THURSDAY, SEPTEMBER 12, 1907.

THE PHYSICAL LIFE OF BIRDS.

The Bird, its Form and Functions. By C. William Beebe. Pp. xii+496; illustrated. (London: Archibald Constable and Co., Ltd., 1907.) Price 14s. net.

MR. BEEBE'S handsome and beautifully illustrated book on the bird forms as charming and interesting an introduction to physical ornithology as the general reader, or the unscientific bird lover, can desire. In his preface, the author points out that too many students of ornithology stop short at the classification of birds, the naming of new species, and the observation of the habits of those that are known; and that not one of an audience of teachers to whom he had lectured, though they could identify fifty birds or more, knew the significance of the scales on a bird's foot. His book is intended to bridge this gap. It is an untechnical study of the bird in the abstract. His aim has been to take a few dead facts and clothe them with the living interest which will make them memorable and full of meaning to any lover of birds, and at the same time to keep them acceptable in tenor and truth to the most critical man of science. Wherever possible, a fact has been illustrated with a photograph from a preparation, or from a living bird, the author's belief being that when verbal exposition fails, pictorial interest will often fix a fact in the memory. How successful he has been in this a glance at the wealth of exquisite illustrations will show. Beginning at the root of all things avian, his first chapter deals with the birds' ancestors, the Ichthyornis, Archæopteryx, &c., both the remains and a "restoration" of the latter being illustrated.

We cannot follow in detail the seventeen chapters in which he deals with the entire structure of birds (treating each part in relation to the various functions it has to perform), their senses, their eggs, and the young in the egg. But we will turn to that on "beaks and bills," as a fair example of the treatment of the subjects. It is illustrated with thirty-three figures, and all the various forms of beak are described with their special adaptation to the wants and habits of the different birds. The beak is all-important to the bird.

"Tie a man's hands and arms tightly behind his back, stand him on his feet, and tell him that he must hereafter find and prepare his food, build his house, defend himself from his enemies and perform all the business of life in such a position, and what a pitiable object he would present! Yet this is not unlike what birds have to do. As we have seen, almost every form of vegetable and animal life is used as food by one or another of the species. Birds have most intricately built homes, and their methods of defence are to be numbered by the score; the care of their delicate plumage alone would seem to necessitate many and varied instruments; yet all this is made possible, and chiefly executed, by one small portion of the bird—its bill or beak."

This picture is hardly overdrawn if we allow a little for feet and spurs and wings, which some birds use for getting food and making homes and fighting. In feeding alone, so many different kinds of beaks are wanted. To pick up small seeds, to probe the deepest calyxes of flowers, catch insects on the wing, and fish in the sea in various ways on or below the surface; to sift the mud and ooze, and skim the surface of the water, to chisel away wood and tear flesh; all these ways of feeding require different beaks, and they are all described in a delightful manner that anyone can understand. So wonderful is their variety and the variety of their functions that this one chapter, like the others, as the author observes, could easily be elaborated into one or more volumes. "A collection of bills of the various wading-birds would look like a complete set of surgical tools."

In the same way the rest of the subject is treated, the chapters on feathers (in which are some most interesting pictures of pelicans in their breeding haunts) and eggs being perhaps the most attractive. The book will take and hold a distinct place in the literature of the subject, for it is quite original and stands alone. Not only is it a most readable and interesting book, but a valuable one to teachers. A short list of books in the appendix indicates sources where much more detailed information may be obtained by those who desire it. They relate chiefly to North American birds, for the author writes from the New York Zoological Park. Nevertheless, his book is of world-wide interest. The wealth of illustration is one of its chief features, and the index is very full and elaborate.

ANIMAL MECHANICS.

Kinematik organischer Gelenke. By Prof. Dr. Otto Fischer. Pp. xii+261. (Brunswick: Friedr. Vieweg and Son, 1907.) Price 8 marks.

