THURSDAY, AUGUST 13, 1908.

GEOLOGICAL EXPLORATIONS IN SINAI.

The Topography and Geology of the Peninsula of Sinai (Western Portion). By T. Barron. Pp. 241; illustrated. (Cairo: National Printing Department, 1907.)

IN NATURE for September 19, 1907, we directed attention to the memoir by Dr. W. F. Hume on the topography and geology of south-eastern Sinai. We have now before us an account of the western portion of the peninsula by the late Mr. T. Barron, who was assisted in the topographical part of his work by Mr. S. T. Hardwick. This new volume does not compare in interest or lucidity with the previous one, but any defects must be dealt with gently when we bear in mind the transfer of Mr. Barron to the Sudan, and the termination of his promising career by death in that region. He has given us, at any rate, a detailed account of his observations on the topography and geology of western Sinai that will be useful enough to anyone visiting the ground, but otherwise difficult to follow. Thus, too few names are given on the geological map, and it is by no means easy to define the lines of geological section that are given in four folding plates.

The geological formations include gneiss and schists, great masses of red and grey granite, diorite, and Carboniferous Limestone and Sandstone, which together form the higher grounds of the interior. On the coast at Gebel Abu Darba there is a fringe of red granite bordered inland by Nubian Sandstone with overlying higher Cretaceous and Tertiary strata. As shown in one of the sections, this belt is separated from the main group of older strata in the interior by the plain of El Qâ, and further east by another tract of Cretaceous rocks, which are bent into a broad anticline with steep westerly inclination towards the plain, and faulted on the other side against the gneiss.

The plain of Qâ, described as a gravelly expanse, wind-swept and without shelter, is formed of a very mixed series of fluviatile, lucustrine, and marine deposits of Pleistocene and recent age, with a covering of igneous boulders from the hills and blown sand. Raised coral reefs and breccia border the greater part of the coast. Some of the sands of the plain are bound together with common salt and carbonate of lime.

The record of Pliocene strata is new. They consist of limestones with many pectens and echinids, and also teeth of *Carcharodon megalodon*, a form familiar to workers in the nodule-bed of the Suffolk Crag.

Particulars are given of the Eocene strata, with their nummulites, also of the Cretaceous divisions, and the author acknowledges his indebtedness to Mr. R. Bullen Newton for the determination of fossils from these and other strata. Some well-known European forms are recorded from the Carboniferous rocks, but, as is customary nowadays, the species are identified less confidently than in the earlier quoted lists.

The grey granite is regarded as one of the most valuable economic products, being suitable for statuary purposes. Iron and manganese ores are likewise of some importance. There are also turquoises, which, in the author's opinion, might be worked to more profit with improved methods of mining. He inclines to the view that they were formed by percolating water, the precipitate being afterwards subjected to enormous pressure. The gems occur in "pockets" in sandstone of Carboniferous age in a region that has been affected by considerable earth-movements, as evidenced by the faulting and folding.

A few remarks are made on the age of the rift of the Gulf of Suez, assigned by Neumayr and Blanckenhorn to the Middle Pliocene. The area of the gulf appears to have been a land surface in early Tertiary times, but at the close of the Oligocene or during the Lower Miocene it became depressed so as to form an arm of the Mediterranean—the Miocene fossils having affinities with the fauna of that sea and none with the Indian Ocean.

After subsequent elevation and denudation of the area, and towards the close of Upper Pliocene times, were formed the faults which bound the igneous and sedimentary ranges on either side of the gulf and the Isthmus of Suez. Subsidence then took place, and the Red Sea, which had by this time come into existence, invaded the depression. After this were produced the faults which bound the present gulf parallel to the older dislocations, and these are evidenced by raised beaches at different levels. The faults on the eastern side are somewhat older than those on the western side, as the series of beaches on the western side indicate a gradual rise after the actual fracture took place on the Sinai side. At the close of the Pliocene or beginning of Pleistocene time, submergence is again evidenced by various beach-deposits and by the brackish-water beds of El Qâ. In conclusion, the author points out that "although geologically the Gulf of Suez was in existence before the Red Sea, in point of age the fractures bounding the former are younger than those which produced the latter." H. B. W.

A TREATISE ON AËRIAL FLIGHT.

Aërodynamics: Constituting the First Volume of a Complete Work on Aërial Flight. By F. W. Lanchester. (London: A. Constable and Co., Ltd., 1907.) Price 21*s.* net.

THE book before us is the first volume of a complete treatise on aërial flight, and is to be followed by a volume on "aërodonetics," a word coined by the author to denote the theory of the motion and equilibrium of bodies in the air. The author, by the way, is rather fond of coining new words; some of them—*aërofoil*, for example—are very happily chosen, and we hope that they may be adopted by subsequent writers on the subject. So far as mathematical theory is concerned, aërodynamics as applied to problems of flight does not differ from hydrodynamics, for with the small changes of pressure that accompany the motion of a flying machine, the compressibility of the air does not sensibly affect the motion. The first chapters, which deal with the theory of aërodynamics,

are therefore a summary in non-mathematical language of the chief methods and results of hydrodynamical theory. They are, on the whole, very clearly written, and present in simple form all the most important points of the theory. The author is not, however, content to follow orthodox theory, but deviates from it in the treatment of several problems. Thus on p. 6 he introduces what he calls the "principle of no momentum," *i.e.* that no resultant momentum can be communicated to a fluid enclosed in a rigid boundary. Against the principle as stated no objection can be taken; but when, as on p. 16, it is applied to the motion of a body in an infinite fluid, it may easily lead to false results.

The second chapter contains an investigation on viscosity and skin friction. This has always been a subject of contention among writers on aërodynamics. Langley and Dines maintain that the tangential force on a plane moving sideways through the air is negligible, less than 0·01 per cent. of the force at normal incidence. Lilienthal, on the other hand, found the tangential force to be between 1 per cent. and 2 per cent. of the force at normal incidence, and therefore at small inclinations it may be comparable with the normal force. Mr. Lanchester, in the second chapter, brings some theoretical considerations to bear on the question, and proves that the force on a plane moving sideways varies as $v^{1\cdot5}$. This result is obtained by supposing the motion laminar, which seems to us quite unjustifiable. In chapter x. an account is given of experiments made on gliders to obtain a value for skin friction. The experiments appear to have been very carefully conducted, and considering the difficulties involved give remarkably consistent results. We hope that the author may be able to extend these experiments and so help to decide this question.

In chapter iv. the author leaves behind the solid ground of orthodox theory altogether, and attempts to work out the motion of a curved lamina or aërofoil. The importance of curved surfaces in flight was first realised by Philipps and Lilienthal. It seems to us that the author is wrong in claiming to be the first to give a theory of the motion of curved surfaces, and that Lilienthal had only a practical acquaintance with the curved form, for Lilienthal clearly realised that the effect of curvature was to diminish the eddy motion and to give an increased upward pressure due to the centrifugal force of the air. The theory has been worked out mathematically by Kutta, and his results are in fair agreement with Lilienthal's experiments. The author of the present volume attempts to work out the problem by applying the theory of cyclic motion to the motion of a surface in two dimensions, but it is difficult to see how this can have any application to the case of a lamina moving in free air. The next chapters contain discussion of various problems connected with flight; many of them are very interesting, but as they turn on the relative value of tangential and normal force, they are, in the present uncertainty as to these values, rather premature.

The last chapter contains an account of the experimental work of Dines and Langley. We could have wished that the author had extended this chapter to include the work of Continental writers such as Lilienthal, Wellner, von Lössl, &c., much of whose work is very valuable, and buried in technical journals which are inaccessible to English readers. Had he done this and excluded some of the more shaky theoretical chapters, the work might without exaggeration be called a complete treatise on aërodynamics.

SPECTROSCOPY.

Handbuch der Spectroscopie. By H. Kayser. Vol. iv. Pp. xix+1248. (Leipzig: S. Hirzel, 1908.) Price 72 marks.

THE amount of material available on the general phenomena of absorption is well known to everyone who has interested himself in this branch of science, and it is impossible to withhold admiration for the manner in which the subject is treated in the present volume. It is not easy in a short notice to discuss in detail the merits or demerits of so varied a chapter of contents as we have before us, but a brief glance will serve to show the lines followed by the author.

Whereas in the latter portion of the third volume there was given a list of compounds of known constitution, together with their absorption spectra, the first three chapters of the present volume contain an account of the absorption of colouring matters as obtained from plant, human, and animal sources. Any possible criticism of the expediency of inserting these chapters is somewhat disarmed at the outset by Prof. Kayser's preface. He was himself somewhat doubtful at first, but concluded that it would be intolerable that a book on spectroscopy should pass over these most important substances in silence. At the same time, there is no doubt that much of the work that has been published on these colouring matters is worthless; indeed, these chapters serve to show how chaotic and uncoordinated are the results of investigators in these fields.

The fourth chapter, which is from the pen of Dr. A. Pfluger, deals with dispersion, or, rather, anomalous dispersion. Herein is to be found a fine critical review of the experimental and theoretical work on the relation between dispersion and absorption.

The next two chapters, which are each about 270 pages long, deal with phosphorescence and fluorescence, the latter being contributed by Dr. H. Konen. The division of the phenomena under the two heads is based upon the criterion that phosphorescence persists for a finite time after the exciting cause has been removed. The chapter on phosphorescence, commencing with an historical account of the subject, deals in succession with the various means of excitation and the experimental methods, the influence of temperature, the spectroscopic investigation of phosphorescence, and finally the theories of the underlying phenomena. This chapter contains a very full account of all the work which has been carried out, and will, indeed, prove very valuable. The literature is very scattered, and this is the first time that a reasoned attempt has been made to collect and correlate the somewhat discordant details of experimental research in the domain of phosphorescence.

Dr. Konen's chapter on fluorescence is again admirable, and is also prefaced with an historical section, from which may be gathered the interesting information that the first mention of fluorescence is an account which Robert Boyle found in a Spanish manuscript dated 1570 of an aqueous extract of some wood.

The second section of this chapter deals with the so-called bright-line fluorescence spectra, including, of course, the work on iodine and Prof. R. W. Wood's new work on sodium vapour. This opens the question as to what is meant by fluorescence, for it would seem that the phenomena of bright-line spectra obtained with iodine and sodium vapours are of a different order from the true fluorescence of organic compounds. Wood's more recent work would certainly go far to show that his results are those of optical resonance pure and simple. On the other hand, the real fluorescent phenomena of organic chemistry are of a very different nature. They are undoubtedly due to a certain complexity of structure; they undoubtedly require a linking together within the molecule of a definite number of centres of unsaturation (used in the chemical sense). Conversely, a simplification of the molecular structure tends to decrease the power to fluoresce. The two phenomena must therefore be of different type, and for this reason it would be preferable to treat the bright-line phenomena under a separate heading of resonance spectra, leaving the term fluorescence to the more complicated molecular phenomena of organic chemistry.

Following on the section upon bright-line fluorescence there are sections dealing with ordinary band fluorescence spectra, the method of investigation, the absorption and emission of fluorescing substances, the influence of temperature, of the solvent, and of the wave-length of the exciting light, and, finally, two sections dealing with the relation between fluorescence and chemical constitution, and also with general theories. A list of substances is added which are known to exhibit fluorescence, a list which, though far from complete, is a very useful addendum. This list brings to conclusion a volume which is a worthy follower of the three volumes which have preceded it.

POPULAR ORNITHOLOGY.

(1) *A Bird Collector's Medley.* By E. C. Arnold. Pp. iv+144; with 12 coloured and 8 collotype plates and illustrations in the text. (London: West, Newman and Co., 1907.) Price 10*s*.

(2) *Birds of Britain.* By J. Lewis Bonhote. Pp. x+405; with 100 illustrations in colour. (London: Adam and Charles Black, 1907.) Price 20*s*. net.

(3) *A Book of Birds.* By W. P. Pycraft. Pp. viii+155; with 30 full-page coloured plates and illustrations in the text. (London: Sidney Appleton, 1908.) Price 6*s*. net.

(1) MR. ARNOLD has been known for several years past in the bird world as an enthusiastic shore-shooter who has been lucky enough in recent years to secure examples of several migratory birds which have very rarely been known to straggle to these shores, and, indeed, to add two species to the British list. He very ably justifies the killing of these rare migrants on the grounds that they are abnormal wanderers which would never settle in England, and adds that it seems far better that they should be carefully preserved for the benefit of those who would otherwise never see them rather than be observed through glasses by one individual for the space of perhaps half an hour at the outside. His introductory chapter is mainly taken up by a forcible defence of the amateur collector, who, he very truly says, is abused by books, periodicals, newspapers, and those very ladies who adorn their bonnets with stuffed terns and bullfinches. What is more contemptible is the attitude of "some eminent naturalist, who has possibly amassed a fine private collection in his youth, and has now taken up the fashionable cry." We were reminded of the truth of this "reprisal" upon reading quite recently a review of this very book. A chapter on bird-protection deserves careful perusal. It is an able summary of the whole matter, so far as it concerns this country, and contains more common-sense and less rubbish (we had almost written hypocrisy) than any other disquisition on the subject we have met with for a long time. For the rest, the book is chiefly an account of the author's personal experience as a field ornithologist and collector in many and varied parts of the British Islands, and contains many very interesting notes and observations.

One of the best chapters relates the experience of a dunlin, born on the fells, going down to the seashore for the winter and back to the moorlands in spring, and is very well told indeed (in the dunlin's own words). There is also a good chapter on bird-stuffing, and a medley was a good name for the book. The twenty full-page plates, the work of the author, portray some pleasing scenes in bird-life. Some also are intended to recall specimens of rare birds in the author's bird collection in the Eastbourne Institute. No one would wish to criticise their merits too closely; it is enough that for the most part they appeal to the emotions of the field ornithologist.

We must protest, however, against the plate of the two ruffs in full breeding dress fighting at their breeding grounds. Anyone who has watched ruffs on the "hill" must have been struck especially with one circumstance, viz. the great diversity in colour of the birds, and that from perhaps a dozen or so collected on the hill at one time it would be impossible to pick out two the colours and arrangement of colours of which were alike. We cannot, therefore, but regard the present picture displaying only two ruffs, and those practically as alike as two peas, as unnatural. For although such a case is not, of course, absolutely impossible, it is extremely unlikely. The various illustrations in the text are from photographs, and some of them, *e.g.* "Doing the Bushes," will recall days spent in that now famous spot to the minds of many birdmen. The addition of an index would have been an improvement to this nicely-got-up volume.

(2) Messrs. Adam and Charles Black have added to their series of beautiful books, with full-page illustrations in colour, a volume on "Birds of Britain." The

hundred illustrations are selected from Mr. Dresser's "Birds of Europe," and the originals, of course, are of the very best. But we can say very little for the reproductions. We see that the old faults of this kind of colour process have not, in this case at all events, been overcome. Here and there one of the colours used has asserted itself out of place or shown uncalled-for strength. On the curlew's plumage there appears a strange flush of carmine pink. This does not matter much to one who has known the curlew well for many years, and who knows that the colour is libellous. But how about "the genuine seeker after trustworthy information on British birds," who turns to the plate in order to find out how a curlew is coloured? Green, too, frequently shows itself when it is not wanted; and while colours have sometimes come out hard and crude, in other cases delicate tints have almost failed or played false, as in the legs of the reed-warbler, which do not agree in colour with the description. The barn owl is curiously blue, Richardson's skua green, and the dunlin, like several others, flushed with pink, while the head of the black-headed gull is much too bright and light a brown. Some plates are faint and indistinct.

Altogether we cannot regard this new colour book as a success. The plates have been selected so as to give examples of the most typical species. But if the book was to prove of help and service to the genuine seeker after trustworthy information on the subject, the selection might have been a more useful one. The commonest birds have not in every case been chosen, for the blue-headed appears instead of Ray's wagtail, and the mealy instead of the lesser redpoll; and it would have been better in the interests of the learner to carry this idea further, and to have illustrated some of the less common birds rather than well-known, conspicuous, and easily identified species. For instance, the blackbird, robin, goldfinch, bullfinch, chaffinch, starling, jackdaw, rook, skylark, kingfisher, kestrel, grouse, &c., might more usefully have been replaced by the woodlark, twite, siskin, brambling, grey shrike, woodchat, merlin, hobby, the harriers, shorelark, and some of the less conspicuously coloured waders and waterfowl. The guillemot in adult summer dress figured here is the variety known as the ringed guillemot. This should have been stated in order to avoid leading a beginner astray. The positions on the plate of the stormy and Leach's petrels are wrongly stated, and should be reversed.

The letter-press (which includes some account of every species of bird which has occurred in the British Islands) is of a popular character and very pleasantly written. The charming notes of the ways and habits of the birds have been taken at first hand, straight from nature, and are valuable and all the more interesting for that reason. But perhaps for this very reason they may seem sometimes to have been written from too limited a field of observation. At all events, if this were not rather a publisher's than an author's book, and more meant for the general public than for the naturalist, we might criticise some of the statements. To turn only to two species. With us the hedge-sparrow's song is certainly not commenced in March; nor do we think the missel-thrush is so very conservative in its choice of a nesting site, or that from four to *six* is the usual number of eggs laid by this bird; or, again, that the missel-thrush will be found sitting on a full clutch towards the end of February in Britain generally, though it may lay in that month in the south. To continue about the same bird; after the late Prof. Newton's observations, any doubt can hardly still exist about its "supposed" fondness for mistletoe berries. As no attempt has been made to husband space by condensing information or avoiding occasional discursiveness, the account given of each species is not so comprehensive as one might expect to find in this bulky volume, but all the birds are described, as well as the eggs and nests of all except the occasional visitors.

