-periods; but it is not yet possible to determine whether this curve indicates a liability rising to a maximum followed by a diminution, or is merely the result of deaths being still ascribed to other causes in the case of cancer of internal organs in aged people. The proportion of total deaths ascribed to the ill-defined cause of old age is 65·6 per 1000 as compared with 65·7 for cancer, and it must be borne in mind that the increases recorded for cancer affect principally the higher age-periods, and that the average age of the population is increasing.

The study of the occurrence of cancer in mankind and in domesticated animals in widely separated parts of the globe has shown that the practice of peculiar customs (involving the subjection of particular parts of the body to chronic irritation), provokes the disease in situations and organs from which it is absent when these customs do not obtain. It is reasonable to suppose that the frequency of cancer would be diminished if such practices as the use of the kangri in Kashmir, the chewing of betel-nut, the eating of very hot rice in China, were discontinued. It is also reasonable to assume that the introduction into England of these exotic customs would greatly increase the frequency of cancer in this country. So definite is the evidence of the mediate causation of certain forms of cancer by chronic irritants, that the possibility of variations in the cancer death-rate must be admitted as regards particular organs and regions of the body. The possibility of a variation of the main incidence of cancer in conformity with changes in certain customs must also be admitted. That irritation is really an important causative factor of cancer is an assumption which is justifiable only for certain forms of cancer occurring in particular regions. The knowledge of the irritants to which different species of animals and the individual tissues of the same animal are susceptible is of very considerable importance. The acquisition of this knowledge will doubtless require extensive study, and it is advisable to approach this study in man statistically, and advisable to have data of the incidence of cancer in persons pursuing different occupations. This information will be embodied in the next decennial supplement to the reports of the Registrar-General.

Heredity.

The breeding experiments which have been in progress for many years have been alluded to in several earlier reports. They have now yielded upwards of 2000 mice of known ancestry and age. 562 females were available for a study of the influence of heredity on the development of cancer of the mamma when an analysis was made on October 24, 1910. The investigations show that heredity plays a part in the development of cancer of the breast in mice. At all age-periods the disease is more frequent when the mother, or either grandmother, or all three had died from cancer of this organ.

Apart from its bearing upon heredity, the obtaining of such mice was most important for furthering the experimental investigation of the genesis, nature, and, should it be necessary, artificial production of cancer, and for attempting to define the reasons for its apparently greater frequency in some geographical areas than in others.

While it is at present impossible to explain how the liability is transmitted, it can be averred with certainty that it does not consist in the inheritance of a soil more suitable for the growth of cancer in general. It can only be inferred, with some probability, that it is a local or circumscribed tissue predisposition, in virtue of which the mammary tissue is prone to pass from mere proliferative reaction into continuous or cancerous proliferation. Further, hereditary predisposition is only one of the factors in play, for it has been found that chronic inflammatory changes are remarkably frequent in the mammæ of female mice of the laboratory. Other factors still unrecognised may exist.

Individuality and Cancer.

The study of the parallel behaviour of normal and cancer tissue, both as regards absence of continued growth and the nature of the immunity reactions induced, when cancer is transferred from one animal to another of a strange species, showed that cancer had all the properties which distinguish the normal tissues of one species from those of another species. Recent experiment has carried knowledge much further. The fact that transplantable tumours grow in normal animals as well as they do in spontaneously affected animals shows that the latter do not present a soil for the growth of cancer substantially different from that presented by normal animals. When this result is contrasted with the almost invariable success of transplanting a portion of its spontaneous tumour into the animal so affected, and the almost invariable failure of implantation of any spontaneous tumour into other spontaneously affected animals, the demonstration is complete that each tumour is peculiarly and genetically related to the individual in which it arises. This conclusion is drawn from studying the growth of tumours under the different conditions just enumerated, and is supported by the results of elaborate experiments on inducing resistance or immunity to the inoculation of cancer-cells under these different conditions. The results of these two lines of inquiry agree also with the fact that resistance has not been induced either with an animal's own tumour or its own normal tissue. The individuality of cancer would thus appear to have been placed at last beyond all further discussion. It has long been maintained in various forms on the basis of deductions drawn from histological (microscopical) examination of the tissues at the site of the primary lesion, and from the nature of dissemination, but this interpretation of the findings has been as vehemently

combated. The combination of the results arrived at by microscopical investigation and experimental study appears to terminate any need for further discussion. A long step has thus been taken in defining the direction in which the future investigation of cancer is alone likely to be profitable.

The Nature of Cancer.

It follows from the argument pursued in the preceding paragraphs that a closer definition of the nature of cancer will involve an analysis of the relation obtaining between the individual developing cancer and the tumour.

In all previous reports guarded reference has been made to the mediate relation obtaining between chronic irritation and certain forms of cancer. The indefiniteness in the way of directing attention to the relationship has been deliberate. In the first place, it is due to an effort to elucidate those forms of cancer with which irritation is most constantly associated without considering other forms in which the particular irritants concerned do not play a part. In the second place, it is due to the fact, already frequently emphasised, that these irritants have nothing in common beyond their association with cancer. The varied investigations of the past nine years have added a knowledge of new forms of irritation. It has become more and more evident that irritation, effective in one case, may be, and often is, quite ineffective in another.

It has been ascertained that every fresh transplantation effects a disturbance of the cancer cells. They are thrown into a state equivalent to regeneration from which they tend to recover, as analogous as possible to reactive proliferation when naturally occurring.