ENGLISH anatomists appear to have taken up the study of the joints and the movements performed by means of them almost entirely from the standpoint of descriptive anatomy, leaving the mathematical and more precise study somewhat severely alone. Proof of this statement is amply afforded by reference to the excellent bibliography which Prof. Fischer has appended to his handbook, the work under review, on the kinematics of living joints. No less than 127 references are given to German or French text-books or papers on the subject, whilst English or American authors are responsible for only nine. Of these, eight are papers to be found in various journals. The only extended mathematical treatment in English is that by Prof. Haycraft, entitled "Animal Mechanics," to be found in the second volume of Schäfer's "Physiology." The combination of a sufficient knowledge of mechanics with the necessary anatomy would therefore appear to be somewhat rare in this country. The subject, however, is one of great interest, and it is treated in a learned and at the same time lucid manner by Prof. Fischer, who has made for himself a considerable reputation in connection with it.

In the first section of this work, a more or less general investigation is made into the mechanical principles which govern the movements of organic joints. This is done by considering first a machine

joint, such as an ordinary hinge, and then the points of difference between such a joint and an organic joint. In a hinge the form of the surfaces in contact is practically constant, as the joint moves between its extreme positions. This is rarely the case, of course, in a living joint. The variations introduced by these changes are carefully considered, the diagrams aiding very materially in the treatment. The mathematics employed requires some knowledge of differential and integral calculus, and also of coordinate geometry, but presents no very serious difficulties.

The succeeding part of the book is of great interest, as it contains a description of Prof. Fischer's own methods of showing graphically the movements of single joints and of combinations of joints. There have been many advances in this direction since the Webers, so far back as 1830, investigated the variation in the position of the centre of gravity of the body in walking and running. M. Marey introduced photographic methods, somewhat resembling modern kinematograph work. The method described in the present work is the best yet devised. A man is clothed from neck to feet in black, and a series of Geissler tubes, eleven in number, are arranged symmetrically on his head and limbs. These are joined to the secondary of a Ruhmkorff coil, the primary of which is interrupted about twenty-five times per second. The man's movements are then recorded photographically by means of cameras placed on either side and in front and behind. In this way records in three directions in space were obtained, and these were coordinated by means of networks of squares photographed at the same time. The phases of movement, either of the whole body or of a single joint-system such as the arm, are thus illustrated.

Prof. Fischer brings much originality into his treatment of a by no means easy subject. The publication of this handbook may well direct the attention of English students to a branch of anatomy which has been somewhat neglected, but in which there remains much to be done.

GAS ANALYSIS.

Traité pratique de l'Analyse des Gaz. By M. Berthelot. Pp. ix+483. (Paris: Gauthier Villars, 1906.) Price 17 francs.

IN that branch of chemical analysis dealing with gases there is by no means the superabundance of text-books characteristic of other branches of analytical work, and it is noteworthy that such works as we possess are nearly all memoirs of original work by the author, or have been developed from that form. The names of Bunsen, Winkler, Hempel, and Travers occur in this connection, and the present work is no exception. In some of his earliest researches, M. Berthelot was met with the necessity of devising methods for the analysis of gases, and many of the methods described in this book were used by him as early as 1858. After an introduction, the work is divided into five sections dealing with the collection and storage of gases, methods of qualitative analysis, general methods of quantitative analysis, monographs, and the recognition and estimation of single gases and mixtures.

The whole book is strongly impressed with the author's individuality, and a considerable proportion of the section dealing with qualitative analysis is original, especially the chapters on the pyrogenic analysis of gases and spectroscopy. In the latter connection, a simple apparatus is described by means of which a spectroscopic examination of a gas at the ordinary atmospheric pressure can be rapidly made, and in the section dealing with the properties of each gas in detail a table of the chief lines observed by this method is given. The actions of the electric spark and the silent discharge are also special to the author, and his methods are expounded in detail. The remarks on the use of absorbents are worthy of close attention, it being rightly pointed out that the reduction of volume by treating with a given absorbent cannot be taken as a proof that a particular gas is present: a gas must be isolated in a pure state before its presence in a gas mixture can be taken as proved. On the quantitative side more exception can be taken to the methods expounded, which, indeed, leave much to be desired, both on the score of rapidity and precision. Water jackets are not used for the measuring vessels, the temperature being controlled by immersion in a large mercury trough holding from 16 to 20 litres, and this is described as "the essential instrument in all exact manipulations relating to gases and their analysis." As this trough requires about 600 lb. of mercury to fill it to its working level, exact gas analysis would of necessity be confined to a very limited number of laboratories if this dictum were to be accepted. The sections on mercury pumps, calibration of measuring vessels, and determination of gaseous densities are also entirely out of accord with present-day standards of accuracy. References to other workers in the same field are rare, and the description of their apparatus and methods not always accurate. The account given of Hempel's gas burette and its use on p. 269 is an example of this. The commencement of the description is that of the Hempel burette, but the figure and manipulation correspond to a modified Winkler gas burette, and Prof. Hempel would hardly recognise the description of his pipette as "formed of two bulbs connected by a fine tube and each furnished with a recurved capillary tube."