(3) The aim of Mr. Pycraft's book is to present the reader with a general survey of the principal groups of modern birds, such as are likely to be met with in zoological gardens or in museums. Of necessity many of the less-known species do not find a place here. In no single volume would it be possible to give anything like an intelligible description of the 14,000 different species of known birds. The reader, however, will find a concise account of some of the more important facts with regard to the life-history of the birds of Great Britain and of their European relatives, as well as of a number of the more remarkable birds of other lands. To give this in about 160 pages of rather large print was, even so, to attempt too much. Too much has been attempted in a small space. The treatment is very slight. Those who know absolutely nothing about birds will doubtless learn a good deal by studying these pages; and if the book wishes to claim the merit of displaying the bird-world at little more than a glance, why, certainly, a very long book was not required. Cheapness is a great merit in a book of this kind, but may perhaps be overdone. About 160 pages of letter-press on good thick paper, and thirty coloured plates, besides woodcuts, for six shillings is too much to expect, and something is likely to suffer. But if the plates make a critical ornithologist shudder, they will give the general reader a very fair idea of the birds they represent, and they are a marvel at the price.

OUR BOOK SHELF.

Handbook of Learned Societies and Institutions—America. Pp. viii+592. (Washington, D.C.: The Carnegie Institution, 1908.)

To the Carnegie Institution a debt of gratitude is due for the preparation of a handbook of the learned societies and institutions of the world. The present volume is the first instalment, and deals with the societies of the western hemisphere, for it includes the United States, Canada, Mexico, the West Indies, Central and South America.

The supervision of the work was entrusted by the Carnegie trustees to the Librarian of Congress, and its organisation was placed in the hands of Mr. J. David Thompson, of the library staff, who has edited the volume, the material having been compiled by Mrs. Lucy C. Daniels Thompson and Miss Mary F. Griffin. Pending decision as to further publication, the remaining material relating to societies and institu-

tions of the Old World will be kept on file available for consultation at the Library of Congress.

The names of the societies are placed in alphabetical order in various sections, the first containing the national societies of the United States, and the second, local societies and institutions; these together occupy 426 pages out of a total of 537. The volume contains twenty-four pages of addenda and corrections, and an excellent index of thirty pages.

Each entry commences with the official name of the society or institution, its postal address, and the name of the official, if any, to whom communications should be addressed. Notes of its history are given, including dates of foundation and incorporation and changes of name and organisation, and if it possesses a library the number of volumes is stated; its object; time and place of meeting; number of members and fees; the exact titles of its publications and any special publications; the mode of distribution of publications; and a statement of research funds and prizes.

It is a remarkable book, not only for its size, but for the large amount of information it contains and the evident care that has been taken in its preparation. It is to be regretted that the entries are not numbered, for it would be interesting to know how many associations there are in the New World; it would be too laborious to count the names in the book, but the first ninety-five pages contain those of no fewer than 125 national societies in the United States. The institutions are not all what would be usually considered as scientific societies, although, no doubt, the works that they perform are carried out in accordance with the scientific spirit.

The index is well arranged; the sciences are printed in capitals with references to the pages on which societies dealing with them are to be found; the full names of societies are in Roman, and those of publications which do not carry the names of the societies which publish them are printed in italics; it may not be generally known that many of the American journals are published by societies, and not by individuals and firms as is often done in this country.

The book is well printed, and cannot fail to be of great use to those interested in American societies and their work; its production reflects great credit on all concerned with its preparation and publication.

H. M.

Supplementum Conspectus Florae Graecae. Auctore E. de Halácsy. Pp. iv+132. (Leipzig: W. Engelmann, 1908.) Price 6 marks.

THE publication of this supplement only four years after the completion of the main work shows once more how, far from exhausting the interest in the exploration of a country, a good flora rather acts as a most effective stimulus in widening and deepening it. As the main work was noticed in detail in this Journal (vol. lxxiv., p. 314), it may suffice here to state that the bulk of the supplement consists in additions of new localities, mostly from recent collections; but there is also a considerable access of species not recorded in the original "Conspectus," and of entirely new forms. The species referred to in one way or another amount to about 1600, certainly enough to justify the issue of a supplement. The disposition of one genus, Taraxacum, has been entirely recast after Handel-Mazzetti's new monograph. As it now stands, it comprises nine species against two in Boissier's "Floræ Orientalis," and five in the "Conspectus."

The treatment of nomenclature is commendably conservative; but why, then, the obsolete Wilckia for the well-known Malcolmia? One point, however, challenges criticism. In the original "Conspectus" we have already two systems of authors' quotations. In the body of the book we find, for instance, *Acantholimon echinus*, L.; in the index it is *Acantholimon echinus*, Bois. In the body of the supplement this species stands simply as *Acantholimon echinus*, whilst the index has it as *Acantholimon echinus* (L.); and many similar instances might be quoted. The correct citation is *Acantholimon echinus*, Boiss., or according to a now rather common fashion, *Acantholimon echinus* (L.), Boiss.

We hope there may be in four or five years' time another supplement with a general index to the whole work, including the supplements. This is very much needed, and it will give the author an opportunity of revising his citations according to a uniform plan, preferably that of the "Vienna rules." Then, we trust, will also disappear the rather numerous printers' errors which disfigure the index of the present supplement.

OTTO STAPF.

Grundriss der Kristallographie für Studierende und zum Selbstunterricht. By Gottlob Linck. Pp. vi+256. Second edition. (Jena: Gustav Fischer, 1908.) Price 10 marks.

IN the preface to the first edition, published twelve years ago, Prof. Linck remarked that he wished to place in the hands of chemists and others to whom some knowledge of the properties of crystallised matter was necessary a book that should be moderate in cost and should discuss with sufficient fulness, yet in simple language, the elements of crystallography. Except for the alterations necessitated by the advances made in both the subject itself and the methods of teaching it during the interval that has elapsed, the second edition follows closely on the lines of the first. The thirty-two classes of possible crystalline symmetry are subdivided into six systems in the usual way, and the proper undertanding of the symmetry peculiar to each class has been much facilitated by the admirable illustrations, reproduced from photographs of wooden models, which have been introduced into this edition; the author now adopts Groth's nomenclature.

In the earlier edition, although Miller's notation was used as well as Naumann's, preference was given to the latter; the reverse is now the case, with consequent improvement in simplification. Space, too, has been saved, which has been utilised for a fuller discussion of the physical properties of crystals. More attention is paid to the relation between crystalline form and chemical composition, in connection with which so great an extension of knowledge has taken place during recent years. The utility of the book would have been vastly increased had a chapter or two been devoted to some simple methods for determining the morphological and optical constants of crystals.

The printing and general appearance of this edition are all that might be expected of the well-known Jena publisher.

G. F. H. S.

A Hill Country: its Physical Features and their Significance. By Russell F. Gwinnell. Pp. vi+26; with geological map. (London: George Philip and Son, Ltd., 1908.) Price 1s. net.

MR. GWINNELL has prepared a contoured relief model of a district in the northern Clyde basin on which contours are taken at each 250 feet, and the vertical and horizontal scales are the same. The pamphlet is intended to be used with the model, and together they form a general illustration of those physical features which constitute what is known as scenery. The model and booklet should prove of real service to those teachers of geography who base their teaching as much as possible upon experiment and observation.

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.]*

On the Antiquity of Mummification in Egypt—A Correction.

In a recent article on the history of embalming, which was published in the *Cairo Scientific Journal*, I stated that a friend had told me there were two left hip-bones and no right in the remains of the so-called mummy of King Mykerinus in the British Museum.

I have just seen the skeleton, and I hasten to state that my information was not correct, and that there is no reason to suppose that all the bones did not belong to one individual.

At the same time, I must add that there is no conclusive evidence to show that the remains found by Colonel Vyse are either mummified or those of Mykerinus.

This question was raised by me in the course of a discussion on the antiquity of embalming. At the time of writing I had seen no genuine mummy earlier than those found at Sakkara in February, 1907, by Mr. J. E. Quibell. They were dated by him as belonging to the period of the tenth dynasty. Since then Prof. Flinders Petrie has directed my attention to a mummy which he found at Medum in 1892. It is assigned by him to the date of Sneferu, the last king of the third dynasty. Prof. Keith, the conservator of the Museum of the Royal College of Surgeons, where this body is now lodged, has allowed me to examine it. The body is certainly a properly embalmed mummy, and if Prof. Petrie's estimation of its age is correct—and it would be presumptuous of me to doubt it—then this specimen shifts back the date when mummification is known (*by positive evidence*) to have been practised in Egypt by nearly a thousand years.

August 7. G. Elliot Smith.

The Mechanics of the Inner Ear.

I am much indebted to Prof. McKendrick for his exceedingly fair review of my monograph on the mechanics of the inner ear (Nature, June 4, p. 114). One point, however, seems to require a reply on my part. Prof. McKendrick suggests that I should make "a huge model" of the cochlea. I believe that it is of some general interest to state why I did not do this long ago.

One of the most important facts which the engineer has to keep constantly in mind is this, that one can but rarely increase or reduce the size of a machine by making all parts geometrically similar to the original. In most (especially hydraulic) machines a part of the function depends on volumes, a part on areas, and a part on lines. A linear increase in size of a hundred would involve an increase of all areas by ten thousand, and of all volumes by a million!

This principle applies, not only to engineering, but also to biology. Suppose I claimed to have made an artificial amœba. Prof. McKendrick surely would not deny my claim on the sole ground of my having failed to make one as large as a frog or a fish, if in all other respects it should be a perfect amœba. Unicellular organisms obviously cannot attain large sizes, because soon their surface functions become insufficient for their volume functions, and they have to obtain special organs for the former (*e.g.* gills).

In the present case, however, the principle is of a purely mechanical nature. The cochlea is a very tiny hydraulic machine, so tiny that its functional elements are microscopical. At the same time, its complexity exceeds that of any machine built by human hand. Any model would have to be a relatively huge model indeed. There are three reasons why I did not make any model:—(1) it is so improbable that in making a model I should hit upon proportions which enable the model to function that I would most certainly waste my time and energy; (2) if the huge model should (by a kind of miracle) happen to function in accordance with my theory, this would not prove that the cochlea functions likewise; (3) as soon as it would be known that the model did not function, some would undoubtedly conclude that therefore the cochlea cannot function thus either, although this conclusion is quite unjustifiable.

Only when, as the result of painstaking experimental, anatomical, and mathematical work, the theory has been greatly perfected will there be any hope of designing and then constructing a huge model which can be expected to function like the inner ear. Max Meyer.

University of Missouri, Columbia, Mo., July 23.

I quite appreciate the force of Prof. Max Meyer's remarks. The point, however, is that while it would be impossible to make a model of a cochlea that would in all respects work like a cochlea, it would be interesting and instructive to make a large model on the principles so clearly set forth in Prof. Max Meyer's monograph, with the view of ascertaining whether a stroke of a piston (imitating the base of the stapes) would act on the whole length of a membrane (imitating the basilar membrane) or only on a portion of it.

A good many years ago I constructed a working model of the cochlea, founded on some suggestions by Prof. Crum Brown. This is described in Schäfer's "Text-book of Physiology," vol. ii., p. 1182, and the model is in the physiological laboratory of the University of Glasgow. It illustrated a possible method of analysis, but obvious objections may be urged against its mechanism. Prof. Crum Brown and I have often thought of making a larger and simpler model, and possibly in the leisure we now enjoy we may return to the subject. I would still recommend Prof. Max Meyer to try his hand on a model and put his views to an experimental test. John G. McKendrick.

Elementary Organic Chemistry?

May I be permitted to direct attention to a question asked in a recent examination in organic chemistry for medical students, the syllabus for which states that "the whole subject is to be treated in an elementary manner"?

The question was:—"On analysis an acid whose melting point was 190° C. gave the following results, 0·2159 gram gave 0·3595 CO_2 and 0·1209 H_2O.

"On titrating with ammonia (1 c.c. = 0·00334 NH_3), 0·4859 gram of the acid required 37·52 c.c.

"From these data calculate the molecular formula of the acid."

Assuming that by the term molecular formula structural formula is meant—else why is the melting point given?—and assuming that the acid does not contain nitrogen, the empirical formula $C_5H_8O_4$ agrees well with the data given.

Of the many dibasic acids of this formula, no one melts at 190°, the nearest being dimethylmalonic acid, which melts at 192°.

But apart from any slight error of this kind, is it to be expected that candidates, in a subject which is to be treated in an elementary manner (or, so far as that goes, in any manner whatever) and who may not consult books of reference during the examination, should be required to know the melting points of all the dibasic acids?

J. F. Thorpe.

The University, Manchester, July 29.

Space and Number.

In relation to the ideas of Mr. Leonard J. Russell (Nature, July 30, p. 305), it may perhaps be interesting to some of your readers to know that Leibnitz entertained analogous opinions upon the same subject. I quote from Baumann, "Die Lehren von Raum, Zeit und Mathematik," Berlin, Reimer, 1869, ii., p. 79:—

"Die Aufdehnung vorstellen wie ein Absolutes, entspringt daraus als seiner Quelle, dass wir den Raum vorstellen nach Art einer Substanz, obgleich er ebensowenig eine Substanz ist wie die Zeit. Darum haben die Scholastiker einst mit Recht den Raum ohne Dinge imaginär genannt, wie die Zahl ist ohne gezähltes Ding." See my book, "Spazio e tempo," Torino, Bocca, 1908, p. 177. Ottavio Zanotti Bianco.

Via della Rocca 28, Torino, August 3.

THE GROUSE-DISEASE REPORT.

WE are indebted to the secretary for an advance copy of an interim report, issued by the Board of Agriculture and Fisheries for Scotland, of the Committee on the Grouse-disease Inquiry appointed in 1905, with Lord Lovat as chairman. It should be stated at starting that although this committee was appointed by Lord Onslow, no Government funds were allocated for its use, in consequence of which the entire expense has hitherto been defrayed by private subscriptions, of which a list is given in the document before us.

From one point of view, the committee has been decidedly unlucky in that during the period of its investigations no cases of the acute, or epidemic, phase of grouse-disease have come under its notice. In these circumstances, to say nothing of further investigations required in connection with the chronic, or endemic, phase, the work accomplished cannot be regarded as in any way approaching finality. Nevertheless, the committee (and we think rightly) decided to issue the interim report now before them, if only for the purpose of informing subscribers what has been already done, to point out the lines of future investigations, and, above all, to endeavour to obtain additional funds, without which the inquiry cannot be much further continued.

As pointed out in a covering letter from the secretary, there is naturally considerable difficulty in issuing a very instructive report in the middle of an inquiry. Many important questions are still under investigation, and even where apparently definite results have been obtained, it has been deemed undesirable to publish these until they have been fully verified. Nevertheless, there is a wealth of most important and valuable information in the document, and the committee is to be congratulated on having apparently identified the cause and nature of the chronic phase of the disease. In the course of the inquiry reports have been drawn up dealing with bacteriology, the causes of mortality in specimens submitted for examination, the economic value of the grouse-shootings in Great Britain, and heather-burning. These and other reports are held over for the present, but will form part of the final report of the committee.

Although great caution is displayed in giving any statement as final, it is pointed out in connection with the chronic disease that it appears to be a wasting, and usually fatal, illness, in which the parasitic intestinal worms affecting grouse at all ages and all seasons attain, probably owing to lowered vitality on the part of their hosts, an abnormal development, and are thus enabled to react injuriously on the bird's general health and condition. The most easily recognised symptoms are loss of weight, redness and acute congestion of the interior of the long blind-appendages (cæca) of the intestine, and an irregular moult and slow subsequent re-feathering, resulting in bare legs and a poor and dingy condition of the plumage.

The latter features, as pointed out by Mr. E. A. Wilson, the field-naturalist to the committee, in a separate section of the report, must not, however, by any means be regarded as absolutely diagnostic of the disease. They may, and frequently do, occur in a bird the moult of which has been delayed, and the recovery of which from the effects thereof has been slow. Such birds display the same appearance of dusky, faded plumage and bare legs and toes common to the majority at an earlier stage of the season (when they do not come under the ken of sportsmen), and likewise to birds afflicted with the disease.

In the earlier stages the grouse is less strong on the wing than ordinarily, and changes its station from the heather to the green ground; in many cases the feathers lose their freshness, while a tape-worm may frequently be seen hanging from the vent as the bird rises. In the later stages the power of flight is lost, the congestion of the intestine becomes still more acute, tape-worms are frequently expelled without the slightest beneficial effect, while both blind-appendages absolutely swarm with microscopic thread-worms. Loss of weight makes itself daily more noticeable, and the bird mopes about the banks of the stream until death puts a term to its sufferings.

The tape-worms have, apparently, nothing to do with the disease, being expelled merely on account of the abnormally irritable condition of the intestines. The real offender seems apparently to be the thread-worm, *Trichostrongylus pergracilis*, with which, as already mentioned, the inflamed cæcal appendages are crowded. This provisional conclusion is supported by the fact that while in other animals tape-worms do not generally give rise to fatal diseases, thread-worms certainly do so, as in the case of the miner's worm.