Ever since the beginning of these investigations it has been maintained that the mere cultivation of cancer had important, if only indirect, bearings upon its nature and genesis. Thirty-five of the tumour-strains have now been growing for more than three years, *i.e.* for longer than a mouse lives, while fifty other strains have been grown for extended periods. The one feature all these tumour-strains have in common is the power of continuous growth which they possess, in spite of the most divergent structure, and of extremes in the rate of growth varying from an almost explosive rapidity to one much inferior to that of embryonic tissue, as determined by weighing experiments.

It can be shown that there is a constancy in the behaviour of a tumour-strain and a variability which is individual. The variations which occur are similar to those which distinguish the eighty-five different strains from one another. They are not mainly induced by the environment, but arise spontaneously; otherwise all strains would approach a common type, which they do not. The demonstration of the occurrence of these variations under artificial conditions permits of the inference that they could also occur under natural conditions, and yields objective evidence of the validity of the conclusion that the cancer-cell is a biological modification of the normal cell endowed with many inherent properties of the latter. The objection at once suggests itself that these variations during prolonged propagation are secondary, and do not necessarily indicate corresponding primary changes as responsible for genesis; but this objection cannot be maintained against the facts that the potentiality for variation has been demonstrated, as has also the tenacity with which the several varieties are adhered to.

Immunity and Therapeutic Investigations.

The dissemination of cancer has been studied experimentally both by injecting cancer-cells directly into the blood-stream and by implanting them in internal organs. It has been found possible to produce the lesions of dissemination in these ways both in the absence and in the presence of a primary growth, and what is more important also, to prevent them. Problems difficult of solution in the mouse, because of its small size and the short duration of its life, can now be studied in the more favourable circumstances obtaining in the rabbit, the extension of experiments to this animal being a new feature made possible by the successful propagation of a sarcoma from rabbit to rabbit.

Nothing but harm can result from the premature application to the treatment of the human subject of methods found to modify the growth of propagated cancer in animals. The methods which induce an *active* immunity to propagated cancer have been tested on thirty-three mice with natural cancer, and have given no evidence of powers either to hinder growth and dissemination or to prevent recurrence of spontaneous cancer after surgical removal.

The successful treatment of animals bearing propagated cancer by means employed to induce *passive* immunity has been described by other investigators. Some of these methods have been tested in the laboratory, but have not yielded positive results. It becomes increasingly evident that the therapeutical treatment of cancer is not to be sought for along these lines.

A considerable number of cases of natural healing of spontaneous malignant new growths have now been observed in mice affected with spontaneous cancer. The changes leading to natural cure appear to depend, as in propagated cancer, on an altered condition of the cell and its contents rather than on an alteration in the general condition or constitution of the affected animal. Means must be devised for elucidating the nature of the change in the cell before curative measures can be discovered.

Since these investigations were first contemplated by those responsible for their inauguration, the provisions made for the investigation of cancer have greatly altered in this country. Whereas nine years ago, apart from special provision for treatment being supplied by a number of hospitals, there existed for the investigation of the disease only one other laboratory in addition to the Imperial organisation contemplated by the founders of this fund. To-day a number of other laboratories exist throughout the country, both in London and the provinces. England and Scotland are now provided with a greater number than any other country in comparison with their size and population. Whenever an opportunity has occurred of furthering the particular investigations upon which these institutions have been engaged, assistance has been rendered by supplying material from the laboratory and by the Imperial Cancer Research Fund in many other ways. The responsibilities thrown upon the workers of the Imperial Cancer Research Fund are not diminished, but rather increased, by the multiplication of institutions engaged in the investigation of cancer.

THE BOARD OF EDUCATION'S SCIENCE EXAMINATIONS AND GROUPED COURSE CERTIFICATES.[1]

AS is well known, the Board of Education for some time past has been considering the reorganisation of the existing system of science examinations conducted by the Board, in the hope of lessening the somewhat heavy cost of these examinations and of securing greater educational efficiency. The conclusions arrived at by the Board have recently been published in a circular, accompanied by a covering letter from Sir Robert Morant, in which is summarised the principal changes which the Board has decided to bring into operation in the session 1911–12.

The general principles governing the action of the Board in respect to the proposed alterations are given in the following extract from Sir Robert Morant's letter:—

"The examinations were instituted in circumstances widely different from those of the present, at a time when no other machinery for promoting scientific or technical instruction was generally available; and they have in the past contributed greatly to the diffusion of scientific and technical knowledge throughout the country. But during recent years there has been a great development in the teaching of the subjects covered by the examinations in evening and technical schools, the organisation of which is necessarily affected by the nature of the examination tests available; and the Board have had to consider under what conditions a system of science examinations, conducted not by the teachers of the schools but by an external body, has any claim to continued existence, and how the working of the system so far as it is retained can best be coordinated with and made to supplement the work of the teaching institutions themselves."

It is evident that the Board recognises the very great difference between the general educational conditions in

1 "Science Examination and Grouped Course Certificates." Board of Education Circular, No. 776, June 20.

force when the examination system was initiated and the conditions prevailing at the present time, and that extensive changes are necessary in order to bring these examinations into harmony with modern developments of educational thought and practice. The Board clearly realises that the annual examination must not be the dominant factor in education. The examination must be subordinate to the teaching. Further, the yearly test, to be of any value, must be mainly an "internal" one, in which the teacher plays an important part. At the present time, the examinations conducted by the Board are purely "external" examinations, carried out by an outside body which is out of touch with the teacher and the students, and necessarily unacquainted with the actual conditions under which the educational work is carried out.