In the fourth section a monograph is given of each gas, and this section will perhaps be found to be the most valuable part of the work. It is a drawback that no references to original memoirs are given in this section, and for this reason it is difficult to make out whether the densities given are experimental or calculated, or whether such a figure as $-93°$ C. for the boiling point of propylene is the result of a misprint or an inaccurate observation.

The book is one which everyone interested in gases should have on their bookshelves, but, like the classical work of Bunsen on the same subject, it cannot be regarded as of practical service as a text-book at the present day. Its value will be historical and personal as the last published work of a great French chemist.

MOTOR ENGINEERING.

A Manual of Petrol Motors and Motor-Cars, comprising the Designing, Construction, and Working of Petrol Motors. By F. Strickland. Pp. ix+376. (London: C. Griffin and Co., Ltd.) Price 18*s.* net.

MR. STRICKLAND has produced a very original and useful work on the modern motor-car. There is no padding; the book is filled from cover to cover with the practical remarks of a man who knows his subject. The matter is conveniently arranged, and the reader, whether he be manufacturer, designer, or user, is able to follow the author, and in almost every case to obtain his very decided opinions on many of the controversial points which have arisen during the development of the car of to-day.

First we have a short but very readable chapter on the power required, and a second chapter on the general arrangements of an up-to-date car. Then follow nine chapters on the details of the engine, and the remainder of the book is devoted to the other details taken seriatim.

It is refreshing to find the author in his chapter on general arrangements taking the bold line of prophesying that the present type of motor-car will not long endure. Most thoughtful engineers will agree with him that this is the right view to take, and in spite of the repeated assurances of those who have the car of to-day to sell, that finality of design has already been reached, and that little remains to be done to pleasure cars beyond perfecting details and cheapening modes of manufacture, it is probable that Mr. Strickland is right in saying that the present design, with its long engine sticking out in front necessitating a long wheel base, has been made necessary by the requirements of the engines, which up to the present are found in practice to need frequent attention on the road. He points out that when the engines become more trustworthy they will be relegated to their proper position underneath and nearer to the centre of the car. He gives strong reasons for showing that this position, although it does not give such facilities as at present for the chauffeur to make his repairs in public, will undoubtedly improve the car in many important respects, not least being that of the comfort and ease of the occupier.

The chapters devoted to the consideration in detail of the various parts of both pleasure and commercial motor vehicles are very complete; every important organ is considered and discussed separately, the various modes of construction are clearly explained, the drawings are real drawings and not process blocks, and are consequently far clearer than is unfortunately now too often the case.

The important features of the book are the tables of the principal dimensions of the best known cars of the day. These tables are accompanied by very full notes, which make them additionally valuable. It is the first time that anyone has attempted to collect together such a mass of useful information as is contained in these tables with their accompanying notes.

While there is so much to praise in this book, it is curious to note the peculiar error that the author falls into on p. 309 when he discusses the comparative flexibility of the steam engine and the internal-combustion engine. He seems entirely to ignore the extraordinary range of power without change of gear that has been rendered possible in the steam engine by the use of flash boilers. When with such boilers it is possible to give effective mean pressures varying from 100 lb. up to 1000 lb., it is evident that even for heavy commercial vehicles the use of change gearing is no longer necessary when steam is employed as motive power.

A few other dicta laid down by the author may be challenged in a similar manner to the above, but on the whole his work contains, in addition to the valuable tables and data above mentioned, an unusually large number of carefully reasoned and valuable conclusions which will render it almost a necessity for everyone who is closely interested in the modern motor-car to keep this book in his library.

THE FAMILY AND THE FUTURE.