The report next takes into consideration the epidemic or acute phase of the disease, which, as mentioned above, the experts of the committee have hitherto had no opportunity of examining. It is true, indeed, that birds in full plumage and of normal weight have been sent in as examples of mortality due to the acute phase, but these, on examination, proved to have died either from the ordinary wasting disease or from the effects of accident.

The external signs of this disease are stated to be that the birds succumb rapidly, without loss of weight or deterioration of plumage, while the local action of the disease is reported in many cases to be intense. *Post-mortem* examination is stated to reveal patchy congestion of one or both lungs, comparable to the "hepatisation" of tissue occurring in undoubted pneumonia. The internal organs generally are also stated to be congested, and to exhibit other symptoms of acute and rapidly fatal fever.

By Prof. Klein this phase of grouse-disease was considered to be an acute form of infectious pneumonia, due to the presence of parasitic organisms probably belonging to the "colon" group, these being chiefly found in the lungs of infected birds, although, at any rate after death, they might occur in other organs.

The committee, without wishing to undervalue the evidence of a specialist of Klein's reputation, or the testimony of naturalists and keepers generally, remarks:—

"Klein's organism belonged to the widely distributed colon group, and, according to the limited cultural and morphological tests then used, differed in no way from other organisms of the colon group found in the grouse.

"Members of the colon group, apparently culturally and morphologically identical with Klein's organism, can be isolated from the heart, blood, lungs, and liver of both healthy and emaciated grouse that have been dead for a period of from twelve to twenty-four hours, the actual time varying with such factors as temperature and moisture.

"With regard to keepers' evidence and statements that birds die in full weight and plumage, it must be placed on record that already several times during this inquiry the acute form of grouse-disease with full-feathered birds of good weight has been reported, but in each case examination by the committee's experts has shown that the bird died only from the wasting disease, or as the result of accident.

"While it is not argued from the above that only one form of disease exists, it is, however, a fact not without significance that in the years 1905, 1906, and 1907 no instance of the acute pneumonic form of grouse-disease has come to the notice of the committee, though that committee has had field-observers, 283 local correspondents, as

well as keepers on the large majority of the more important moors constantly on the look-out for it."

In his own portion of the report Mr. Wilson observes that a condition similar to that supposed to be diagnostic of the acute form of the disease may be found in almost any grouse picked up dead upon the moors. Prof. Klein described and figured preparations of the lungs of grouse supposed to have died from the acute phase of the disease, in which the vessels are absolutely plugged by bacteria.

"Without doubt," writes Mr. Wilson, the observer "finds in his microscopic sections of similar lungs similar conditions, presumably of similar disease. But to the experienced bacteriologist a doubt occurs whether these plugs of bacteria in the vessels of the lung should not be considered *post-mortem* instead of *ante-mortem* productions; the result of *post-mortem* changes allied to decomposition, rather than to pathological changes due to disease in life. Following this comes another doubt, whether the more gross appearances of disease in the lungs on dissection are not really due to *post-mortem* changes rather than to disease in life. And upon examination of presumably healthy birds after a lesser or greater prolongation of *post-mortem* putrefaction and delay, suspiciously similar appearances in the lungs are certainly observed."

Again, experiment has shown that in a healthy pigeon killed by chloroform the appearances to the naked eye supposed to be characteristic of the acute grouse-disease make themselves noticeable in the lungs after a period sufficient to permit the development of *post-mortem* changes.

Reading between the lines, it seems to us apparent that the experts of the committee are very sceptical whether, in the first place, the acute phase of the disease really exists, and, in the second, if it be existent, whether it is of a pneumonic character. They do not, however, apparently "like to bet till they know."

To revert to the chronic phase, its place of origin and mode of dispersal are points to which special attention has been directed by the committee, but considerable difficulties have been experienced in these respects owing to the very natural reluctance of owners and keepers to report the occurrence of disease unless it is widely spread in their district.

One fact the committee considers to have been indisputably established, namely, the intimate connection existing between the food-supply and the health of the grouse, or, in other words, the fact that the capacity of the birds to resist the attacks of the intestinal worms depends mainly upon their physical condition and general fitness. Owners and keepers have for years been convinced of cycles of maximum and minimum development of grouse-disease. Records from various estates extending over a period of more than half a century indicate that the cycle comprises a good year, a very good year, the record year, the bad year, the recovery year, the average, and the good average year.

A regular sequence of events, culminating in an over-stock, a consequent shortage of food, the appearance of disease, and a sweeping of the moor, occurs in the rare cases where disease follows a bad year. Examination will, however, often show either that in such cases the effect of a previous outbreak had not passed away, or that exceptional conditions had reduced the food-yield of the moor to less than usual. Again, the exceptional occurrence of several consecutive good years may be attributed to a better heather-crop, through improved management, or to open winters or early springs which have allowed a larger stock of birds to be maintained.

The theory that disease is due to the consumption of frosted-heather is refuted by the fact that heather in this condition is never eaten by grouse. Investigation has shown that grouse have to do all they know in the way of eating in order to maintain themselves in condition, especially in winter and spring; consequently any food-shortage at the two latter seasons is bound to result in ill-effects. Further, it has been observed that the mortality among hen-birds is most noticeable in late summer, perhaps induced by shortage of food during the nesting-season.

As regards remedial measures, nothing really definite can be suggested until much deeper investigation has been made into the life-history of the grouse thread-worm—investigations to which Mr. Shipley is devoting his best attention.

As contributory measures to the checking of the disease, attention is, however, directed to the importance of proper estate-management, in the matter of heather-burning, the supply of grit of proper quality for the birds to eat, the draining of the ground, and last, but not least, the killing off of weakly birds —"cheapers"—which cannot but give rise to a poor and ill-nourished progeny.

In conclusion, we desire to offer to the committee and the experts by whom they are assisted, our congratulations as to the admirable and exhaustive manner in which this very difficult inquiry and investigation has thus far been conducted.

R. L.

THE INTERNATIONAL GEOGRAPHICAL CONGRESS AT GENEVA.

THE ninth International Geographical Congress was opened at Geneva on July 27, and the business portion of the proceedings came to an end on August 6. It is only possible here to give a brief sketch of the subjects discussed and resolutions adopted.

As regards the general intention and meaning of the congress, it may be assumed that that somewhat vague word geography is usually taken to denote a group of studies connected with the influence of the surface features of the earth on the human race. But, if the proceedings of the congress may be taken as a guide, this aspect of geography has no very full recognition. By far the most prominent discussions and papers were those dealing with mathematical geography, cartography and allied subjects, and those treating of physical geography. The latter subject was chiefly in the hands of the geologists; indeed, it is hard to imagine anyone but a geologist doing useful work in this field. It might almost be said that geography, in the opinion of the average geographer, as deduced from the proceedings of the International Congress, is mainly the concern of surveyors and geologists. Geography in this sense is earth-knowledge; its chief function is to determine and explain the shape of the earth, the positions, forms, and characters of its surface features, and, so far as may be, to predict future surface changes.

Of the 232 papers of which the programme was composed, 124 dealt with physical geography, survey, exploration, and kindred subjects; 11 with rules and nomenclature; 14 with the teaching of geography. Meteorology accounted for 15, biology for 10, anthropology for 14, historical geography for 15, and economic and social geography for 26. The sectional meetings in some of the last-mentioned subjects were not well attended.

At the opening session a paper of considerable historical interest, entitled the "Circumnavigation of Africa under Necho II.," was read by M. A. Moret,

of the Musée Guimet. According to Herodotus, it was Necho II. who caused certain Phœnicians to undertake this journey, which lasted three years. The successors of Herodotus denied that Africa was surrounded by water, and the world remained ignorant of the truth of the case until the time of Vasco da Gama.

M. Moret described how he found a scarab inscribed with hieroglyphics amongst the objects left by the will of the late M. Burian, the Egyptologist, to the Musée Guimet. The inscription relates the return of the navigator Pa-du-Neit to Bubastis. This account is corroborated and completed by an inscription on another scarab in Brussels; this latter scarab also originally belonged to Burian's collection. The second inscription states that the explorer took one year and seven months to reach the Cape (of Good Hope?), that the entire journey lasted four years, and that Necho caused the details of the voyage to be engraved on a stele in the temple at Bubastis.

In the discussion which followed the reading of this paper, M. Naville expressed his belief in the authenticity of the scarabs. Prof. Oberhummer, however, pointed out the necessity of caution in accepting evidence of this character, and threw some doubts on the genuineness of the scarabs. The net result is that the layman is left very much where he was before, and it would appear that even if the scarabs be accepted as genuine, the accounts are too vague to indicate any high degree of probability that the supposed circumnavigation was accomplished at that early date.

Early in the proceedings of the congress a discussion was originated by M. Lecointe, director of the Royal Observatory of Belgium, on the subject of the organisation of an International Polar Institute. It appears that such an institute was founded at Uccle in 1907 by private enterprise, that it is strongly supported by the Belgian Government, and that it is intended eventually to instal the offices and library of the institute in Brussels.

At present the institute does not, perhaps, deserve the appellation "International." Its staff is essentially Belgian. It should be mentioned, however, that the scheme has the support of the Duke of the Abruzzi, of Captain Cagni, and of Mr. Nordenskjold.

The intentions and objects of the Institute, as set forth in the prospectus circulated at the Congress, are:—(1) the formation of a special library, (2) the collection of maps and photographs, (3) the compilation of a bibliography, (4) the organisation of an encyclopædia, (5) the publication of an International Polar Review, and (6) the formation of a museum.

Now, although such an establishment would be instructive, and would, no doubt, have an educational value, it is extremely doubtful whether it would, in the present state of knowledge, be of any real practical service in assisting the work of polar exploration. For instance, would an intending British explorer study at the Brussels Institute when there is so much more first-hand information available in London? Is the existing information which we possess about the polar regions so voluminous as to require special and formidable apparatus of the character above described? These considerations prevented the British delegates from supporting the scheme, although they did not actively oppose it. Its ultimate failure or success will largely depend on the attitude of the principal geographical societies.

At the second general sitting of the congress, Prof. Penck read a report on the state of advancement of the general map of the world on the scale of 1 : 1,000,000. This scale was recommended by the London congress of 1895. Series of maps on this scale have been published by the British War Office, by the French Service Géographique de l'Armée, and by the German Landesaufnahme. The United States Geological Survey is about to publish maps on the same scale, and General Schokalsky announced that the Russian geographical service was about to do the same.

A very practical proposition was made by Prof. Davis on behalf of Mr. Gannett, of the United States Geological Survey, that a committee should be appointed to recommend a uniform system of symbols and conventional signs. This proposal was warmly supported by the British delegates, who made the additional proposal that each Government or map-producing office should be asked to supply within twelve months specimens of maps on this scale to form a basis for discussion.

A temporary committee composed of one representative each of Great Britain, France, Germany, Russia, and the United States was appointed. The committee met without delay, and drew up a series of resolutions defining generally the character, symbols, and conventional signs of the map in question. These resolutions were printed and submitted to a general meeting of the congress, and were approved. They will now be brought to the notice of the various Governments concerned, and it is hoped that these Governments will appoint an official international committee to draw up detailed rules.

As was to have been expected, a good deal of time was devoted to the discussion of the history, structure, and action of glaciers. Prof. Penck gave an address on the climate of the Alps in the Glacial period. He pointed out that although the glaciers descended to a low level, there was in the centre of the Alps a region entirely free from ice. The extension of the glaciers may be considered as due to a diminution of temperature of a few degrees only. M. Chodat supported Prof. Penck's theories from the botanist's point of view.

Prof. Brunhes dealt with glacial erosion. He described the difference between glacial valleys of a U form with a stepped longitudinal section, and those of the V form of regular longitudinal slope.

M. Raoul Gautier directed attention to the correspondence between the oscillations of glaciers during the nineteenth century and temperature observations at the St. Bernard. Several speakers pointed out the importance of the erosive action of the glacial streams. M. Jacob described the glacial research carried out in Dauphiné under the direction and at the cost of the Ministry of Agriculture; and there were many other communications on the same subject.

Glacial literature and discussion appear to be growing at a somewhat alarming rate. A summary, in English, by a competent writer, of modern investigations and theories would be useful.

There is no space here to describe, even in outline, the discussions in the borderlands known as historical geography, biological geography, and ethnographic geography. As regards meteorology, few of the communications had any strictly geographical bearing, and the greater number were more suited for discussion at a meteorological congress.

The arrangements of the congress were satisfactory as regards the halls and lecture-rooms, which were lent by the University, to which body the delegates owe their thanks. But in one important respect the organisation was defective. No summaries of papers were published in advance, and it was difficult to discover in advance anything about the character of the communications. It is much to be hoped that at the next congress, which will be held in

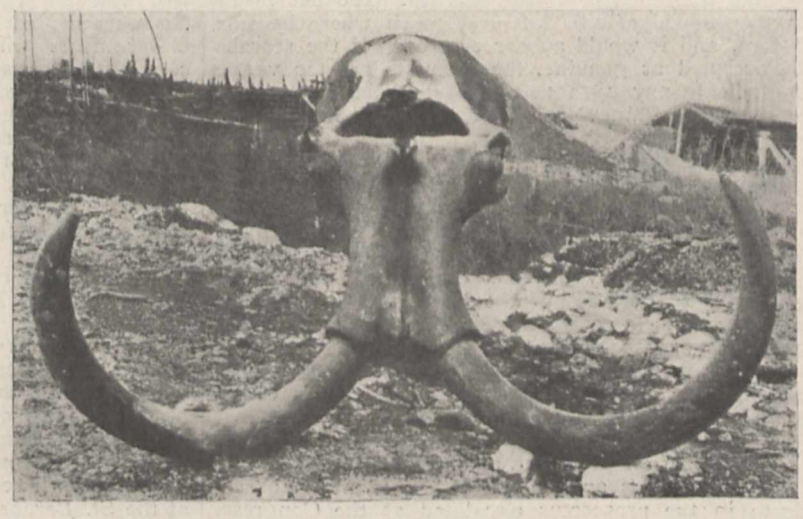
Rome in 1911, the following points may be attended to:—(1) The working session should be limited to one week; (2) only papers of serious scientific value should be accepted; (3) summaries of all such papers should be distributed (in the four authorised languages) on the opening day.

On the social side the delegates have every reason to thank the Federal and Cantonal authorities, the organising committee, and the Swiss members of the congress for their charming hospitality.

As to the outcome of the congress, the principal concrete result is the step taken towards the standardisation of the 1 : 1,000,000 map. But in all such meetings the obvious results are by no means the only ones to consider. It is no small gain that men of many nationalities, interested in a particular group of studies, should meet together to exchange ideas and experiences. One cannot doubt that such meetings have a value in broadening human knowledge and sympathies which is not to be measured in any simple quantitative way. As the president of the Swiss Confederation said, in words which it would be difficult to improve, "Votre Congrès contribuera au rapprochement des nations et à la fraternité entre les peuples, car rien n'est plus propre à dissiper les divergences de vues et à élever le regard au-dessus des bornes-frontières de chaque pays que la connaissance des lois universelles qui régissent le monde et unissent d'un lien naturel la grande famille humaine." C. F. CLOSE.

MAMMOTH-HUNTING IN ALASKA.

SINCE Kotzebue's discovery of fossil remains of mammoth and musk-ox in 1815, Alaska has been famed as a store-house for Pleistocene mammals; and in 1904 the Smithsonian Institution dispatched an expedition to obtain specimens for the museum at Washington. This expedition also visited Yukon territory, where it was successful in obtaining the magnificent mammoth skull shown in the accompanying illustration. Last year a second fossil-hunting expedition was dispatched by the same body, in charge of Mr. C. W. Gilmore, the results of which are recorded in vol. li. of Smithsonian Miscellaneous Collections. Mammoth-tusks of very large size were seen and measured, although it does not appear that the finest were transported to Washington. Incidentally, it is mentioned that the largest known skeleton of the mammoth is in the museum of the Chicago Academy, and is stated to be 13 feet in height. If this be true, reconsideration of the opinion that the mammoth was an animal of the approximate size of the Indian elephant is apparently demanded. Reports have been current to the effect that remains of the American mastodon occur in the Alaskan mud in company with those of mammoth. This, however, is an error, such remains being found in this region only in the "placer" deposits of the Yukon, which are doubtless of somewhat earlier age. The other remains discovered by the expedition include those of bison, elk, horse, beaver, and bear. The bison-skulls, some of which retain the sheaths of the horns, are referred to two distinct species, and indicate animals with an enormous horn-spread, altogether unparalleled by their modern representative. Alaskan mammoth-ivory is stated to be, on the average, inferior in quality to that from Siberia.



Skull and tusks of *Elephas primigenius* found 42 feet below the surface, in the muck, on Quartz Creek, near Dawson, Yukon Territory, Canada.

ALPHONSE PÉRON.

IT is with deep regret that we record the death of Alphonse Péron, eminent geologist and soldier, who passed away at Auxerre on July 2, after a lingering illness.

Pierre Alphonse Péron was born at Saint Fargeau on November 29, 1834, and studied at the college of Auxerre, where his lively interest in natural history soon became manifest. At the age of nineteen he entered Saint Cyr, whence he passed into the infantry in January, 1855. He served in various districts in France and in Corsica, was engaged in Algeria in the suppression of the rebellion of 1864, obtained his captaincy in 1867, and in the Franco-Prussian war served with the army of the Rhine. At Sedan he was severely wounded and left for dead upon the field. He retired from the army in 1896, having received the honour of Commandeur de la Légion d'Honneur in 1890.