The Board, however, is not yet prepared, "as regards all students, to hand over entirely to the teaching staffs . . . the functions which the Board at present discharge in regard to the testing and certification of the attainments of individual students, although a partial transfer of such responsibility has now become possible." In the future, the Board will leave the examination of, and the issue of diplomas to, full-time day technical institution students to the teachers concerned, subject to regulations to be previously submitted to and approved by the Board. Full-time day students will not in general be permitted to attend the evening science examinations. The examination of all first stage evening or part-time students is also handed over to the institutions. Further, "the Board intend to invite the assistance of some teachers in technical schools as members of the examining boards to be constituted for the reorganised examinations."

Coming to the examinations themselves, the principal changes enumerated in the circular are the following:—

(*a*) A number of the examinations formerly held by the Board will be discontinued. These examinations are mainly in subjects which have attracted comparatively few candidates in the past (*e.g.* nautical astronomy), and in certain branches of natural science, such as botany and biology, which have usually been taken only by candidates reading for university degrees. The examinations to be retained by the Board are divided into five groups as follows:—

(1) *Group A.*—Pure and Applied Mathematics:—Practical plane and solid geometry, pure mathematics, practical mathematics, theoretical mechanics (solids), and theoretical mechanics (fluids).

(2) *Group B.*—Engineering:—Machine construction and drawing, applied mechanics (materials and structures), applied mechanics (machines and hydraulics), heat engines, building construction, and naval architecture.

(3) *Group C.*—Physics:—Heat, magnetism, and electricity.

(4) *Group D.*—Chemistry:—Inorganic chemistry and organic chemistry.

(5) *Group E.*—Mining and metallurgy:—Coal mining, metallurgy.

It may, perhaps, be regretted that the Board proposes to cease its examinations in subjects such as agriculture, hygiene, and physiology, in view of the national importance of these subjects, the rapid development of public interest in them, the increasing provision of facilities for instruction, and the absence of any generally recognised and easily accessible system of examinations in these subjects if the Board's examinations be withdrawn.

(*b*) Up to the present the Board has held four examinations in each subject, arranged as follows: 1st stage, 2nd stage, 3rd stage, and Honours. In the future, the Board will not conduct elementary examinations corresponding to the first stage, as it is felt that these examinations are now unnecessary, the "inspection" by the officials of the Board on their visits to the classes being sufficient to test the efficiency of the teaching. The Board will only hold two examinations in each subject, termed "Lower" and "Higher" examinations respectively. The standard of the Lower examination will be approximately equal to that of the present Stage II., while that of the "Higher" examination will be intermediate between Stage III. and Honours.

The main objections which may be urged against the withdrawal of the Stage I. examinations are:—(1) The present Stage I. syllabuses are a valuable guide to many teachers, especially perhaps to those interested in the more directly technical subjects and to those employed in the smaller, isolated technical schools; (2) the lack of uniformity in the elementary stages of technical instruction caused by the absence of syllabuses followed by schools all over the country, thus hindering the transfer of students from one institution to another. These obvious disadvantages may probably be best overcome by consultation between the representatives of the teachers and the Board of Education inspectorial staff, with a view to arrive at a common measure of agreement respecting courses, curricula, and the standard of work to be aimed at, especially in the earlier years of a student's work.

(*c*) Practical examinations, such as those in chemistry and metallurgy, will be discontinued, but candidates for admission to the Higher examination in subjects other than practical geometry, mechanics, &c., "will be required to furnish a certificate of having completed a satisfactory amount of laboratory work, and to submit his laboratory note-books signed and certified by the teacher."

Elaborate regulations, which will probably be found somewhat burdensome in actual practice, are outlined in the circular with regard to "grouped course certificates and diplomas, and conditions of endorsements." The Board will not, in general, issue certificates to students who have passed a given single examination. The Board will, however, endorse certificates or diplomas granted by school authorities upon the satisfactory conclusion of well-balanced courses of study, and "they trust that a certificate or diploma, endorsed by the Board under the prescribed conditions, will be recognised by all concerned as having at least a definite minimum value and standard."

"Grouped courses" are classified by the Board into two main classes: (1) evening or part-time day courses, (2) full-time day courses. Each of these is again subdivided into three groups: (*a*) junior courses (14 years to 16 years of age), (*b*) senior courses (16 years to 18 years), (*c*) advanced courses (18 years to 20 years).

Generally speaking, the proposed regulations as outlined in the circular mark a distinct advance upon the arrangements in force at present. In the main, the alterations are in the direction of freedom for the teachers, a greater elasticity permitting more modifications to suit local educational and industrial requirements, and the placing of examinations in a relatively less important position. The circular holds out to technical teachers the promise of speedy action by the Board of Education in regard to two important matters which they have long pressed upon the attention of the authorities at Whitehall, namely, the cooperation of the teachers in the drawing up of syllabuses and the conduct of examinations, and the improved organisation and coordination of all grades of technical education.

J. WILSON.

THE BRIGHTON CONFERENCE OF THE MUSEUMS ASSOCIATION.

THE attendance at the Brighton meeting of the Museums Association, held on July 10–15, was large and representative, delegates being present from forty-two museums at home, as well as from the American Museum of Natural History (New York), the Australian Museum (Sydney), and the Deseret Museum (Salt Lake City, Utah). The presidential chair was occupied by Mr. H. M. Platnauer, of York. Mr. Platnauer was one of the original founders of the Museums Association, which was inaugurated at York twenty-two years ago.