Population and Progress. By Montague Crackanthorpe, K.C. Pp. viii+131. (London: Chapman and Hall, Ltd., 1907.) Price 2*s.* 6*d.* net.

THIS volume contains a series of five essays, of which the first three were published originally in the *Fortnightly Review*, the earliest in 1872 and the two later ones in 1906 and 1907. As is stated in the preface, the thread that binds them is the "Voluntary Principle," that is to say, the principle that married people should for the good of society exercise voluntary control over the size of their families. Together they form a connected and forcible argument in support of this principle. The author sees in it, if not a panacea for all social ills, at any rate the most effective of prophylactic measures. Some space is occupied in reasoning, probably without avail, with those who would oppose it on religious grounds; but this we will pass by, mentioning only the very pertinent reminder to those who urge the biblical precept "be fruitful and multiply" that there were at the time at which this injunction was given, according to the very record on which its authenticity is based, only eight persons living on the face of the earth.

Dealing with masses, one may recognise two kinds of limitation of family, the one general or non-selective, the other eugenic or selective; each is regarded by the author as conducive to social sanitation, but the class of disease which may be prevented by the former is somewhat different from that on which the latter puts a check. The possibility and desirability of eugenic limitation of families has been much discussed recently, and most people recognise that society suffers if epileptics, degenerate and feeble-minded persons, or those suffering from inheritable disease are allowed freely to propagate their kind. In this connection Mr. Crackanthorpe does not rely on the "Voluntary Principle" only, but advocates that anti-eugenic marriages should be prohibited by law, and he gives instances, quoted from the writings of Dr. Rentoul, of Liverpool, of laws of this nature in force at the present time in Austria, Servia, and some American States.

The range of evils, which, according to the author, may be met by general limitation of families, is large—embracing prostitution on the one hand, and war on the other. The chief excuse for the former is that many men are prevented by prudential consideration from contracting early marriages; and this he suggests might be removed if it were universally recognised that prudence might be exercised after marriage, and if popular opinion shifted so as to condemn the raising of larger families than could be adequately provided for. With regard to war, we find on p. 128 the following passage:—

"The wars of brutal conquest and plunder, of religion, and of dynastic succession, which have from time to time devastated Europe, are now things of the past. But there remain commercial and colonial laws—wars to procure in old countries fresh markets for manufactures, and to provide in new countries an outlet for their superfluous inhabitants. These are the wars that the future has in store for us, unless we can remove the causes of them."

Of the causes referred to, the most predominant is the numerical increase of the population of the older countries in a ratio disproportionate to their food supply or to the territory at their disposal.

E. H. J. S.

OUR BOOK SHELF.

Temperatur und Zustand des Erdinnern. Eine Zusammenstellung und kritische Beleuchtung aller Hypothesen. By Hermann Thiene. Pp. iv+100. (Jena: Gustav Fischer, 1907.) Price 2.50 marks.

THIS memoir, which was written as a prize essay in connection with the University of Jena, is an admirable *résumé* of the various memoirs dealing with the nature of the earth's interior. The first twenty-eight pages contain a slight sketch of the literature of the subject from the earliest times down to the year 1870, beginning with Plato's "Phaedon" and ending with Delaunay and Sterry Hunt. The work done since 1870 is treated in somewhat greater detail in the second part of the memoir. For the chemical composition of the earth's crust the author adopts the average calculated by Clarke from the analyses of American rocks. He then discusses the determinations of the mean density of the earth, concluding that it must lie between 5·4 and 5·7, while for the density of the crust he argues that the specific gravity of diorite (2·8) may be accepted as an average. On the problem of the distribution of density within the globe, the author cites the views of Lipschitz, Sir George Darwin, Stieltjes, Callandreau, and Radau, and proceeds to consider the very problematic views that have been enunciated concerning the chemical constitution of the earth's interior.