Notwithstanding the exacting nature of his military duties, Péron neglected no opportunity for the indulgence of his taste for geology. Wherever he went he never failed to note the geological characters of the district, and, when possible, to make a collection of fossils. His observations in the field provided a considerable number of memoirs and notes which have appeared in the Memoirs and Bulletins of the Geological Society of France, of which society he was elected president in 1905; in the *Comptes rendus* de l'Académie des Sciences, in the *Comptes rendus* de l'Association française pour l'Avancement des Sciences, and other serials. The Société des Sciences historiques et naturelles de l'Yonne, in which he took great interest and ably supported his friend Cotteau, owes much of its success to his energy; in the Bulletin of this society are to be found some important papers from his pen. Among Péron's principal contributions to geological science since the appearance of his first work, "Notice sur la Géologie du Canton de Saint Fargeau," published in 1865,

may be mentioned "Notes pour Servir à l'Histoire du Terrain de Craie dans le S.E. du Bassin Anglo-Parisien." To his sojourn in northern Africa we owe the numerous works on the geology of that region, and one of them, the "Essai d'une Description géologique de l'Algérie," was awarded the Grand Prix des Sciences physiques. A most important work on "Les Ammonites du Crétacé supérieur de l'Algérie," was published in the Memoirs of the Geological Society of France in 1896–7. He also made a special study of the stratigraphy of the Cretaceous rocks of France and Belgium.

Péron was a correspondant of the Academy of Sciences. In him geology loses one of its most conscientious and disinterested students, one who, while honours were showered upon him, found his greatest delight in assisting his younger *confrères* in the elucidation of some difficult problem in stratigraphy.

NOTES.

A ROYAL Commission has been appointed by the King to make an inventory of the ancient and historical monuments and constructions connected with or illustrative of the contemporary culture, civilisation, and conditions of life of the people in Wales from the earliest times, and to specify those which seem most worthy of preservation. The commissioners are:—Sir John Rhys, University of Oxford; Prof. E. Anwyl, University College of Wales, Aberystwyth; Prof. R. C. Bosanquet, University of Liverpool; Mr. E. Vincent Evans; Alderman Robert Hughes, J.P.; Rev. Griffith Hartwell Jones; and Lieut.-Colonel W. Llewelyn Morgan, R.E. The secretary is Mr. Edward Owen, of the India Office, S.W., and the assistant secretary Mr. P. E. Thomas. We warmly congratulate Wales. We presume there are no ancient monuments in the other parts of Britain.

WE regret to learn that Prof. Kamerlingh Onnes's account of his researches on the liquefaction of helium is delayed by illness brought on by overwork. We hope, however, to be able to print an authoritative description of the investigations shortly.

WE learn from *Science* that by a recent decree of the Government of Peru, issued by President Pardo, the time of the seventy-fifth meridian west of Greenwich was on July 28 adopted as the national standard time for the whole of Peru. The meridian is only a few minutes from that of Lima, and runs almost exactly through the middle of the country. All timepieces throughout Peru will now coincide with those in the United States where eastern time is kept. Peru is the first South American republic to adopt the world standard.

IT is proposed to publish reproductions of the collection of 338 portraits of living physicists presented recently in an album to Prof. von Lang, Vienna, in celebration of his jubilee, if a sufficient number of subscribers can be found. Intending subscribers should communicate with Prof. Anton Lampa, Vienna, IX. Türkenstrasse 3. Applications after the publication of the reproductions cannot be considered, as only so many copies will be made as are subscribed for.

WE notice with regret that the committee of the Denmark Greenland Expedition has received a telegram announcing that Dr. Mylius Erichsen, the leader of the expedition, and two companions, a Dane and an Eskimo, have perished in a snowstorm while travelling inland. The general work of the expedition has, however, been successfully accomplished, and the whole north-eastern coast of Greenland has been charted. A Reuter message states also that Dr. Erichsen and his two companions who perished with him were driven on to an ice-floe during a snowstorm, and that they drifted away from land. Their provisions being exhausted, the explorers became so weak that they were unable to return to the station. The Eskimo who brought the news arrived in a dying condition, and died immediately after making his report. The expedition left Copenhagen on June 24, 1906, and its main object was to map the little-known parts of north-east Greenland and collect material for the study of ethnological, biological, and seismological questions in those regions.

THE next meeting of the Australasian Association for the Advancement of Science, which will be held at Brisbane in January, 1909, provides an opportunity for the younger generation of scientific workers to bring the results of original work before an influential and interested audience in the Antipodes. At the meeting there will be gathered together most of the leading representatives of scientific and engineering societies of Australasia, and also men holding high administrative or consultative positions under the various governments. Papers from British contributors will be sure to receive marked attention, and the authors' names will be introduced to important people in a portion of the globe where competition for vacant posts is less keen than it is in Europe or the United States. Mr. K. Swanwick, honorary secretary of Section A (Astronomy, Mathematics, and Physics) of the association, asks us to say that original papers from the British Isles will be heartily welcomed in his section; for, in the absence of the large and well-equipped laboratories of the older countries, it is unlikely that such papers by local workers will be numerous. Communications should be sent to Mr. Swanwick at Celtic Chambers, George Street, Brisbane, as early as possible, and the final date for receiving papers is December 26, 1908.

ON Saturday, August 8, Mr. W. Wright made a remarkable flight with his aëroplane at the Hunandières race-course, Le Mans, in the presence of leading members of the Aéro Club of France. The aëroplane rose easily to a height of 30 feet or 40 feet, and travelled over a course of about 2500 feet in one minute forty-five seconds, returning within 50 feet from the point of departure under the complete control of the aëronaut. On Monday, August 10, Mr. Wright made his machine describe a figure of eight twice in the air, and then returned to the starting point without any difficulty. In another flight, on Tuesday, he described three wide circles at various altitudes. The flight lasted three minutes forty-three seconds, and the aëroplane travelled at a speed of 65 kilometres an hour.

FURTHER particulars of the voyage of Count Zeppelin's airship on August 4, and its subsequent unfortunate destruction, can now be added to the information available when we went to press last week. It appears that the voyage from Friedrichshafen, which was left at 6.45 a.m., to Mannheim—a distance of about 360 kilometres—was accomplished in eight hours. When Count Zeppelin landed near Oppenheim about 6 p.m., the airship had been eleven hours continuously in the air, but the average speed for the whole voyage was reduced, owing to a defective motor, to 36 kilometres an hour. The return voyage from Mainz to Echterdingen, where Count Zeppelin landed on the morning of August 5—to await fresh supplies of hydrogen rendered necessary by leakages in the balloon—took eight hours, though the distance was

only 200 kilometres. According to Reuter, at Echterdingen, a sudden violent thunderstorm breaking over the town struck the balloon at its moorings and blew one of the cars into the air. The car fell back, striking the ground, and a motor exploded, setting fire to the adjoining parts of the airship. Several soldiers helping to hold down the airship were dragged into the air with the ascending car, and severely injured by the explosion. The blazing airship was caught by the storm and driven up into the air, where it was completely destroyed, and the framework blown away by the storm. A *Times* correspondent states that the most probable explanation of the disaster appears to be that when the airship was torn from its moorings by the force of the sudden hurricane the machine was brought into violent collision with trees and other obstacles, with the result that the benzene exploded and set fire to the whole fabric. The German Government has sanctioned the payment to Count Zeppelin of the grant of 25,000*l.* voted to him by the Reichstag last spring as compensation for his many years of self-sacrificing creative work in the building of airships. A public subscription has been inaugurated in Germany, and is meeting with a liberal response. Public and private donations to the amount of about three million marks (50,000*l.*) have been promised already toward a great national testimonial to Count Zeppelin.

THE oyster-fishery in the Lim Fjord forms the subject of parts xv. and xvi. of the report of the Danish Biological Station for 1908. After a historical survey of the discovery of oysters and the development of the fishery in this locality, the author, Dr. C. G. J. Petersen, refers to the present unsatisfactory state of the trade, and makes certain suggestions as to the best means of improving it in the future. The most obvious method is by preventing the enormous wastage of "spat" which now takes place, and with this object in view it is suggested that the beds would show a much better yield if they were regularly dredged by Government, or were leased out to private owners on more favourable terms than at present.

IN a paper published in the *An. Mus. Nac. de Buenos Aires*, vol. xvii., on the structure of the scapular arch in edentates and monotremes, as affording evidence of the reptilian descent of those groups, Dr. F. Ameghino recalls that in 1893 Mr. Lydekker proposed a new scheme of nomenclature for the bones of this part of the skeleton in vertebrates. It was shown, for instance, that in dicynodonts there exist a coracoid and metacoracoid, of which the first is represented in edentates, while both occur in monotremes (where the first is generally miscalled epicoracoid and the second coracoid). It follows from this that the so-called coracoid of a bird and a lizard is a metacoracoid. Although Mr. Lydekker's views were strongly opposed at the time of their publication, Dr. Ameghino maintains that they are indisputably correct, and that the revised nomenclature of the bones should be adopted in anatomy.

A SECOND paper by Dr. Ameghino in vol. xvii. of the *Anales* of the Buenos Aires National Museum is devoted to the alleged occurrence of remains of armadillos in the Oligocene of France and Germany. In view of the opinions which have been advanced as to the reptilian nature of these remains (which consist mainly of the plates of the dermal head-shield), the author states that he can no longer definitely assert that they indicate the occurrence of armadillos in the European Oligocene. At the same time, he refers to a figure of the microscopic structure of one of these bony plates, published by Filhol, which accords very closely with similar figures of armadillo plates, and differs markedly from the structure presented by the plates of certain lizards. To settle the question, it is urged that sections of the plates of the so-called Necrodasypus should be compared with those of the dermal armour of the approximately contemporaneous lizard Placosaurus.

IN a paper published by the Carnegie Institution of Washington (No. 101) under the title of "The Variation and Correlations of Certain Taxonomic Characters of Gryllus," Mr. F. E. Lutz records the results of a series of observations undertaken for the purpose of ascertaining whether detailed measurements of those parts of the body on which the distinction between the various American species of crickets mainly rests would afford absolute data for the determination of such species. The observations, which relate to an enormously large series of specimens, were intended to apply to the question of the exact definition of species in general. So far as American crickets are concerned, the results show that in the matter of length of various parts—especially the ovipositor—there is an almost complete gradation from the maximum to the minimum dimension, and consequently that the half-dozen or so species which have been named have no real existence in nature. Nevertheless, it is urged, the recognition of such species is advisable for convenience of reference. Local conditions of environment have, it is true, some effect on the taxonomic characters, such as the length of the ovipositor, but very similar variations occur in one and the same locality. It is added that these insects exhibit a dimorphic feature—namely, large or small wings—quite independent of the so-called specific characters.

IN his presidential address delivered before the annual meeting of the Linnean Society, held on May 24, Prof. W. A. Herdman discussed the question whether the practice of taking small samples of the oceanic plankton in particular localities at certain intervals of time affords a sufficient and trustworthy means of ascertaining the micro-organic contents of the oceans as a whole. As the result of observations at Port Erin, it has been ascertained that there exists, in the first place, a sequence and periodicity of stages in the life-history of these organisms; secondly, there are irregularities due to the interaction of organisms, as when one group serves as food to another; while, thirdly, there occur periodical changes and abnormalities of either time or abundance brought about by the nature of the water or by climatic conditions, which largely affect the plankton. From these facts it is clear that observations taken every three months, or even fortnightly, are inadequate to give a proper idea of the plankton of any one area, and it is therefore necessary to have samples taken weekly, and during three months of the year daily, to furnish a trustworthy basis of calculation. In the course of his address, the president directed attention to the occurrence in the Irish plankton of an extraordinarily large number of what are usually regarded as "oceanic" types.

THE report of the director of the Royal Botanic Gardens, Ceylon, for 1907, gives cover to the reports of the various officers attached. The post of scientific assistant to the director has been abolished. In connection with the curatorship of the gardens, Mr. H. F. Macmillan refers to the flowering of the giant bamboo, *Dendrocalamus giganteus*, and the giant orchid, *Grammatophyllum speciosum*; the bamboo has been flowering irregularly for three years, producing a proportion of fertile seed. An indigenous liliaceous plant, *Ophiopogon intermedius*, is recommended for edgings under the shade of trees. *Colvillea*

racemosa and *Artocarpus cannoni* are two of the new introductions into the gardens; also the Lombiro and Manicoba rubber trees, and Manihot "von Piauhy."

THE records of Mr. T. Petch, Government mycologist in Ceylon, provide information regarding the manner in which certain fungi show different propensities in different countries. The "bleeding disease" of cocoanut trees in Ceylon is traced to the fungus *Thievalopsis ethaceticus*, that is known in the West Indies and Java as causing a disease of sugar-cane. *Pestalozzia palmarum*, which attacks cocoanut palms in the latter countries, produces the "gray blight" usually associated with tea in Ceylon. With regard to this species of Pestalozzia, Mr. Petch does not accept the European reference to a species *guepini*, and generally holds the view that identifications cannot be satisfactorily made on dried specimens sent to Europe.

MR. A. S. HITCHCOCK has rendered good service, more especially to American botanists, in making a careful examination of type-specimens of American species of grasses deposited in European herbaria. The results of his study of the grasses described by Linnæus, Gronovius, Sloane, Swartz, and Michaux are collated in the Contributions from the United States National Herbarium (vol. xii., part iii.). The author pursued his investigations in the herbaria of the Linnean Society of London, the Natural History Museums at South Kensington and Stockholm, and the Museum d'Histoire naturelle at Paris.

THE second number of *Parasitology* (i., No. 2) contains important papers on ticks, spirochætæ, and piroplasmata (by Prof. Nuttall), and one by Dr. Castellani describing a spontaneous liver abscess in a monkey caused by an amœba.

PROF. LEDUC gives an interesting account of the osmotic "growths" which develop when a fragment of a soluble calcium salt (nitrate or chloride) is immersed in a solution of sodium carbonate. The calcium carbonate formed develops into curious outgrowths resembling those of the lower plants, and having a cellular structure analogous to that of the latter (Festband der *Biochemischen Zeitschrift* für H. J. Hamburger, 1908, p. 280).

WE have received an advance copy of Messrs. Merck's report of recent advances in pharmaceutical chemistry and therapeutics for 1907. Within a compass of 262 pages a large amount of information on new remedies, &c., is given, and the report should be in the hands of every medical man. It is sent free on application to 16 Jewry Street, E.C.

THE Livingstone College Year-book for 1908 contains the annual report, notes on experiences of former students and on climatic outfit and hygienic questions, and a review of the progress of tropical medicine, together with a reprint of Sir Patrick Manson's opening address on tropical research. The Livingstone College aims to give elementary instruction in the principles of medicine and surgery to missionaries.

A CLEAR and somewhat detailed statement of the present position and recent progress of the science of comparative psychology is to be found in the June number of the *Psychological Bulletin*. Prof. John B. Watson contributes an article on the power of imitation in monkeys, which sets in vivid contrast the utterances of popular anecdote and scientific experiment. Working with rhesus and cebus monkeys, he has found it impossible to obtain any conclusive evidence for the presence of the function of imitation in its higher forms. This result is diametrically opposed to that previously obtained by Prof. Hobhouse in a series of similar—in part identical—experiments. Prof. Watson suggests that the monkeys used by Prof. Hobhouse had previously learnt a variety of tricks similar to those demanded by the experiments. In his own work this source of error had been carefully guarded against. The long review of the psychological literature of the past year which follows this article brings out very vividly the signal success which is attending the application of the experimental method to the problems of animal psychology.

WE have received from the Canadian Department of Mines, geological survey branch, a couple of admirably executed maps. One is a special contoured map of Rossland, British Columbia, drawn on a scale of 400 feet to the inch by Mr. W. H. Boyd, and the other is a topographical map of the Yukon territory on a scale of 32 miles to the inch, showing the position of the gold, silver, copper, and coal deposits.

THE annual progress report of the Geological Survey of Western Australia for the year 1907 (Perth, 1908) records much useful work done during the year. The account has been arranged upon slightly different lines from those adopted hitherto, in that all reports of a scientific character have been omitted, and their places taken by abstracts pending their publication in the Bulletins of the survey. Particulars are given of the results of boring for coal at various localities, of the reported gold discoveries at Mundijong, and of investigations of the wolfram and tin deposits near Brookton, and of the copper deposits at Yandanooka. Several minerals not previously noted as occurring in the colony were noted during the year, namely, meymacite (hydrated oxide of tungsten), tagilite (hydrated phosphate of copper), amazon-stone, zoisite, and hemimorphite.