In his presidential address Mr. Platnauer strove to answer the question "What is a museum?" and showed by his remarks that he conceived all museums, whether of science, art, or history, to have a broad and educational function. He deprecated the idea that a provincial museum should be purely local, would not agree that the function of an art museum is merely to make a pleasurable appeal to the emotions, and suggested that museum arrangements should convey the facts of natural evolution and human progress by exhibits arranged in more than one dimension of space.

Mr. H. S. Toms had prepared an account of the Brighton Museum, with special reference to developments since the last meeting of the association in Brighton twelve years ago. It was plainly indicative of great progress, and

embodied some very useful practical hints on the care of collections.

Mr. J. A. Charlton Deas introduced the subject of national art loans to municipal museums, pointing out the great and growing need for making the artistic treasures of the nation more accessible to the dwellers in the provinces.

The value of museum guides, catalogues, and other publications was dealt with by Mr. Thomas Sheppard under the title "Pastimes for Curators." He described the manner in which the eighty or more publications issued by the Hull Museum had been prepared, and showed how they kept public interest in the collections alive and frequently led to desirable acquisitions.

Dr. J. A. Clubb read a paper on the purpose and arrangement of an index museum, in which the idea was elaborated of making the entrance hall of the museum a philosophic introduction to those fields of human knowledge covered by the museum collections. The validity of the word "index" in this connection came in for some criticism, but it was generally agreed that some form of introductory collection, broad in conception and treatment, is an absolute necessity in all large museums. By the multiplicity of their collections and specimens such institutions bewilder the uninitiated visitor, who should be enabled to get a clear grasp of what the institution is aiming at by some lucidly sketched outline.

As a new departure in the work of the association, a public lecture was given during the conference. The lecturer was Dr. F. A. Bather, F.R.S., who took for his subject "Open-air Folk Museums." The lecture consisted chiefly of a description of the open-air museum founded at Skansen, Stockholm, by Arthur Hazelius. Dr. Bather gave an outline of the object of such museums, and emphasised the urgent need for promoting some such scheme in Sussex, and thus preserving the fast disappearing relics of its extremely picturesque past.

A further paper by Mr. W. Ruskin Butterfield on folk museums dealt specially with the material at present available in Sussex, and showed how rich Sussex still is in picturesque old dwellings, involving much delightful folklore.

Mr. Arthur Smith showed how collections of photographs might serve the purpose of recording the history and progress of the surrounding district. Many places have collections of photographs and prints secured merely for the purpose of what may be called a survey, but Mr. Smith emphasised the fact that this is not sufficient. Photographs ought to be taken so as to show clearly, for instance, the original and altered condition of a street or building, so that a person looking at them may realise the nature and extent of the change which has taken place.

Evolution in archæology was dealt with by Mr. R. A. Smith, of the British Museum, who described the succession of developmental characters exhibited by such articles of human manufacture as stone implements, pottery, brooches, and primitive British coinage in a lucid and informing manner. He strongly advocated the arrangement of antiquities on evolutionary lines wherever possible.

The evolution of English pottery during the eighteenth century was the subject of a paper by Mr. H. Stuart Page. He argued that the adoption of an intelligent system of classification on lines which he set out in some detail would enable the involved story of English pottery to be illustrated by a carefully selected series of examples showing the gradual development in materials, processes, and technique. It was a matter for speculation how long the English potters would have continued contentedly in their antiquated methods of producing coarse heavy ware but for the introduction of Oriental china, brought into the country by tea-drinking habits. The beauty of this ware —all the more emphasised by the rudeness of the English production—created a remarkable infatuation, and the English potters sought to rival it. Their history then becomes one of laborious costly experiment, absorbing lives and fortunes. Ignorant of chemistry, they were, in fact, groping in the dark. The eventual result, however, was the acquisition of a technical skill which, whatever be the artistic quality, holds its own among the ceramic productions of the world.

Mr. E. Rimbault Dibdin read a paper on the functions and scope of a municipal art museum, in which he showed that there exists in England a very confused idea of the way in which to make an art museum of value. He urged that special efforts should be made to attract curators and directors of art institutions, and to assign a special day to the discussion of the questions of function, scope, conservation, arrangement, lighting, and the hundred and one other practical problems which face the administrator of art collections.

A small trade exhibition organised in connection with the conference was of considerable practical interest to curators.

During the meeting visits were paid to the Worthing Museum and Library, to the Booth Museum, to Hastings Museum, to Sedlescombe Museum, and to Battle Abbey. The association concluded its business by accepting the invitation of the Board of Agriculture and Technical Instruction for Ireland to meet in Dublin in 1912, and by unanimously electing Count Plunkett, director of the Irish National Museum, through whom the invitation was conveyed, to the presidential chair for the ensuing year.

THE FRENCH AEROTECHNICAL INSTITUTE.

ON July 6 the Aërotechnical Institute of the University of Paris, which has been founded by the generosity of M. Henry Deutsch de la Meurthe, was inaugurated at St. Cyr. Its object is entirely scientific, and is to study all problems of aviation and aërostation relative to the support of bodies in the air, both at rest and motion, from the double point of view of theory and practice. Under the presidency of the vice-rector of the Paris University, with M. Deutsch de la Meurthe and the dean of the faculty of sciences of the Paris University as vice-presidents, the council includes all the famous names in French aëronautics, as follows: MM. Armengaud, Barthou, Baumès, Blériot, Bouttieaux, Cailletet, Carpentier, Eiffel, Estienne, Hugon, Janet, Jouguet, Kapferer, Kœnigs, Le Cornu, Loreau, Maurain, Marchis, Painlevé, Picard, Sauvage, Soreau, Surcouf, Urbain, Voisin, Weiss.

The area occupied by the buildings and grounds is 72,000 square metres, of which the principal part has been reserved for building purposes. The remainder includes a strip 25 metres by 900 metres, with an additional piece of some 462 metres in length, which has been conceded by the Minister of War. Moreover, 4000 metres have been set apart for the erection of aëroplane sheds, workmen's houses, &c.

In the central hall are the following:—

(1) A large fan, two metres in diameter, fitted with various adjustments, and an aërodynamical balance for measuring wind-pressures on surfaces.

(2) A wind tunnel furnished with a fan for the study of the reaction of the air on surfaces, the air-current being capable of maintaining a uniform speed of 20 metres a second.

(3) An aërodynamical balance.

(4) A wind tunnel similar to that built by Col. Renard for studying the stability of model hulls or planes.

(5) An apparatus for measuring the friction of various surfaces moving through air of various pressures at gradually increasing speeds.

(6) A dynamometrical installation for measuring the thrust of stationary propellers.

(7) An installation for the study of helicopters.

(8) A protected chamber for testing the resistance of propellers at very high speeds. (Although it would be difficult to attain to bursting speed, it will be possible to run them at a considerably higher rate of revolution than the normal.)

(9) A test bench for motors.

In the chemical laboratories researches will be made in the study of light gases, of fabrics for balloon envelopes and aëroplane coverings, and of varnishes.

The physical laboratories will be concerned with the improvement and application of instruments used in aërial navigation, and the physical properties of light gases.

The photographical section will be occupied in obtaining records of experiments made; a special department will test all materials used in the construction of flying-machines and dirigibles; and the usual meteorological instruments are provided.

The power-house contains two compound vertical steam engines, one of 120–150 horse-power, and the other of 30–40 horse-power, driving dynamos of 200–300 amperes and 160 amperes respectively.

In the grounds is an experimental track 1400 metres long, quite straight, and perfectly flat save for 80 metres at one end which has a slope of 10 mm. in the metre to facilitate the start of the rolling platforms, and a rise of 5 mm. in the metre at the other end to assist stopping and returning them.

The rails are 12 metres in length, welded two together by an aluminothermal process so as to give 24 metres without a joint. The current is conveyed to the carriage by live rails raised on oak standards about 0·7 metre high on each side of the track, the return being made through the track-rails themselves.

Four rolling platforms are to be provided, each designed and fitted for its special work. The first measures the vertical and horizontal components of air-pressure on planes and curves, both simple and compound, and determines the position of the centre of pressure at various angles of incidence. This has been already built. The others under construction are to comprise two for propeller testing (one for large dirigible propellers and the other for aëroplane propellers to obtain their thrust, speed of rotation, the power absorbed, and their mechanical efficiency), and one for measuring the resistance of the different parts.

Platform No. 1 weighs, including the motor of 1100 kgs., 4900 kgs. The iron chassis is 6·12 metres long, 2 metres wide, and is rounded in front. The motor-bed is carried in the centre. Two axles 3·60 metres apart carry the chassis, which projects 1·86 metres in front and 0·66 metres in rear. This inequality is for the purpose of putting additional weight on the front axle, which tends to be lifted during experiments with large horizontal surfaces. For the same reason the axis of the motor is nearer the front axle than the back axle. The wheels of cast steel are one metre in diameter. The steering swivels run in ball-bearings, and special arrangements are used to prevent lateral play. A system of brakes engaging additional rails at the end of the track brings the platform to a standstill. All the platforms are to be fitted with the following instruments:—

(1) A registering chronograph for the number of turns of the axles.

(2) A registering cinemometer, giving the speed at every point along the course.

(3) Dynamometers.

(4) A wattmeter registering the motive power at every point.

The platform at present in use can easily obtain a speed of 33 metres a second.

As open-air experiments are not always desirable or possible, a whirling table has been installed in a circular building 38 metres in diameter. The axis of the planes or propellers tested on the end of the arm will be 16 metres from the centre, thus describing a circle 100 metres in circumference. There are two motors, one of 20 horse-power, which turns the arm, and another of 25–30 horse-power, which is connected up with any propeller undergoing tests.

There only remains to mention the library, on behalf of which an appeal is made for gifts of books, pamphlets, and prints, and the bulletin of the institution, in which will be published from time to time the results of the work accomplished.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

GLASGOW.—At its last meeting for the session, the University Court, with the concurrence of the Senatus, resolved to increase the teaching power of the University by the institution of the following:—a third lectureship in engineering; a second lectureship in zoology, with special reference to protozoology; a new assistantship and a new assistant demonstratorship in physiology; two new assistant demonstratorships in geology; and a new demonstratorship in physical chemistry and radio-activity.

The resignation by Captain Lyons, F.R.S., of his lectureship in geography was accepted with regret. It was agreed to intimate the vacancy, and to take steps for the appointment of a new lecturer before the beginning of next session.

The resignation by Sir Robert Wright of the office of principal and professor of the West of Scotland Agricultural College brings into operation a provision by which the University and the College, through a joint committee, take part in the appointment of the new professor. The committee will meet for the purpose during the summer.