THE elaborate character of the work being carried on by the United States Geological Survey in the investigation of the fuel values and possibilities of the coals and lignites of the United States is well shown in the report on the United States fuel-testing plant at St. Louis, Missouri, from January 1, 1906, to June 30, 1907 (Bulletin No. 332). The experts responsible contribute reports on field work, on the work of the chemical laboratory, on steaming tests, on producer-gas tests, on washing tests, on coking tests, on cupola tests for coke, and on briquetting tests. The briquetting plant has developed new possibilities in the utilisation of slack coal and of anthracite culm as an efficient locomotive fuel, and the producer-gas investigations have shown the availability of bituminous coal, lignites, and peat rich in volatile matter, for the production of power. We have also received a report by Mr. R. L. Humphrey and Mr. J. A. Holmes on the organisation, equipment, and operation of the structural materials testing laboratories at St. Louis, Missouri (Bulletin No. 329). Funds have been supplied to the Geological Survey by Congress for investigations of structural materials with the view of reducing the cost and improving the quality of the materials used in building and construction work. Equipment of an elaborate character has been purchased, and much work has been done in studying the properties of concrete and reinforced concrete, and in testing various materials to determine their relative value for mortar and concrete.

DR. E. J. SPITTA has published in the Journal of the Quekett Microscopical Club for April, recently received, a short address on a method of photographing very trans-

lucent diatoms at high magnifications. The necessary high magnification requires the use of rapid plates, and with these the image of each dot or pearl is seen to be surrounded by a halo of fog, due to optical causes. To remove this the author makes a copy of the negative through a positive, using at one or both stages of the process a plate of much lower speed than could be used for the original negative. By this means the contrast is increased, and the foggy appearance thus eliminated.

IN a pamphlet entitled "Ratio Coordinates and Carnot's Theorem" (London: Whittaker and Co., 1908, price 1s. net), "J. L. S. H.," of East London College, suggests a method of dealing with certain theorems in analytical projective geometry of quadric curves associated with triangles. His "ratio coordinates" of a point practically represent the ratios, with their signs changed, of the triangular or areal coordinates, their product thus being -1. Equations expressed in terms of these coordinates are neither homogeneous nor symmetrical, the equations of a straight line and a quadric being of the form of linear and quadric equations in two variables, namely, one of the coordinates and the reciprocal of another coordinate.

WE have received from the director of the Zi-ka-wei Observatory (near Shanghai) a copy of a new and carefully prepared word-code for transmitting typhoon and gale warnings, with particulars as to direction of motion, &c., to such lighthouses on the Chinese coast as possess telegraphic connection, and to some foreign places. A code has been in use for many years, and has from time to time been improved, but it became necessary to reduce, so far as possible, the work of the telegraph companies, who generously transmit the messages gratuitously. In our note of May 23, 1907, it was explained that captains of vessels leaving port were invited to repeat, under certain restrictions as to time, &c., the warnings they had seen in the harbours to lighthouses not yet electrically connected. The plan appears to have met with success, and orders to cooperate in passing on the signals in a modified and simple form have been issued by several naval commanders to their respective fleets.

THE results of an investigation of the connection between band and line spectra of the same metallic elements were described by Prof. W. N. Hartley, F.R.S., before the Royal Dublin Society on June 16. The author concludes that band spectra belong to the elementary atoms, and may be considered as caused, not only by the motion of translation of the atoms themselves, but also of the vibratory movements of the component parts within the atoms. The banded flame spectra of lead, antimony, bismuth, tin, zinc, cadmium, copper, silver, and gold are the spectra of the atoms. The lines of these elements also are the spectra of the atoms, and it is inferred therefrom that the component parts of the atoms are in a state of dissociation. It is concluded that the metallic elements with monatomic molecules which exhibit two spectra—one of lines and the other of bands—can exist in two different conditions, the difference being in the larger amount of energy associated with the atom which exhibits a line spectrum.

THE Journal of the Röntgen Society for July contains a paper by Mr. W. Duddell, the president of the society, on the measurement of the current through a Röntgen-ray tube. The current was derived from a 12-inch induction coil, the primary of which was supplied from the mains at 200 volts through a mercury turbine interrupter giving about seventy-five interruptions per second. The secondary current was rectified by a point and cup spark gap, and passed in series through the tube, an oscillograph, a thermoammeter, and a galvanometer, by means of which the shape of the current curve, the mean square current, and the mean current were respectively determined. The current curve was almost invariably a triangle with a very short base and a height from 30 to 45 milliamperes, the mean current varied between 0·5 and 1·2 milliamperes, and the root mean square current between 2 and 5 milliamperes. Mr. Duddell is disposed to think that there is a connection between the maximum value of the current and the "hardness" of a tube for a given mean current.

THE most recent experiments of Mr. H. N. Morse on the osmotic pressures of sugar solutions, as described in the *American Chemical Journal* for June and July, are characterised by so marked an improvement on the excellent results already obtained as to merit much greater attention than the titles of the papers would suggest. The earlier sources of error due to variations of temperature have been overcome by improved thermostatic methods, those due to the change of volume resulting from the displacement of the manometer connections have been reduced to insignificant proportions by improved mechanical arrangements, and the last remaining disturbance, due to the dilution of the contents of the cell during the periods of closing and opening, has now been got rid of. As a result, the errors of measurement have been reduced from an atmosphere or more to a few hundredths of an atmosphere only on pressures up to 24 atmospheres. In the experiments on glucose, eight duplicate determinations showed a deviation of 0·01 atmosphere only, whilst the two remaining pairs differed by 0·04 atmosphere. Observations of this degree of accuracy make it possible to follow, not only the main course of the osmotic pressure laws, but also the deviations from these laws, to which so much attention is being paid at the present time.

PROF. W. F. OSGOOD has given in the Annals of Mathematics (2), ix., 3, a simple proof of the rule for the differentiation of an integral when the independent variable enters into the integrand and also into the limits. The proof in question involves an application of Green's theorem. It may be noticed that for teaching purposes a geometrical proof is very useful, and probably sufficient.

AT the meeting of the Société française de Physique on July 3, an absolute torsion electrometer due to M. E. Salmon was exhibited. The arrangement follows that of the Kelvin absolute electrometer, the attracting plate, the attracted disc, and the guard ring being, however, vertical instead of horizontal. The attracted disc is supported by a fibre in such a way that when no electrical force acts on the disc its front surface is coplanar with that of the guard ring. When the potential to be determined is applied to the attracting plate, the disc moves outwards from its normal position, and is brought back by twisting the head of the suspending fibre through the requisite angle. The torsional constant of the fibre is determined by means of a thread attached to the centre of the disc, which passes over a pulley and supports a weight. The instrument has been used to measure potentials between 0·05 volt and 40,000 volts, and has an accuracy of about 1 per cent.

MESSRS. T. C. AND E. C. JACK will publish shortly a popular work entitled "The Wild Beasts of the World," edited by Mr. Frank Finn. The work will be illustrated with 100 reproductions in full colours from drawings, and

will be published in seventeen parts at a price of one shilling net each part.

MESSRS. ROWLAND WARD, LTD., announce for publication next month a concise work on British birds, entitled "The Sportsman's British Bird Book," by Mr. R. Lydekker, F.R.S. The volume will be illustrated, and will appeal to the field-naturalist as well as to the sportsman.

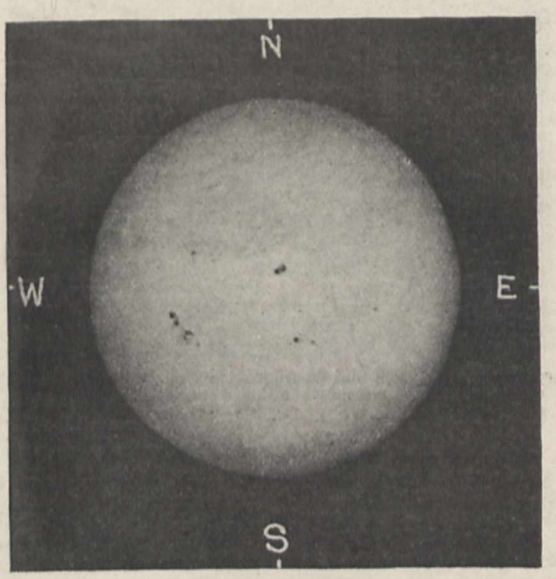
THE *Yorkshire Weekly Post* is publishing an interesting series of articles on "Natural History as a Shakespearean Study." The author is evidently a careful naturalist and a painstaking student of Shakespeare. The admirable natural history notes which occur week by week in our contemporary have been arranged under the present editor for the last fifteen years.

THE Sanitary Publishing Company, Ltd., has published a second edition of "By-laws as to House Drainage and Sanitary Fittings made by the London County Council," annotated by Mr. Gerard J. G. Jensen and another. The new by-law made under the Metropolis Management Acts (By-laws) Amendment Act, 1899, which came into force in 1903, has been included in the new edition. The work also contains references to the by-laws of various other cities in the United Kingdom. The price of the volume is 3*s*. 6*d*. net.

OUR ASTRONOMICAL COLUMN.

SUN-SPOTS VISIBLE TO THE NAKED EYE.—The accompanying photograph of the sun, taken at South Kensington at 2h. 45m. (G.M.T.) on August 6, shows the large groups of sun-spots which have recently been visible to the naked eye.

A feature of the most recent sun-spot maximum (1905–6) has been the number of naked-eye groups that has been



Photograph of the sun's disc, 1908, August 6, 2h. 45m.

observed, and it is somewhat remarkable that at the present time, two or three years after the epoch of the maximum, there should be two such groups visible at the same time. Both the group in the S.W. quadrant and that near the centre were quite easily seen for several days after August 3, a dark glass being the only equipment necessary. The former first appeared, as a few small spots, at the limb on July 30, and developed until, as the photograph shows, it was more than 100,000 miles long on August 6. The group near the centre was first seen, at the limb, on July 31, whilst the smaller group preceding it apparently formed on the disc and was first seen on August 3.

A BRILLIANT FIREBALL.—Mr. Denning writes:—"While watching the eastern sky for meteors on July 28 at 11h. 6m., the north-west region was illuminated by the outburst of a very fine meteor at a low altitude, and a few days later brought me letters from several of its fortunate spectators. An observer at Brynmawr, South Wales, says he was startled by the sudden illumination, and turning round to N.W. he saw a ball of fire drop there, leaving a bright streak for a short time. The Rev. W. F. A. Ellison, of Fethard, Waterford, describes the meteor as unusually magnificent. The flash was more vivid than lightning, and there was a momentary streak left about 4° to the right of Polaris. Path about 325°+80° to 115°+65°. Flight very swift, less than half a second. An observer at Naas, Kildare, wrote a description to the *Irish Times*, in which he says that the brilliancy of the fireball was so strong that it bathed the whole country in daylight for three or four seconds. It left a short streak, like a red bar, between γ and β Lyræ, but not quite connecting these stars. The meteor was also seen at Newtownwards, in co. Down, and by many others in different places. The radiant was at 302°+23°, and the height of the object about eighty-two to forty miles above Tullow and Kildare. The length of visible path extended more than fifty miles, and the velocity was very great and equal to 100 miles per second according to Mr. Ellison's estimate. The fireball would have fallen to the earth in west Meath could it have withstood disruption during a further flight of forty-eight miles. It was by far the finest meteor of the July epoch, and this is a period specially noted for the abundance and brilliancy of its meteoric phenomena. The shower in Vulpecula, near Sagitta, has frequently been observed at Bristol. This year, between July 22 and August 3, I recorded twelve meteors from it; they were swift and generally inconspicuous objects. Three were seen (one of mag. 3 and two of mag. 5) on the night of the fireball, and this amply proves that meteors great and small are commingled in showers of this character. The swiftness of motion is noteworthy. We should expect slow meteors from a radiant at 302°+23° at the close of July."

THE LARGE METEOR OF JUNE 28.—Other observations having come to his knowledge, Mr. Denning has been able to compute the path of the supposed bright Scorpiid seen by him on June 28. He finds that the observed path commenced, at a height of sixty-nine miles, near Mere (Wiltshire), and ended, at a height of forty-five miles, over Kineton (Warwickshire), the length of its path being eighty-four miles and its velocity twelve miles per second. The radiant was at 237°, −18°, about 15° W. of the usual Scorpiid radiant, so it appears that this object was in reality a member of the neighbouring Librid shower (the *Observatory*, No. 399, p. 318, August).

OBSERVATIONS OF ENCKE'S COMET.—Encke's comet was photographed by Mr. Woodgate, with the 13-inch astrographic telescope at the Cape Observatory, on five nights from May 27 to June 5, and the reduced positions, for 1908·0, are published in No. 4266 of the *Astronomische Nachrichten* (p. 297, August 1). The comet is recorded as being very faint, and it is stated that the images are diffused and irregular in form, the diameter exceeding 1′ of arc.

A VARIABLE STAR OF REMARKABLY SHORT PERIOD.—The examination of the Paris *carte du ciel* plates has led M. Baillaud to the discovery of another variable star of which the period of light-variation is a remarkably short one. The star in question is situated in the position (1900) R.A.=14h. 41m. 31·80s., $\delta = +23° 43' 59''·7$, and its range of variation is between magnitudes 12·8 and 14·3. The change from minimum to maximum takes about 0·070d., or 1h. 41m., and the complete period is either 7h. 54m. 26s. or 11h. 51m. 43s. The star is of the δ Cephei type, and there is a suspicion of a secondary maximum 1h. 40m. after the principal maximum (*Comptes rendus*, No. 4, p. 230, July 27).

ECONOMIC GEOLOGY IN THE UNITED STATES.

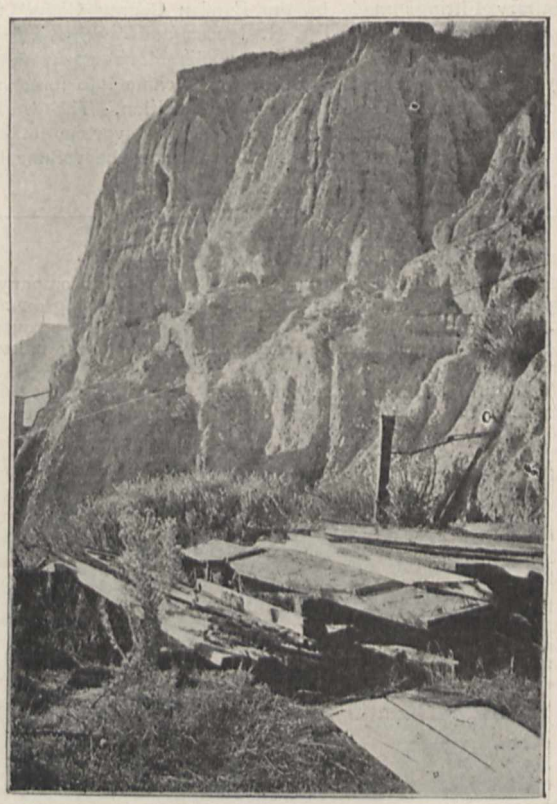
A MASS of official publications received from the United States Geological Survey bears striking testimony to the extensive and admirable work which is being carried on by that body for the direct advancement of mining interests throughout the country. During the year ending June 30, 1907, the sum of 308,404*l.* was appropriated for the survey, and a large proportion of that amount was devoted to investigations of an economic character. The Bulletins published are admirably edited and copiously illustrated with plates and geological maps. The most valuable of the series is Bulletin No. 316, dealing with contributions to economic geology bearing upon coal, lignite, and peat. Special investigations were made to determine the extent of the coal lands remaining in the possession of the Government, and the quality and value of the coal deposits on these public lands. The survey has been giving more and more attention to the subject of coal, both as regards its geological relations and its technology. The brief reports contained in the Bulletin, the object of which is to secure prompt publication of the economic results of the investigations of the survey, have been edited by Mr. M. R. Campbell, and deal with work in the coal-fields of Pennsylvania, Kentucky, Virginia, Alabama, Illinois, Arkansas, Montana, Wyoming, Colorado, Utah, New Mexico, and California.

The technological work of the survey on fuels was started at the St. Louis Exhibition in 1904, and has since then been extended in scope. Much of the work of the branch has been the testing of waggon-load samples of coal under the direction of Mr. J. S. Burrows, who contributes a valuable paper on the importance of uniform and systematic coal-mine sampling. One of the most important results of these tests is the demonstration that producer gas for power purposes can be made successfully from all grades of bituminous coal, lignite, and even peat. The results of these tests, which are discussed in a paper by Prof. R. L. Fernald on the present status of the producer-gas power plant in the United States, point conclusively to the substitution of producer-gas plants and gas engines for the generation of power in place of the wasteful steam engine now in general use. Another field of investigation which promises to have a distinct bearing upon the better utilisation of American coal is that of briquetting, and the present condition of the briquetting industry is summarised in a paper contributed by Mr. E. W. Parker.

In addition to No. 316, we have received six other Bulletins dealing with coal. The Arkansas coalfield is described in detail by Mr. A. J. Collier (Bulletin No. 326), who shows that its structure is more complex, and the areas of workable coal more limited, than the results of previous surveys would indicate. The coals are, however, of a quality not to be found elsewhere in the United States west of West Virginia. In Bulletin No. 325 Mr. L. P. Breckenridge gives the results of a study of four hundred steaming tests made at St. Louis. Mr. D. T. Randall submits a preliminary report (Bulletin No. 334) on the burning of coal without smoke in boiler plants. Washing and coking tests of coal and cupola tests of coke, made at St. Louis, are described by Messrs. R. Moldenke, A. W. Belden, and G. R. Delamater (Bulletin No. 336). A study of the numerous tables given indicates many important facts as to the behaviour and treatment of the coals mined in the various portions of the United States when prepared as metallurgical coke.