Professorships of medicine, surgery, obstetrics, and pathology in connection with the Royal Infirmary, and in addition to the existing chairs, have been sanctioned by his Majesty in Council, and will be filled up in time for next session.

THE Nevada State University, says *Science*, has received 50,000*l.* from Mr. Clarence Mackay, of New York City, and several of his friends, for the construction of a library and administration building.

THE annual meeting of the Midland Agricultural and Dairy College, Kingston, Derby, will be held at the college on Monday, July 31, when the report on the year's work will be presented, and the Duke of Devonshire will address the meeting and present the diplomas and certificates awarded to students during the past session.

IT is stated in *Science* that all the qualified men in this year's graduating class in the College of Agriculture of the University of Wisconsin have secured positions, and the requests for teachers are still coming in. The demand is especially strong from agricultural high schools both in Wisconsin and other States. Many of the requests are for men who have been brought up on farms, have had some teaching experience, and also have had a thorough course in agriculture. The demand for such instructors in agriculture for high schools is very much greater than the supply. Even as early as four weeks ago most of the seniors had accepted positions as farm managers, as research assistants, or as teachers of agriculture in colleges and secondary schools. The average salary of the men who will teach next year in agricultural schools is 250*l.*

IN referring, in the issue of NATURE for March 2 (vol. lxxxvi., p. 30), to the centenary of the University of Christiania, which was founded by King Frederic IV. in 1811, we were able to give the important items of the interesting programme of events which has been arranged for the occasion. The following representatives of British universities and other institutions had, up to July 13, been chosen to attend the celebration, which begins on September 4 and lasts until September 8:—University of Bristol, Prof. I. Walker Hall; University of Cambridge and the Cambridge Philosophical Society, Sir George Darwin, K.C.B., F.R.S.; University of Durham, Rev. H. Gee; University of London, Dr. H. A. Miers, F.R.S.; the Royal Society, Sir J. Rose Bradford, Sec.R.S.; the British Academy, Prof. W. Paton Ker; the Royal Institution, Prof. H. E. Armstrong, F.R.S.; the Victoria Institute, Dr. J. W. Thirtle; Victoria University of Manchester, Prof. C. H. Herford and Sir William J. Sinclair; University of Oxford, Prof. W. J. Sollas, F.R.S.; University of Aberdeen, Prof. D. W. Finlay; University of St. Andrews, Dr. H. M. Kyle; University of Edinburgh, Lord Edward T. Salvesen, K.C.; the Royal Society of Edinburgh, Mr. James Currie; University of Glasgow, Prof. J. Ferguson; Queen's University of Belfast, Prof. J. Symington, F.R.S.; University of Dublin, Rev. T. B. Willson; the Royal Irish Academy, Prof. C. Marstrander.

LORD HALDANE distributed the prizes at Mill Hill School on July 22 and delivered an address. He said the British nation is now taking a wider view of education. A great deal has been learnt from the Continent and from hard experience. "For two years and a half," said Lord Haldane, "I have been chairman of a Royal Commission on University Education. How much longer we shall have to sit before we have dealt with the whole of the material we have to survey I do not know." The Commission has shown two things—first, that the nation is waking up about education, and that very great advances are being made; and, secondly, that those advances have come none too soon, because other nations have been making advances. This nation has come to learn that education is one and

indivisible. Organisation is the order of the day, and without it nothing can be done. Schoolmasters are functionaries of a very important order; they have to mould the national life of the generation that is coming on. The world is moving forward. There used to be a tradition, said Lord Haldane later, that our great public schools were very much behind the great secondary schools of the Continent, but as schools of character English public schools are not to be beaten.

UPON the recommendation of the Development Commissioners, the Treasury has decided to make an advance from the Development Fund to the Board of Education to enable the Board to make additional grants in aid of farm institutes. Such an institute should serve as the headquarters for the miscellaneous and itinerant work of the county agricultural staff, and should also provide accommodation for central courses of instruction in agriculture and kindred subjects and for demonstration. These central courses might include, for example, (1) a sixteen or twenty weeks' winter agricultural course for the sons of small farmers who have acquired some practical experience on the land since leaving elementary schools; (2) shorter courses in dairy work, poultry-keeping, and the like during spring and summer; and (3) vacation courses for teachers of rural subjects in local continuation courses. The grant in aid of the provision or enlargement of a farm institute will not exceed 75 per cent. of the total cost, while the grant for maintenance will be limited to 50 per cent. of the total cost. On educational grounds, the Board regard it as essential that there should be a farm and garden in connection with the institute, which should not only be used for the internal teaching, but should also serve as an object-lesson to the farmers and gardeners of the county. In some cases a small holding might be added. These should be conducted on business principles, but some annual deficiency will generally be entailed by their use for educational purposes. The grants are not to have the effect of reducing the amount of any expenditure at present incurred by a local education authority out of the rates or other local resources upon work of the type to be aided, or the amount of any contribution by the authority to the educational work conducted by the agricultural colleges.

SOCIETIES AND ACADEMIES.

PARIS.

Academy of Sciences, July 17.—M. Armand Gautier in the chair.—A. **Haller** and Ed. **Bauer**: Syntheses of substituted β-diketones, of ketonic ether-salts, and of enolic ethers by means of the sodium derivatives of ketones. The interaction of the sodium derivative of isopropylphenyl-ketone with benzoyl chloride gives two isomeric benzoyl compounds, one, the diketone dibenzyl-dimethyl-methane, from which a monoxime is readily prepared, and the other the enolic form, not combining with hydroxylamine. Other examples of similar reactions have been worked out. Chlorine and iodine compounds give different reactions in some cases.—A. **Lacroix**: The alkaline rocks of Nosy komba (Madagascar).—Ch. Ed. **Guillaume**: The modifications undergone by nickel steels after prolonged heating and on the action of the time. These measurements show the necessity of a preliminary tempering of nickel steels used in the construction of instruments of precision, and the possibility of calculating by extrapolation during a period of several years the length of a standard invar bar maintained between certain limits of temperature.—Paul **Sabatier** and A. **Mailhe**: Some new preparations of the benzylamines and of hexahydrobenzylamine. The general method employed consists in acting with ammonia gas upon the vapour of an alcohol at 300° C. to 350° C. in presence of a catalytic oxide, such as thoria. With benzyl alcohol the chief products of this reaction are benzylamine and dibenzylamine. Pure benzylamine, obtained by this method, treated with hydrogen at 170° C. to 180° C. in presence of a very active nickel gives ammonia, toluene, and hexahydrobenzylamine. The latter base was isolated, and its properties are described.—M. **Bernstein** was elected a correspondant in the section of medicine and surgery in the place of the late M. Engelmann.—M. **Borrelly**: Observations of the Kiess comet (1911*b*) made at Marseilles Observatory with the comet finder. Observations of the comet and comparison stars are given for July 9, 12, 13, 14, and 15. The comet appeared as a globular nebula with a condensation at its centre, and was about the 8th or 9th magnitude.—M. **Esmiol**: Observations of the Kiess comet made at the Marseilles Observatory with the Eichens 26 cm. equatorial. Observations given for July 13 and 15.—Ernest **Esclangon**: Observations of the Kiess comet (1911*b*) made with the large equatorial of the Observatory of Bordeaux. Positions of the comet and comparison stars given for July 10 and 11. The comet appeared as a nearly round nebulosity of about 2′ diameter.—Observations of the Kiess comet (1911*b*) made at the Observatory of Besançon with the 33 cm. bent equatorial. Positions given for July 10, 11, 12, and 13.—A. **Petot**: The extension to geodesic lines of a kinematic property of the right line.—Ruben **Mallton**: The construction of integral functions of irregular growth.—A. **Korn**: An important class of asymmetrical nuclei in the theory of integral equations.—H. **Vergne**: A theorem in hydrodynamics.—MM. **Melchissedec** and **Frossard**: The mechanical theory of some tubes producing sound.—A. **Leduc**: Internal pressure in gases. Formulæ of state and the law of molecular attraction.—M. **Hanriot** and F. **Raoult**: The magnetisation coefficients of gold. A comparison of the magnetic properties of the brown gold (previously described by the authors) and ordinary gold into which the brown gold is converted by heating shows that they are distinct varieties of the same metal.—G. **Chavanne**: Isopyromucic acid. Its behaviour towards oxidising agents. Dibromomaleic and bromoxymaleic dialdehydes. Dibromomaleic aldehyde,

$$OCH—CBr=CBr—CHO,$$

is obtained by acting with bromine upon monobromisopyromucic acid, and treatment of the bromine addition compound thus obtained with bromine and water.—Ph. **Barbier** and R. **Locquin**: The transformation of some substituted paraconic acids into the isomeric cyclopropanedicarboxylic acids. This transformation is effected by the action of thionyl chloride upon the dry acid dissolved in one and a half times its weight of benzene, and maintained at the temperature of the water-bath for twelve hours. This new reaction will be studied with other lactones.—G. de **Gironcourt**: The cheeses of Touareg. This native cheese is remarkable for the small proportion of water it contains. It keeps well for long periods of time, and can be carried great distances without change.—MM. **Vermorel** and E. **Dantony**: Sulphur capable of being moistened. A method of treating sulphur for agricultural purposes.—A. de **Varenne**: The destruction of Cochlyis of the vine.—Pierre **Lesage**: The characters acquired by plants watered with solutions of common salt. The addition of the salt causes a reduction in the size, a yellowish coloration, and a reduction in the duration of the cycle of growth.—G. **Perrin**: The prothallus of Equisetum.—A. **Guilliermond**: The mitochondria of plant cells.—C. L. **Gatin**: The influence of the tarring of roads on the growth of the trees of the Bois de Boulogne. In certain cases only, where the road is much exposed to the sun and where the traffic is heavy, could the tarring of the road be proved to have a marked deleterious effect on the trees.—Edmond **Perrier**: Remarks on the preceding communication, pointing out the serious damage done to the trees in the Jardin des Plantes by the adjacent tarred road.—B. **Roussy**: The existence of a very simple geometrical law of the body surface of a man of given dimensions, demonstrated by a new method. Detailed instructions are given (with two diagrams) for determining two magnitudes called by the author the mean perimeter and the total mean peripheral height. The surface of the skin is shown to be equal to the product of these two quantities.—Raphael **Dubois**: Fluorescence in luminous insects.—L. **Mercier** and R. de **Drouin de Bouville**: The disease of the crayfish of the lake of Nantua: a criticism of the views of M. Dubois.—F. **Rogoziuski**: Researches on the glycogenic property of glucosamine.—A. **Daniel-Brunet** and C. **Rolland**: The influence of sex and of castration upon the quantity of lipoids in the bile of cattle.—Stanislas **Meunier**: An example of pluvial decalcification realised in the course of the lower Tertiary epoch.—Louis **Laurent**: The presence of the genus Atriplex in the Tertiary flora of Menat (Puy-de-Dôme).