Bulletin No. 333 is a preliminary statistical report on the causes and prevention of coal-mine accidents, by Mr. Clarence Hall and Mr. W. O. Snelling. The matter was taken up in consequence of the transference of the general supervision of the work of the coal-mine inspectors in New Mexico and Indian territory to the Geological Survey on June 10, 1907. The figures given in the report are most depressing. During 1906 nearly 7000 men were killed or injured in the coal mines of the United States, and the number of accidents caused by explosions has been steadily increasing. Experience in deeper and more dangerous mines in other countries indicates that these mine accidents might be reduced to one-third their present number. In Bulletin No. 339 Mr. D. T. Randall discusses the purchase of coal under Government and commercial specifications on the basis of its heating value, and gives analyses of coal delivered under Government contracts. The necessity for a more uniform standard in the purchase of coal is apparent, and there is much to be said in favour of the plan of buying it on the basis of its heating value, a plan already adopted by several Government departments and by many large commercial consumers.

The petroleum resources of the United States have received careful attention from the survey. The growth of the consumption of fuel oil in California has led to the publication of reports on the Santa Clara Valley, Puente Hills, and Los Angeles oil districts by Mr. G. H. Eldridge and Mr. R. Arnold (Bulletin No. 309); on the geology and oil resources of the Summerland district, Santa Barbara County, by Mr. R. Arnold (Bulletin No. 321); and on the geology and oil resources of the Santa Maria oil district in the same county, by Mr. R. Arnold and Mr. R. Anderson (Bulletin No. 322). The region near the Pacific coast in Santa Barbara County has shown promise



Unconformity near North Star Wharf, looking West. Pleistocene deposits resting on nearly vertical oil-bearing Fernando sandstone and conglomerate.

of becoming one of the most productive oilfields of the West, if not of the whole United States, and the geological investigations recorded in these Bulletins cannot fail to aid in the extension of developments. The character of the country is indicated by the accompanying view showing unconformity near North Star Wharf, in the Summerland area. The Pleistocene deposits are seen to be resting on nearly vertical oil-bearing sandstone and conglomerate.

The mineral resources of Alaska are investigated by a distinct division of the survey. The geography, geology, and mineral resources of the area north-east of the head of Cook Inlet have been studied by Mr. S. Paige and Mr. A. Knopf, whose results are given in a report on the Matanuska and Talkeetna basins (Bulletin No. 327). The territory mapped covers an area of 7000 square miles. The principal resource of the region thus far developed is coal. As a portion of the coal is of high grade, com-

paring favourably with Pennsylvania bituminous coal, and as anthracite is also met with, the investigation was directed to determining the boundaries of the various coal-fields and to ascertaining the ages of the various coal horizons. The occurrence of gold- and copper-bearing rocks is also recorded.

The investigations of structural materials begun in 1905 has been continued, and a valuable report on Portland cement, mortar, and their constituent materials has been drawn up by Mr. R. L. Humphrey and Mr. W. Jordan (Bulletin No. 331).

The work of the survey includes investigations of underground water, and in order to furnish trustworthy information on general principles, Mr. M. L. Fuller has drawn up a very instructive summary of the controlling factors of artesian flows (Bulletin No. 319). The term "artesian" is applied in the sense adopted by the survey, namely, to designate the hydrostatic principle by which confined waters tend to rise in virtue of the pressure of the overlying water-column, whether or not this pressure is sufficient to lift the water to the surface and to produce a flow.

Lastly, there is the work of the mining division of the survey. The outcome of the work, a volume of 1307 pages, contains the report on the mineral resources of the United States for 1906. Much of the information given has already been published as advance chapters. Suffice it to say that the year 1906 was by far the most prosperous ever known in the mining industry of the United States. The total value of mineral products amounted to 380,000,000*l*., an increase of more than 15 per cent. over the value of the output in 1905. Compared with the previous volume of the series, noticed in NATURE (vol. lxxvi., p. 257), several changes are apparent. The smaller type, which was tiring to read, has been abandoned, and several new names appear as the authors of the various chapters. This is in pursuance of the policy of the new director of the survey of assigning all subjects to members of the survey who are employed solely in the Government service. This has doubtless been conducive to economy, but there is the loss of the authority given to the reports by the signatures of such experts of world-wide reputation as Mr. James M. Swank, Mr. Charles Kirchhoff, Mr. John Birkinbine, and Dr. George F. Kunz. The annual reports of the last-named authority on precious stones were works of originality and of great literary charm, whilst the report on precious stones in the present volume is an arid catalogue of facts. The reports on gold, silver, and quicksilver are more successful, the technical knowledge of the authors as mining geologists serving as compensation for their lack of experience in statistical work.

The reports reviewed in this article cover 2239 pages. It has, therefore, obviously been impossible in the space available to do more than indicate briefly the nature of their contents in order to induce those interested in the various branches of economic geology dealt with to peruse the original reports, which will well repay careful study.

THE SYNCHRONISATION OF CLOCKS.[1]

THE hon. secretary of the British Science Guild has sent us a copy of a report on the synchronisation of clocks which has been adopted by the executive committee, and is here reprinted. Steps are being taken to carry out the recommendations contained in the report.

The committee wish, in the first place, to direct prominent attention to the fact that a very large amount of most excellent work in the matter before the committee has already been done by the General Post Office in disseminating standard time in London and large provincial towns, and also to outlying districts in Great Britain, though in the latter case the arrangements, perhaps, are not quite so perfect as in the large towns.

They also wish to state that private companies, like the Standard Time Company, Ltd., are doing excellent work in the same direction in London and its neighbourhood. They are, however, of opinion that much more has still to be done before London and other parts of the country can be said to be in a satisfactory condition as regards the time shown by its public clocks, and they consider the time has come when public action is urgently demanded.

Greenwich mean time is of course recognised as the standard time for the whole of Great Britain, and this time emanates from the mean solar clock at the Greenwich Observatory.

The problem, therefore, is solely how to make this time available throughout the country in the widest and easiest manner possible, and at the lowest possible cost to the State or public, and also so as not to interfere in the slightest degree with any telegraphic or telephonic services at present in use.

The present arrangements as to the dissemination of this time in London and elsewhere may, perhaps, be described with sufficient accuracy as follows:—

Greenwich mean time signals are transmitted at the sixtieth second of each sixtieth minute day and night to the General Post Office, London, and daily at 10 a.m. to every telegraph office in the kingdom, when the signal then sent from the mean solar clock at Greenwich Observatory is received at the Central Telegraph Office in London upon apparatus which is known as the chronopher, the function of which is to distribute automatically the signal to the larger provincial telegraph centres.

By means of a clockwork arrangement, electrically controlled by a regulator clock, the telegraph lines are disconnected from their respective telegraph instruments and are joined to the relays of the chronopher at two minutes before ten, in readiness for the signal from Greenwich. The time current passes exactly at ten o'clock, and the normal connections are restored by the clockwork at two minutes past ten.

From the large centres the word "ten" is signalled to all the small towns and villages.

In London "nine" is signalled to all London offices connected to what is known as the "main inter-communication switch" in the Central Telegraph Office, and an hour later, when the "chronopher" signals "ten" o'clock time to provincial offices, "ten" is also signalled to the remainder of the London telegraph offices.

From the Post Office the public may in London, by arrangement and by paying a certain annual sum, obtain the hourly Greenwich mean time signals.

In other cases, one or other of two daily signals, at ten o'clock and at one, can be sent to places in the provinces, but the number of private subscribers for such signals is relatively small.

At present the signals from Greenwich sent *via* the Post Office only give the indications of the exact time by sounding bells or deflecting needles, and are not generally utilised to influence individual clocks or to control them, it being left to the individuals in charge of such clocks to make use of these signals, and to set their clocks accordingly.

It is at this point that much is to be desired in the present arrangements, for there is no doubt that many clocks are not as accurately set as they should be.

In addition, these time signals are communicated, amongst others, to private companies like the one previously referred to, and this company, or similar companies, make it their business automatically to re-distribute them to their subscribers in such a way that the electrical signals actually set the clocks of the subscribers to the correct standard time at the moment of each signal.

It would appear, therefore, that there is no general system by which the public is provided with the means of getting exact standard time, such as would be the case if there were an arrangement by which time balls in prominent positions could be electrically dropped, or time guns fired at any fixed hour. In the case of London, the area to be covered would prohibit any such treatment of the case.

The committee are strongly of opinion, and think it highly desirable and important, that arrangements should be made so that a number of public clocks in different districts of London and in other large towns, and perhaps the clock at a telegraph office in smaller towns and villages, should at certain hours be *automatically* corrected to agree with the true standard or Greenwich mean time, and that these clocks should be known as standard clocks, and be thus marked or labelled.

[1] Report of a Committee of the British Science Guild on the subject of the synchronisation of clocks in London, and in other parts of Great Britain.

The committee examined the point as to whether even the best of clocks could be depended on always to show true standard time, and, after full discussion, decided unanimously in favour of some form of control of public clocks by electric synchronisation by signals from the central time authority, and decided that the control and correction of such public clocks by hand is quite out of date and untrustworthy, and should be abolished.

The committee are given to understand that arrangements exist by which, given an electrical signal at certain specified hour or hours of the day, the hands of a clock can be automatically set to indicate the absolutely correct time, and they also understand that such arrangements can be applied to existing clocks at a very small cost.

The committee are informed that there are several distinct methods of synchronising public and other clocks.

In one, used in connection with large clocks, a slight gaining rate of the pendulum is compensated by arresting the clockwork, by means of the time signals, for the number of seconds or parts of seconds gained since the previous synchronisation.

In another method, applied to smaller clocks, the hands are mechanically set forward or backwards to standard time by an electromagnet, excited by the time signals.

It would not be difficult to provide for clocks automatically to come into circuit on telephone and private wires at stated intervals, in order that the time currents might affect the electrical controlling devices of both types referred to above, if this were thought advisable.

The utilisation of telephone and private wires used for correspondence for the synchronisation of clocks would naturally involve the suspension of their use for conversations during the short periods that they would be connected to the electrical controlling devices at the hours at which the time currents were due.

The system involves, therefore, first of all, a system of wiring for the electric signal; and, secondly, the necessary apparatus in each clock. The cost will evidently depend on the charge for the signals, the charge for the use of the wires and of the apparatus in the clocks. The first and last will be small, and the second will depend on the rate per mile charged for the use of wires.

It is obvious that as such a system for communicating electric signals already exists in the telegraphic and telephonic wires belonging to the Post Office, it would be quite unnecessary to set up an independent system of wiring for the time signals. If this is accepted, and if the synchronisation of public clocks becomes general, it is obvious that such signals must not be sent too often, and that they must be sent at a time when such wires are more or less free from the ordinary traffic. It would appear to the committee that for most purposes a single automatic signal once a day, at some convenient time of the night, perhaps at 2 a.m. or 3 a.m., would be enough, but if greater accuracy were desired more frequent signals could be made. If found necessary, signals might even be sent twice or three times a day to synchronise clocks, such as at 8 a.m. and 8 p.m., or, in addition, at 2 p.m., when in the early morning and evening the wires would certainly not be overburdened with work, but such details could be considered later on.

The question of the public or private distribution of such signals was briefly discussed, and the committee considered that any recommendation on this subject would be out of place, but they would merely point out that the initial signals giving true time must come from a public source, *i.e.* Greenwich Observatory, and there is little doubt such signals must be mainly transmitted by the wires of the General Post Office, though perhaps it is an open question whether the apparatus in the clocks themselves for utilising such signals should be a public enterprise or be done privately.

As a beginning, it would probably be well to take a few large public clocks in London and have them synchronised, and these could then be set apart and considered as "standard time clocks."

The nearest approach to a standard time public clock in London at present is probably that in the Clock Tower at Westminster. From the report of the Royal Observatory, Greenwich, read at the Annual Visitation on June 8, it would appear that the maximum error of "Big Ben" during the preceding year did not exceed three seconds, except on two occasions. This may be accepted as sufficiently accurate for ordinary purposes.

Many other public clocks, on the other hand, constantly show variations, running to minutes, and such clocks clearly should be electrically synchronised as far as possible.

Clocks like that at the General Post Office in St. Martin's-le-Grand, at the Royal Exchange, and others in large public buildings should, it is submitted, be *automatically* or *electrically synchronised*, and be considered as "standard time clocks." A few of them might be taken up as a commencement, and synchronised once or twice a day.

As most public clocks have no arrangement for showing seconds, the exact time to seconds cannot be shown on them, but as most public clocks are striking clocks, it might be arranged that the first stroke of the hour bell should be the signal indicating standard time, so that persons could tell the time accurately to a second from such signal.

It remains, therefore, to consider what can be done in the case of London in the first instance.

The following would appear to be the actions necessary to be taken by the Guild:—

(1) To approach the Postmaster-General, to ask that in the case of post offices the time signals sent to the offices should actually automatically set at least one of the clocks in each public office to standard time, and not merely indicate standard time and depend upon subsequent hand correction of the clocks, as at present.

(2) To form a deputation to the L.C.C. to ask them to have all public clocks under them, or in any way under their influence, synchronised in the same way.

(3) To take similar action with reference to the clocks under the control of the Corporation of London.

(4) To take similar action with reference to the clocks at railway stations in London.

(5) To take similar action with reference to the Office of Works, which it is believed is responsible generally for the clocks in Government departments, some of which exhibit large clocks, and which, therefore, should be synchronised.

(6) To ask the Local Government Board to take the necessary steps to secure the passing of a bye-law calling upon persons exhibiting clocks publicly to have such clocks synchronised, or, failing this, for such clocks to be done away with.

Similar action could be taken later on for provincial towns, and afterwards for smaller centres in Great Britain.

EDUCATION AT THE FRANCO-BRITISH EXHIBITION.

UNDER the chairmanship of Sir William Mather, the committee of the Education Section of the Franco-British Exhibition undertook to exhibit to the British public and our French visitors the principles and methods of our national education in all its branches and phases. So formidable a task has not been attempted heretofore in this country, and a very large amount of well-directed labour must have been spent in achieving such a great measure of success. We shall have occasion to point out certain respects in which the results fall short of the ideal; but the more closely one investigates the exhibits, the more one marvels at the thoroughness with which the display has been organised. The nearest approach from the Wood Lane entrance is through the hall of textile and chemical products, whence we enter the west end of the building (300 ft. × 200 ft.) devoted to British and Irish education. The chief decoration is a series of pleasing frescoes forming a deep frieze along three sides of the hall. These depict in allegorical form the virtues which schools seek to develop, and all have been designed by students of the Royal College of Art. We may mention that all the exhibits—with the exception of statistics and a few other administrative matters—are the work of children, students, and teachers, from the infant school to the University or technical college. The west wall is occupied by colossal maps showing the exact position of every public educational institution in the British Isles, with panels of statistics.

It appears that there is no class of the people in any district without facilities for education, but it must be admitted that the quality of these facilities is not everywhere such as to leave no scope for the reformer's zeal. Perhaps Ireland illustrates most clearly the progress made in the last decade. Prior to 1899 there was little technical education in Ireland, and in 1900 there were not more than half-a-dozen laboratories in the secondary schools. Now there are 280 laboratories, and 15,000 students are to-day being taught experimental science. There are but few secondary schools where such teaching has not been introduced. In addition, there are under the Department of Agriculture and Technical Instruction 45,000 students, and visitors will hardly fail to notice the specimens of their work which are on view; the Arts and Crafts Section being of considerable intrinsic merit.

Starting from the west and working towards the east end of the hall one passes from kindergarten to university. In valuing the work, especially of the young children and of the boys and girls of our elementary and secondary as distinct from technical schools, we must not lose sight of the true aim of the educator. Our judgment should be based, not on the intrinsic value or the "finish" of the exhibits, but on the extent to which their production is calculated to aid disciplined development of character, mind, and physique. From our increased expenditure on education we may look for more than improved school-attendance. We ought to find in this exhibition signs that a balanced and harmonious growth of all faculties is being encouraged by normal school-courses, apart from educational fads.

Elementary Schools.—During the last few years the improvement in infants' schools has been very great. To appreciate rightly the work of their highly competent teachers, one ought not to be content with examining the schemes of work, models, and drawings to be seen in the exhibition hall, although these bear witness to enthusiastic work. One ought also to visit an infants' school, see the conditions of work, and obtain personal experience of the skill with which modern teachers deal with the difficult task of setting drafts of babies to happy, intelligence-forming work and play. The work of elementary, higher elementary, and higher grade schools is very well displayed. We select the exhibits of the London County Council and the City of Manchester as furnishing an index to such work. We find:—(1) *Albums* which contain schemes of work, time-tables, photographs, and specimens of work; (2) *mounted illustrations* of syllabuses in drawing, science, needlework, domestic economy, wood-work, physical exercises, nature-study, geography; (3) *class-worked exercises* connected with the foregoing. The feature which impressed us most was the large share of attention given to drawing, nature-study, physical exercises, and organised games. The development of motor-activities appears to be the guiding principle. Certain of our writers and public speakers who constantly inform us that our methods are too "bookish" are under the mistaken impression that schools of to-day are still in the old grooves. A visit to the British Education Section might make them wiser and happier men. The science, domestic, and art teaching is of the type which calls upon the pupil to take an intelligent share in the work, and to employ his or her inventive powers. Presumably less time is given to reading and spelling in the first stages; but we did not observe any resulting defects in the later work. Rather we think that there is a better power of expression in the higher standards; probably the result of improved general intelligence, stimulated by modern methods. It should be mentioned that the housewifery is quite practical and simple, not *in nubibus*. Moral teaching is given with a straightforward dogmatism suited to the age of the children. The extent to which individual ability and self-reliance are being encouraged in the schools is most creditable when the conditions of work are considered.