CAPE TOWN.

Royal Society of South Africa, May 19.—Mr. S. S. Hough, F.R.S., vice-president, in the chair.—R. **Marloth**: Some new South African succulents and other plants. Among the plants described in this paper are three species of special interest, viz., one of Cytinus, one of Borbonia, and one of Anacampseros. The Cytinus is noteworthy as it constitutes a second species of Rafflesiaceæ for South Africa; the Borbonia is of economic importance, being the source of a colonial tea, viz., "rooibosch-tea," and the Anacampseros is another example of mimicry-plant, of which eight species were described in previous papers.—Miss D. L. **Bleek**: Note on the language of Bushmen tribes north of the Orange River. All words and sentences taken down from Bushmen south of the Orange River show that they spoke one language, with dialectical variations. North of the Orange River, however, in the Langeberg and adjoining Southern Kalahari, we find a different language, that of II n Bushmen, closely allied to that of I Xam Bushmen (those south of the river); the difference in the vocabulary, and still more in the grammar, of these two tribes is too great to be called a mere dialectical variation. In the Northern Kalahari the so-called Masarwa are found, people living exactly as Bushmen do, though said to be mixed in type. The South African Museum has a series of gramophone records taken from pure Masarwa, in the heart of the Kalahari region, which the author has transcribed, and which, in spite of the instrument not having recorded clicks clearly, gave valuable evidence that the language belongs to the Bushman family.—L. **Péringuey**: Note on the result of investigation of a Strand Looper rock-shelter, with exhibition of the objects found. The cave which it was decided to excavate is, properly speaking, a rock-shelter, filled with an accumulation of kitchen refuge, blown sand, &c. The excavation was carried through a depth of nearly 14 feet of this material, when it was found necessary to stop, owing to the dampness of the detritus. The cave was originally discovered by Mr. C. J. Whitcher, who carried on some excavation first, and very kindly allowed the museum to proceed with further exploration work. This cave proves to have been a necropolis, a considerable number of skeletons having been found at different depths. In the pelvic bone of a young child (or female) was found embedded a small stone chip, part of the point of an arrow, probably poisoned. Most of the skeletons are in a greatly advanced stage of decay. Some are plainly Strand Loopers, but others were found which are not Strand Loopers; they are of greater and more robust stature, and would appear to be half-bred, or perhaps Kaffirs, yet the mode of burial is the same, but the skulls of this "larger race" are not entire, nor could all the fragments be found. A feature of the hitherto unrecorded burial rites is the placing of flat stones, occasionally painted, on the hunched-up body resting on its side. One of these stones has polychrome paintings of the Bushman type, but unlike any of these paintings, in this one the eye, and an attempt at facial delineation is noticeable. The evidence of the bone and stone implements found in this sepulture not only indicates that the two industries prevailed simultaneously, but that implements of palæolithic and neolithic type were also coeval. It can now be said that in South Africa the hiatus which in Europe, or in the Palæarctic region, separates the palæolithic from the neolithic, is now proved not to have existed.—T. **Burtt-Davy**: Observations on the inheritance of character in Zea Mays. In Red Cuzco and some other breeds of red maize, the red colouring matter is confined to the pericarp, and is therefore a fruit character; it does not appear in the first cross between a white male and a red female. In a red dent breed the red pigment occurs in the aleurone layer; it is therefore a seed character; it is dominant to whiteness. When this breed is crossed with a white sugar breed the results in the second generation are approximately:—Red: starchy, 56·25 per cent.; sugary, 18·75 per cent. = 75 per cent. White: starchy, 18·75 per cent.; sugary, 6·25 per cent. = 25 per cent. A single grain has been seen, in which the starchy character appears in one half, the sugary character in the other. The number of rows on a maize ear, within certain limits, is subject to fluctuating variations, which may perhaps be affected by season or food supply, or both. When an 8-row type is crossed with an 18-row type, both characters disappear in the heterozygous form, and an intermediate type is produced, in which there are 10, 12, or 14 rows, 12 rows greatly predominating. A white-cobbed breed crossed with a red-cobbed produces a red-cob in the first filial generation. Result of reciprocal cross is the same.—E. **Nevill**: The early Babylonian eclipses of the sun. On the fourteenth line of Tablet No. 35968 of the British Museum Collection, Mr. King has deciphered the record:—"On the twenty-sixth day of the month Sivan in the seventh year the day was turned into night and fire in the midst of heaven. . . ." From collateral evidence contained on the tablet, the author supports Mr. King's contention that the phenomenon referred to is a total eclipse of the sun, but differs from Dr. Cowell, who has identified it with the eclipse of B.C. 1062, July 31. The author has examined the features of some seventy eclipses which occurred between B.C. 1250 and B.C. 950, the extreme limits of date which seems to be compatible with the inscription, and finds that three of these only appear to satisfy the prescribed conditions of having been visible from the neighbourhood of Babylon at a time of year corresponding with the twenty-sixth day of the month Sivan, viz., those of —1217 June 5, —1123 May 18, and —956 May 31. The identification of this eclipse is of importance as bearing on the theory of the moon's motion, as well as in relation to doubtful points concerning the chronology of the earlier kings of Babylon.—T. **Muir**: Sylvester's axisymmetric unisignants.

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