In the higher elementary schools the study of physics is encouraged. Geography makes a good show; especially worthy of notice is the geography scheme of Basnett School, Battersea. Modern methods, based on regional survey, have been successfully applied in a district which at first sight appears to offer drawbacks rather than facilities. Despite the fact that history receives more attention than formerly, the utility of charts, pictures, &c., seems underrated. There is little evidence in this exhibition of "the appeal to the eye" in connection with history teaching in elementary schools.

County Organisation.—This is clearly exemplified in the cases of Essex, Warwickshire, and Northamptonshire, which afford good examples of decentralised administration with especial reference to local needs and industries. The combination of counties to permit interchange of teachers and scholars for the purpose of training or to form other centres of higher education is still to a great extent an unfulfilled aspiration. Perhaps the next great exhibition will be able to illustrate useful results from the working of neighbouring authorities in association. The Essex authorities have furnished much useful information as to the cost of salaries, buildings, and school supplies generally.

Public Schools and the older Universities.—The deepest matters of education have to do with "things unseen," and it does not follow that Oxford does less for the nation than a domestic economy or engineering school because the products of the latter institutions bulk more largely at Shepherd's Bush. So far as Oxford and Cambridge are concerned, we must thank those responsible for their interesting display of portraits, relics, and models, and the copious supply of photographs and official publications. Perhaps this was all that could be done; one cannot "allot space" to the spirit of a university. But something more ought to have been done to furnish visitors with a concept of that characteristic institution, an English Public School. At least, the committee ought to have acquired a model of buildings, playing-fields, &c., such as are to be found in the all-round equipment of our public schools, and are not to be found in any other country in the world. (We remember a model of Rossall School which created great interest some seven or eight years ago.) A critical observer will find much worth attention in the portfolios and exercise books. They show the actual everyday work of the boys. The pursuits of their leisure hours are copiously illustrated.

London University and the newer Universities.—Special handbooks are issued by the London University and by the deans of the metropolitan schools of medicine. We do not think that so clear and concise a statement of the multifarious activities of the University had been published hitherto. The illustrated guide to the medical schools is a good-sized volume, full of interest to all concerned in medical education. It is important to observe how the opportunities for clinical study and research are being extended, and that these opportunities are appreciated by large numbers of qualified men. The movement for promoting social intercourse among undergraduates by athletic clubs and halls of residence is gaining ground. Victoria and Sheffield Universities are strongly represented on the technological side. We are interested by a photograph taken at the Mason College, Birmingham, where the lecturer is seen addressing a theatre crowded with working men. There is room for more of this kind of university extension.

Girls' Education.—Nothing is more clearly shown than the strides made in the education of girls, especially in domestic subjects. Neither in the elementary nor in the secondary and high schools is to be found unreasoned imitation of boys' education. The work shown by the Cheltenham Ladies' College and by the Manchester High School is of a high standard, the humanities being well cared for.

Technical Instruction, Fine Arts, Arts and Crafts occupy an important place. The difficult task of selecting really typical work from the technical schools of the country was performed mainly by the Association of Technical Institutions. A display of real educational interest is the result. The growth of organised instruction in the different branches of industrial work is well evidenced by the exhibit of the City and Guilds Institute. The students' work in the fine arts and arts and crafts compares not unfavourably with the corresponding trade exhibits in other halls of the exhibition.

Music.—The weak spot in the exhibition is that the claims of music have not been recognised. The Guild of Church Musicians furnishes the only exhibit we dis-

covered. A hall for demonstrations and lectures has just been erected, and we ventured to suggest that demonstrations of school-music would be welcome.

Special Institutions.—The work that is being done in schools for the blind, the deaf, and the mentally defective calls for respectful acknowledgment. Cases showing what is being accomplished, so far as material products are concerned, can be seen near the entrance. The moral benefit to the pupils cannot be expressed.

It reflects credit on the committee and the secretaries that the whole of this wonderful collection was in place at the opening of the exhibition. The objects are displayed in an admirable manner, and furnish innumerable suggestions of value to the practical teacher.

French Education Exhibit.—Although not large enough to furnish grounds for comparison of French with English organisation of education, the French section contains many interesting features. It is housed in the corridors between Shepherd's Bush and Wood Lane, unfortunately rather distant from the English section. The *Écoles Professionelles, l'Enseignement Technique*, and the *Ecoles Primaires Supérieures* contribute; Lille, Toulon, St. Etienne, Nîmes, Dupuy, and Rouen are represented.

Much of the manual work is excellent, and teachers of chemistry may glean some useful hints from the apparatus and diagrams, which are clearly displayed. There has been an attempt to introduce some really artistic adornment into certain of our own elementary schools; but we still have much to learn in this respect. Our authorities would do well to pay attention to the charming pictures sent by the Société Artistique de l'Art à l'École. Incidentally, we observed that Arabic was included in the curricula of some pupils whose note-books we inspected.

Undoubtedly the space allotted to the French education section is too small, and hence the display falls short of our expectations. We admit that those expectations were high. In justice to the work performed in bringing together the exhibit, we should add that the interesting quality of what we could see considerably strengthened our desire for a fuller display of recent achievements by our neighbours in the field of education.

G. F. DANIELL.

THE ELECTROCHEMISTRY OF LIGHT.

IN the April and May numbers of the *Journal of Physical Chemistry*, Mr. Wilder D. Bancroft contributes two long articles under this heading, long chiefly because of the very extensive quotations from the writings of Grotthuss, Herschel, H. W. Vogel, E. Vogel, Timiriazeff, Acworth, v. Hübl, Bothamley, and others whose work bears upon the subject. The object of the communication is "to bring the various catalytic actions of light under one head so far as possible," and to show that this may be done by accepting two laws enunciated by Grotthuss some ninety years ago:—(1) that only those rays of light which are absorbed can produce chemical action; (2) that the action of a ray of light is analogous to that of a voltaic cell. The action, therefore, is regarded as electrolytic, and sensitisers, whether "optical" or "chemical," are viewed as depolarisers. The fundamental conception of Grotthuss, that the action of light is essentially electrolytic in character, is held to be sound and to accord with modern notions, though the language in which he expressed it may be somewhat obscure.

The author proceeds to show that the decomposition of various salts containing silver, iron, copper, mercury, chromium, uranium, manganese, vanadium, and molybdenum, as the result of light action yields the same products as those resulting from electrolytic action, but that some substances are light-sensitive only in the presence of a suitable depolariser (or absorber of one of the products of the decomposition). Herschel's account of his experiments on the action of light upon iron salts and ferro- and ferricyanides is quoted in full from the Philosophical Transactions. When paper is impregnated with a mixture of potassium ferricyanide and ferric chloride and exposed to light, the ferric chloride is reduced and Turnbull's blue is formed, further exposure giving a brown substance of unknown formula. The author records that since his writing Mr. Schluederberg has succeeded in producing this brown substance by electrolytic means. Herschel's observation that by the continued exposure of a Prussian-blue print to light the colour was bleached, but that the colour returned when the print was left in the dark, and that this reversal took place even when the iron salt was exposed alone and the ferricyanide added afterwards, is explained by the supposition that the light, after it has reduced the iron of the ferric ammonium citrate to the ferrous state, by its prolonged action produces a reducing agent powerful enough to reduce the ferricyanide, the white ferrous ferrocyanide that results being re-oxidised in the dark.

The analogy between the oxidation of organic bodies by the action of light and by electrolysis is not so easy to trace for want of facts. Whether the oxygen (of the air) or the dye is the depolariser must be decided experimentally in each case, and "there is one conclusive way" of answering this question. "If the active light is light which is absorbed by the substance to be oxidised and not by the oxygen, then the substance to be oxidised has been made active by the light and the oxygen is the depolariser. If the active light is absorbed by oxygen and not by the substance to be oxidised, then this latter is the depolariser, and the oxygen is made active by light. If the active light is absorbed by both, it is possible that each is made active and that each is also the depolariser. In this last case, however, the results should be checked by experiments with another oxidising agent and another reducing agent. While light can only act in case it is absorbed, it does not follow that all light which is absorbed acts to any appreciable extent." In the bromination of organic compounds, Schramm and Zakrzewski have shown that the most effective rays correspond to the weaker bromine absorption bands in the yellow-green and orange instead of the stronger bands in the greenish-blue and blue. The researches of Herschel on the action of light on the colouring matter of flowers are explicable by the Grotthuss theory, and Timiriazeff in his Croonian lecture (1903) showed the strict applicability of the law so far as regards the correspondence between the absorption of light and its chemical action in the case of chlorophyll.

In some cases the depolariser changes the sensitiveness of the system with regard to certain rays. These substances are generally distinguished as "optical sensitisers," but, the author says, "a more rational distinction would be between depolarisers with marked absorption bands and depolarisers without marked absorption bands." The discovery of the action of "optical sensitisers" by H. W. Vogel in 1873, that is, the possibility of sensitising photographic plates for the less refrangible rays by means of dyes, and Eder's work that led him to the conclusion that the absorption of silver bromide dyed with eosin and the maximum of the photographic sensitising action of eosin on silver bromide exactly coincide in the spectrum, are detailed by copious extracts from the writings of these investigators. Eder distinguished between the absorption of the dyed silver salt and a dyed gelatin film or aqueous solution of the dye, the former giving an absorption of greater wavelengths, in accordance with Kundt's law. Acworth, who worked under apparently ideal conditions, comparing the maxima of absorption and sensitiveness by estimating them in the same emulsion, found that the sensitiveness maximum was displaced towards the red as compared to the absorption maximum, and Wiedemann accounts for this by suggesting that the light at the place of maximum absorption may cause increased vibration within the molecule, resulting in radiations or heat waves, but without the amplitude of vibration in the molecule attaining a sufficient magnitude to result in any decomposition or chemical change of the molecule. Mr. Bancroft accepts Acworth's experimental results, but considers that his absorption curves show the sum of the absorptions of the dyed gelatin film and the dyed silver bromide, instead of the absorption of the latter alone, and that therefore his results do not disprove Eder's conclusions that the maxima of absorption and photographic effect coincide.

Concerning the mode of action of such sensitisers, he states that the theory of Grotthuss enables us to make a definite statement with regard to them, "and one that differs to a certain extent from any of the previous ones.

A sensitiser must be a depolariser, directly or indirectly. It must be a reducing agent in the broad sense of the term, or it must be changed into one by the action of light. In either case the sensitiser is decomposed by the action of light on the sensitive plate." In support of this position he quotes Bothamley's observation that sensitisers act and a developable image is produced on exposure when the plate is immersed in a powerfully reducing solution, as proving that the dye is not oxidised by exposure as Abney suggested, and shows that the instability of the dye on exposure to light is generally acknowledged as a necessary condition for it to act as a sensitiser. This theory also explains Abney's experiment of exposing a collodion film stained with cyanine to the spectrum, and then coating it with a silver bromide emulsion and developing. The silver bromide was developed to an image over the absorption band of the cyanine, though the silver salt had never been exposed to light.

Among the general conclusions referring to this part of the subject that the author gives in his summing up, the two following have perhaps not been indicated in this abstract, namely:—(1) whether any substance is reduced or oxidised by light depends on the depolariser, and (2) all sensitisers are light sensitive, but the light sensitiveness and sensitising power need not run strictly parallel. Finally, he maintains that the electrochemical theory of light, first proposed by Grotthuss, accounts for all the known facts concerning the action of sensitisers and the action of light upon salts.

In a third chapter (*Journal of Physical Chemistry*, June) Mr. Bancroft deals in a similar way with the action of chlorine and bromine on organic bodies, and the effect of halogen carriers upon the reactions in darkness and in light. He deals with benzene and toluene, and the formation of addition and substitution derivatives, distinguishing in the case of toluene between the replacement of hydrogen in the ring and in the side chain. After summing up the known facts and showing wherein other theories are deficient, he quotes the suggestion of Bruner that chain substitution is due to the bromine molecule and ring substitution to free bromine atoms, the preponderance of ring substitution when the reaction takes place in nitrobenzene as a solvent being "certainly connected with the fact that bromine and a *portion* of the acid of the polybromides is dissociated into ions" in this solvent. Mr. Bancroft agrees with this theory in the main, but carries it further. He assumes that as light of suitable wavelength increases the conductivity of most gases, apparently by forming ions, this dissociation will probably give products (atoms or ions) one half of which will be positive and one half negative—whatever meaning may be attached to these words. If the dissociation products are ions, these words will have their usual meaning. To this assumption he adds four others that are partly new:—(2) That there is a slight reversible reaction between bromine and the positive gaseous ion,

$$Br_2\ Br^+ \rightleftharpoons Br_2 + Br^+.$$

(3) That substitutions take place in the ring when the negative gaseous ions are present in excess; otherwise in the side chain. (4) That the addition products of benzene are to be considered as analogous to the chain substitution products of toluene. (5) That there is a reversible dissociation of the halogen carriers with formation of so-called gaseous halogen ions, and whether these ions are positive or negative depends on the nature of the carrier.

Granting these assumptions, at low temperatures and in the dark, $Br_2.Br^+$ will be formed, and therefore an excess of negative bromine ions and ring substitution. With rising temperature the proportion of positive to negative bromine ions increases, and sunlight will increase the dissociation of bromine and of the $Br_2.Br^+$, until the ratio of positive to negative ions approaches unity, and then side-chain substitution takes place. With reference to the fifth assumption, in chlorides of iron, antimony, molybdenum, and aluminium, there is no doubt that chlorine is the negative radical. In iodine monochloride, phosphorus pentachloride, and sulphur chloride, there is evidence of a tendency to form positive gaseous chlorine ions. The author remarks that "it would strengthen the argument if it were possible to show why negative chlorine substitutes in the ring and positive chlorine in the side chain, but I do not see any explanation which can be carried through." A weak point in the argument is the behaviour of aluminium chloride, which Goldschmidt and Larsen have found to behave exactly like stannic chloride as a carrier, although no lower chloride of aluminium is known. But, on the other hand, Turrentine has found evidence of its existence by the electrolysis of a chloride solution using an aluminium anode, though the aluminous salt has not been isolated. C. J.

BAROMETRIC GRADIENT AND WIND FORCE.[1]

THE relation between the wind and the pressure distribution is a fundamental question of dynamical meteorology. In qualitative form it is expressed by Buys Ballot's well-known law that in the northern hemisphere an observer standing with his back to the wind has the region of lowest pressure on his left. The idea of a quantitative relation between gradient and wind has been made familiar to meteorologists by the classic researches of Guldberg and Mohn. It must, however, be admitted that a comparison of the wind velocity calculated from the pressure gradient by the method given by these authors with anemometer readings has not given entirely satisfactory results. The discrepancies are generally attributed to surface friction, but this quantity has not proved amenable to theoretical treatment, a difficulty which seems to have barred the way for further progress along these lines.

We should expect the effects of surface friction to decrease rapidly with altitude, so that the results of kite and balloon ascents should yield a more suitable material for a comparison of theory and observation than the observations at ground level do. In the report before us, Mr. Gold has used the data accumulated by the Prussian Aëronautical Observatory for such a comparison. From the distribution of pressure he has computed the gradient velocity over Berlin by the formula given by Guldberg and Mohn for each day of the year 1905, and has set beside it the observed direction and velocity of the wind at 1000 metres and 2000 metres above sea-level. The agreement at 1000 metres is surprisingly close. In the preface Dr. W. N. Shaw says of it:—"The general result of the investigation is, in my opinion, to confirm the suggestion that the adjustment of wind velocity to gradient is an automatic process which may be looked upon as a primary meteorological law, the results of which are more and more apparent as the conditions are more and more free from disturbing causes, mechanical or meteorological."

Cases of discrepancy between observed and calculated values may thus be regarded as exceptional, and their special investigation promises an interesting field for research. The observations of wind made at the surface may perhaps also be utilised in this manner if, as Mr. Gold suggests, we prepare a series of coefficients, applicable to the individual stations, which will enable us to allow for the disturbing effects of surface friction.

For work on these lines a simple means of calculating gradient velocities from pressure distribution is required, and a considerable section of the report is accordingly devoted to providing it. Tables have been constructed showing the gradient velocities corresponding with different distances between consecutive isobars on charts of certain specified scales in different latitudes, or, if we prefer it, we have in the frontispiece a convenient scale for reading off the values from the map of the daily weather report or the working chart of the Meteorological Office.

The tables and scale give the gradient velocity on the assumption that the isobars are straight, *i.e.* that the path of the wind is a straight line. If this condition is not fulfilled, a simple correction has to be applied from a second set of tables (or scale of concentric circles) to allow for the curvature of the path of the wind.

There is one point of principle which requires to be mentioned in this connection. In applying the correction,

[1] Report to the Director of the Meteorological Office on the Calculation of Wind Velocity from Pressure Distribution and on the Variation of the Meteorological Elements with Altitude. By Ernest Gold. (London Wyman and Sons, for H.M. Stationery Office. Price 2s. 6d.

it is assumed that the curvature of the isobars is identical with the curvature of the path. This is only true in the special case when the pressure distribution remains constant. If the curvature is small or the pressure distribution is changing rapidly, the difference between the curvature of the isobars and that of the path may be considerable, and the gradient velocity obtained by assuming them identical may be considerably in error. Unfortunately, the determination of the wind path is impossible under these special conditions, and the method of determining the gradient velocity then becomes untrustworthy. Mr. Gold optimistically extricates himself from the difficulty by suggesting a method for determining the motion of the centre of curvature from the difference between the observed velocities and the velocities calculated from the curvature of the isobars and the distance between them.

Two theoretical results arrived at by Mr. Gold are of special interest. He has calculated the time required for air, starting from rest, to acquire the gradient velocity and to adjust its motion to the direction of the isobars. The values found for latitude 50° vary between 4 hours and 16 hours for different conditions of motion, and are thus small compared with an interval such as the day. On another page he gives us an interesting counterpart to the well-known fact that strong winds and steep gradients do not occur near the centres of anticyclones. From the opposition of the accelerations due respectively to the earth's rotation and the curvature of the path, he shows that there must be a limiting velocity and a limiting gradient for anticyclonic areas, if it be granted that the motion of the air adjusts itself to the gradient velocity.

The concluding pages of the report are devoted to a graphic summary of the variation of the different elements with height, as disclosed by the ascents carried out on behalf of the Meteorological Office by Mr. Dines at Oxshott in 1906, and by ascents made at Lindenberg, Berlin, and Blue Hill Observatory, U.S.A.

There is one point to which we should like to refer before concluding. Nobody can take up a paper like the present one, which deals so largely with providing the tools for future research, without being forcibly struck by the disadvantages of our English system of units, at any rate for the purposes of dynamical meteorology. Mr. Gold invites us to measure the distance between isobars for intervals of a tenth of an inch in millimetres. The gradient velocity he gives us in metres per second, and provides a subsidiary table for converting these to miles per hour, the units adopted for wind velocity in all English meteorological publications, even in those specially devoted to the investigation of the upper air. He apologises for the incongruity in a special note, and explains it on the score of convenience. Should our would-be investigator require to chart his results, our map-makers will probably offer him outline maps on a scale of miles to the inch, and a further troublesome reduction will be necessary before he can apply Mr. Gold's tables. We note with pleasure that the maps used by the Meteorological Office for its working charts and daily weather reports are on a scale which is closely related to the natural scale $1:10^7$. We wonder whether other offices use similar scales. The advantage of uniformity in such matters is forcibly brought home by a report such as the one we have described.

THE WORK OF THE PHYSIKALISCH-TECHNISCHE REICHSANSTALT IN 1907.

THE work accomplished by the Reichsanstalt last year, as shown by the annual report of that institution recently issued, appears to be of a character useful both to physicists and to the industries which seek its assistance in elucidating various technical problems.

As regards the physical side of the work, the following researches may be mentioned:—

In accordance with a commission received by the institution, tests were started on the exact measurement of very small pressures (of the order of between 10^{-6} and 10^{-3} mm.), the pressures being determined from the deflection of a metallic membrane of 25 cm. diameter by means of the Fizeau interference method. The absolute velocity of sound in dry air (free from carbonic acid) has been investigated and found to be 33192 ± 5 cm. per second. Dr. Scheel has tested some further materials for expansion between −191° and +16° C. with the Fizeau dilatometer described in the previous year's report, and has obtained results varying from 2120 microns per metre for palladium to −41 microns per metre for quartz glass. Scheel and Schmidt have obtained a much lower value for the refractive index of helium than that found previously by Lord Rayleigh and by Ramsay and Travers, the figures of the former being 1·0000340. Some useful work has been done in regard to the specific heat of nitrogen, CO_2 and water-vapour, up to 1400° C., and experiments to determine the saturation-pressure of water-vapour above 100° C. have been commenced.

In the Electrical Standards Department the variations in manganin resistances have been found to be very slight and the "humidity effect" only just perceptible. Resistance coils are now being wound on metallic spools with longitudinal slots to render them somewhat flexible; in this way it is hoped to make any effect due to humidity practically negligible. Measurements of the wave-length of electric oscillations can be made with an accuracy within 1 part in 1000 for long waves (above 1000 metres), and for shorter wave-lengths the accuracy is within 1 per cent. Other experiments have been made with undamped electric oscillations produced after the Poulsen method by means of an arc burning in oxygen. A research of importance to opticians was carried out in regard to the secular variation of the planeness of surfaces of optical glasses, results being given in the report.

In addition to the researches mentioned, a number of routine tests were carried out in the various departments of the Reichsanstalt, some of these yielding interesting results from a commercial standpoint.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

MANCHESTER.—Dr. J. E. Petavel, F.R.S., has been elected professor of engineering and director of the Whitworth laboratories. The following additional appointments have recently been made:—Mr. T. G. B. Osbern, as lecturer in economic botany; Mr. C. H. Lander, lecturer in engineering drawing; and Dr. F. H. J. A. Lamb, senior demonstrator in physiology. Dr. Hans Geiger has been re-appointed to the Harling research fellowship in physics, and Dr. Harry Osborne has been re-appointed a junior research fellow in public health.

THE Department of Agriculture and Technical Instruction for Ireland has issued a circular to committees of management of schools dealing with the question of the liability of school managers and teachers in cases of accidents to pupils in attendance at their schools. In a recent action at law, damages were recovered from a teacher on account of injuries received by one of his pupils in consequence of a dangerous substance, used for scientific experiments, having been left carelessly in the way of his pupils. The department has been advised that teachers may be held accountable for the accidents which may occur as a result of allowing dangerous substances to be within the reach of children so young as to be likely to deal with them in a manner causing injury, or for injuries which may ensue as a result of negligence in allowing these pupils to perform dangerous experiments without providing reasonable safeguards against accident. The object of the circular is to make teachers aware of their responsibility so that all precautions may be taken to guard against accidents to their pupils. Fortunately, it is easily possible to devise suitable school courses of elementary science, including no experiments of a dangerous character, and it may be hoped that this timely warning may interfere in no way with the suitable study of science by boys and girls.

AN address on the teaching of the sciences and the formation of the scientific spirit was given by Prof. Paul Appell, president of the French Association for the Advance-

ment of Science, at the meeting held last week at Clermont Ferrand. From a summary given by the Paris correspondent of the *Times*, we learn that Prof. Appell defines the man of science, not as "the man who knows," but as a man who "combines with his knowledge scientific activity, that is to say, a curiosity always alert, indefatigable patience, and, above all, initiative and again initiative." French instruction, he pointed out, was not generally calculated to develop the latter. The examination system was a trial of memory, not of real knowledge, observation, and experience. The evil extends from the primary schools to the upper special schools, and nothing is more necessary than to begin to oppose this tendency. Prof. Appell's solution would be to utilise universities for scientific education and to substitute for the technical schools, which are now virtually closed to many temperaments that might develop scientific capacities—even a Claude Bernard failed to pass his examination for the medical faculty—open schools in which the selection would take place from among the pupils according to the results of their work for the entire year. He would substitute for the two or three years now passed in the Lycée to prepare for the entrance into the upper special schools a course of scientific training immediately after the close of secondary studies. Prof. Appell developed an elaborate system of re-organisation of the universities involving a complete change in the curriculum of the Sorbonne and in the administration of the Museum of Natural History. He would not, however, in any way alter the character of the Collége de France.

THE Board of Education has issued (Cd. 4184) regulations for the training of teachers for secondary schools. Funds have long been available for the purpose of assisting the training of elementary-school teachers, but there has hitherto been little official recognition of the necessity of making some systematic provision for the professional training of men and women intending to teach in secondary schools. Now, however, a Parliamentary grant of 5000*l.* has been made available from the Exchequer for this purpose, and the regulations under which the fund will be dispensed are of great interest. The Board has decided that the course of training must be taken after graduation or its equivalent, and be confined to purely professional work. It is to be an indispensable condition for recognition as an efficient training college that there shall be access for the students, under proper conditions, to secondary schools which are thoroughly suitable for demonstration and practice, and not less than one-half of the staff must have been successful teachers for a reasonable time in secondary schools. Grants will be paid to colleges, in which the number of recognised students is not less than ten, at the rate of 100*l.* in respect of every complete group of five recognised students, subject to the condition that the grant does not exceed one-half of the total sum paid for salaries on account of services in training the students. It is satisfactory to find so complete an appreciation of the imperative need that the staff responsible for the training of secondary-school teachers must possess high academic qualifications, and be, in addition, experienced and successful teachers. There has been in the past an uneasy feeling that much of the training available for secondary-school teachers was divorced too completely from schoolroom practice and over much concerned with theoretical and historical matters, and these regulations of the Board of Education will serve to inspire greater confidence in the value of the training provided in assisted colleges.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, May 28.—"On the Theory of Capillarity." By Dr. E. T. **Whittaker**, F.R.S.

The fundamental quantities in the theory of capillary phenomena are the *surface-tension* γ (expressed, say, in dynes per centimetre), and the *surface-energy* λ (expressed in ergs per square centimetre). The relation between these two quantities is at once given by the thermodynamic equation connecting available energy with total energy; it is therefore

$$\gamma = \lambda + T\frac{d\gamma}{dT}, \quad . \quad . \quad . \quad . \quad . \quad . \quad (1)$$

where T denotes absolute temperature.

This equation implies that when the area of a surface of separation is increased by 1 cm.^{2} at temperature T, the external agencies do work amounting to γ ergs against the surface-tension: and this energy, together with a further contribution of $-Td\gamma/dT$ ergs which is appropriated from the heat-energy of neighbouring bodies, becomes resident in the film, giving rise to an increase of λ ergs in its internal energy.

The relation between the surface-tension and surface-energy is, of course, exactly the same as the relation between the electromotive force of a voltaic cell and the energy of the chemical reactions which occur in the cell.

The author has deduced the values of λ which correspond to Ramsay and Shield's experimental values for γ, and shows that they satisfy a relation which may be stated as follows:—*The surface-energy* λ *of a liquid in contact with its own vapour at any temperature is proportional to the product of the internal latent heat and the* (*absolute*) *temperature.*

The internal latent heat is intimately connected with Laplace's "intrinsic pressure" K of a liquid, and so with the classical theory of capillary phenomena.

PARIS.

Academy of Sciences, August 3.—M. Bouquet de la Grye in the chair.—A problem relating to the theory of orthogonal systems and the method of the mobile trihedron: Gaston **Darboux**.—Contribution to the dynamical study of motors: A. **Witz**. If, when the motor has arrived at a state of steady motion, the motive power is instantaneously cut off, the moving parts make a certain number of revolutions with a decreasing velocity. From a study of this decreasing velocity important conclusions concerning the effects of friction can be obtained. The application of this method to a gas engine, working a dynamo, gave an efficiency of 79 per cent., as against 78·4 per cent. obtained by using the dynamo as the motor. For smaller gas engines the results were less satisfactory.—The families of Lamé composed of equal surfaces: J. **Haag**.—The tendency of material systems to escape friction: Georges **Rémoundos**.—Detectors for use in wireless telegraphy with points of tellurium and tellurides: Édouard **Branly**. The tripod detectors with points of tellurium or tellurides acting on polished steel belong to the group of radio-conductors working by variations of resistance, and require an external electromotive force for their working. The thermoelectric detectors of M. Tissot belong to a different class.—The conditions and duration of the auto-excitation of dynamos: M. **Swyngedauw**.—The electric arc between a solid electrode and a liquid: G. **Athanasiadis**. Duddell's experiment may succeed when the arc is produced between a liquid anode and a solid kathode. The arc formed between an electrolyte and a solid electrode as the kathode may be produced even with an immersion of 7 cm. or more, the difference of potential being 220 volts, and in certain cases this arc may give rise to the effects of the Wehnelt interrupter, although with reduced intensity. It is impossible to produce an arc between a solid anode and an electrolyte even with a voltage of 220 volts.—The quantitative indications furnished by dissociation spectra: silver: A. **de Gramont**. The number and intensity of the silver lines, obtained in the dissociation spectra of mineral conductors, bear a direct and constant relation with the proportion of the metals in the specimens. Details are given of the lines for various minerals and alloys containing from 1 per cent. to 0·0001 per cent. of silver, and application is made of the method to the study of argentiferous galena.—A new method of preparing pure hydrogen: M. **Mauricheau-Beaupré**. Aluminium foil is treated with a small quantity of mercuric chloride and powdered potassium cyanide. In contact with water this material gives 1300 c.c. of pure hydrogen per gram. Advantages are claimed for this material in aëronautics.—The realisation *in vivo* and *in vitro* of precipitins for ovalbumen: André **Mayer** and Georges **Schæffer**.

A precipitin has been obtained for ovalbumen by injecting certain fatty acids or their esters in the rabbit; this material possesses all the properties of that obtained by injecting the rabbit with ovalbumen.—The maturation of the egg and cytodiæresis of the blastomers of *Paravortex candii*: Paul **Hallez.**—Composition of the strata transported from the Peloponnesus to Mt. Ithoma: P. **Négris.**—The first twilight of the morning and the second evening twilight: E. **Durand-Gréville.** This phenomenon appears to be general, and is not peculiar to mountain districts, and hence an explanation cannot be sought in the cooling of the air in the mountain valleys.

NEW SOUTH WALES.

Linnean Society, June 24.—Mr. A. H. S. Lucas, president, in the chair.—A catalogue of the Hemiptera of Fiji: G. W. **Kirkaldy.** The previous total of Fijian Hemiptera was about forty. This is brought up to 202 (of which seven have not been specifically determined), including the representatives of ten genera, one subgenus, and forty-two species described as new. But the endemic forms were scarcely yet collected, as only three islands had been searched for Hemiptera, viz. Viti Levu, the largest island and the seat of the present capital; Ovalau, a small island, the former seat of government; and Taviuni, an island to the east of Vanua Levu. The whole archipelago must be exceedingly rich in Hemiptera, and probably less than a tenth of the total of that fauna is known.—Revision of the genus Seirotrana (Coleoptera: fam. Tenebrionidæ), together with descriptions of new species of other Australian Coleoptera: H. J. **Carter.**—The new genus Austrogynacantha (Neuroptera: Odonata): R. J. **Tillyard.**

CALCUTTA.

Asiatic Society of Bengal, July 1.—Proposals for a standard temperature for use in tropical countries: Paul **Brühl.** Specific gravity and other tables constructed for normal temperatures of 62° F. or 15° or 20° C. do not, as a rule, serve the purposes of the chemist and physicist who work in the tropics, and the spread of science in tropical countries will render the choice of one or two standard temperatures specially adapted to the tropics a matter of necessity. The author's observations lead him to the conclusion that the most convenient standard temperature for Calcutta is 30° C. at least during the period extending from the beginning of March until the middle of November. During the remaining part of the year 22° C. would be more useful as a standard temperature. Tables of the specific gravity of sulphuric acid at 25°, 30°, and 35° C. have been worked out.—Recent plant immigrants: Paul **Brühl.** A considerable number of phanerogamic species have found their way into Bengal during the last hundred years, and have become practically endemic. Some of them belong to the most common weeds found on road-sides and waste-places. One of the most recent immigrants is a species of Croton, which was first identified with *Croton sparsiflorus*, Morung, by Colonel Prain, who discovered the plant in the Sunderbuns. A detailed description of the plant is given; its present distribution is traced as far as possible. A list of those species is added which appear to have immigrated into Bengal during the last century.—Geological notes on Hill Tipperah (including the Lalmai range in Comillah district): Hem Chandra Das **Gupta.** This paper gives a sketch of the geology of a district about which little is known, except that the rocks are all of Tertiary age. The account of the tract called "pyaro land" is interesting, as it directs attention to a phenomenon not easily to be accounted for. It may be an area of local subsidence, set in motion by the earthquakes that have been so numerous in eastern Bengal during the past few years.—Drosometric experiments and observations: Paul **Brühl** and Bepin Behari **Das.** The fact that a great number of plants growing in Bengal continue to flourish during the drier seasons of the year, notwithstanding the absence of rainfall during several months, points to the dew playing an important part in Bengal plant life. The authors have, therefore, during the last three years, made a number of observations on the condensation of dew from the end of one rainy season to the beginning of the next. For this purpose they have constructed a dew-recording instrument, which is described. A selection of the curves obtained is added.—The surgical instruments of the Hindus, with a comparative study of surgical instruments of the Greek, Roman, Arab, and modern European surgeons. Part ii., Blunt instruments: Dr. Girindra Nath **Mukerjee.** The author describes at length the blunt surgical instruments mentioned by Susruta and other writers, and compares them with instruments known to the Greeks.—Observations on the intensity of daylight illumination in Lower Bengal: Paul **Brühl** and Bepin Behari **Das.**—The most complete set of observations on daylight illumination is that made by Prof. Leonhard Weber and his coadjutors in the Physical Institute of the University of Kiel. Some observations have also been made in the tropics, especially by Wiener in Java. The authors have collected corresponding data in the Physical Laboratory of the Engineering College, Sibpur, using a Weber's photometer as the observing instrument and a large screen of plaster of Paris for the illuminated surface. The results have been tabulated.—Reduction of Fehling's solution to metallic copper—a method of depositing a shining, mirror-like film of copper on glass vessels: Panchanan **Neogi.**

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