On the question of the temperature of the earth's crust the author finds himself on safer ground, and he gives a summary of the evidence derived from the observations carried on in tunnels, mines, wells, and bore-holes, which is fairly complete and up-to-date. With speculations on the limits of temperature in the earth's interior, the author returns to more debatable problems, and in the absence of exact knowledge concerning the effect of enormous pressures on materials at high temperature can only cite the guesses that have been made upon the subject. The discussion of the question of the condition of the earth's interior, to which the latter part of the memoir is devoted, contains a very useful *résumé* of the views of various authors upon the subject, the important bearing of recent discoveries concerning radio-activity upon the question of the source of the internal heat of the globe and upon the age of the earth being kept in view. No fewer than one hundred and fifty-eight authors are cited, and the catalogue of works and memoirs numbers one hundred and seventy-seven. A few, not very important, omissions may be noted, but the summary, on the whole, is fairly complete and judicious, and it can scarcely fail to be of great service to those interested in the important questions with which the author deals.

The Garden Anthology. Edited by Rose Gardner. Pp. xiv+313. Price 2*s.* 6*d.* net.

The Voice of the Sea. Edited by Ingram Swale. Pp. x+163. Price 2*s.* 6*d.* net.

The Wayfarer. Edited by Claude E. Benson. Pp. xv+252. Price 2*s.* 6*d.* net. (London: George Routledge and Sons, Ltd.; New York: E. P. Dutton and Co.)

THESE three volumes contain good selections of prose and verse. In each case the respective editor has brought together a very interesting collection. Those fond of flowers and gardening will be attracted to the first book named. The poems have been classified, so that it is possible to refer to gardens of various kinds and to their aspect at the different seasons of the year. Some of the references to plant-life exhibit a very accurate knowledge of the less obvious changes it undergoes.

"The Voice of the Sea" is chiefly of interest as a collection of poems dealing with the sea in its many changes and phases; objects of marine interest are in some cases referred to, but in few instances is expression given to more technical thought in connection with them.

"The Wayfarer" is a miscellaneous collection referring to the seasons, the times of day, and touching on many things dealing with wild life and nature. The poems are brought together under various headings, and the book should be of interest to many readers.

The Relation of Man to the Animal World. By Sir Samuel Wilks, Bart. Pp. 34. (Hampstead: The Priory Press, 1907.) Price 1*s.* net.

WE find ourselves somewhat at a loss to discover the object and aim of this "booklet," which is based on an address by the author delivered some few years ago before the Church Congress at Folkestone. The subjects discussed, or rather, perhaps, mentioned, include the killing of animals for food, clothing, &c., and sport, their maltreatment for the sake of fashion, the use of eggs and milk as nutriment, castration and vivisection, and the rearing of animals in domestication. Although incidentally recording his objection to some of our methods of treating animals, the author (who is an eminent medical man) is in no sense a fanatic or a faddist, taking up for the most part what may be best described as the equivalent of an "agnostic" position. He remarks, for instance, on the concluding page that "if anyone should ask what position I adopt myself towards the animal world, I can say no more than that I submit tacitly with others to the present arrangement, which our forefathers have made for us." Such a very tame conclusion seems to cut away the whole *raison d'être* of the book, which is neither a stalwart defence of present conditions such as can be used against the ultra-humanitarian school, nor an advocacy for reform. On the whole, it seems to us likely to do more harm than good.

R. L.

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.]*

Regnault's Experiments on the Joule-Thomson Effect.

THAT Regnault made a number of experiments similar to some of those described by Joule and Kelvin in their papers on the thermal effects of fluids in motion does not seem to be commonly known; at all events, the numerical results of his work on this subject are not often mentioned. After experimenting on the flow of gases through small holes in thin plates, and through long capillary tubes, he followed the example of Joule and Kelvin in using porous bodies, especially discs and tubes of soft, unglazed porcelain. He found great difficulty in getting definite results, especially in the regard that the temperature observed in the stream of gas issuing from the porous wall depended on the position of the thermometer. He concludes the account of his experiments in the following words:—"Après ces tentatives infructueuses et beaucoup d'autres dont je ne parlerai pas, j'ai renoncé à l'espoir d'obtenir quelque chose de précis, d'expériences fondées sur la mesure de températures dans les courants gazeux, et il ne m'est resté que le regret d'avoir consacré beaucoup de temps à des recherches stériles" (Regnault, "Relation des Experiences," vol. iv., p. 707, 1870).

At the present day we can see that Regnault's experimental method was not in this case the best that might have been devised, but in spite of his dissatisfaction with the results of the work, his most definite numerical values are not very different from those of Joule and Kelvin. Air under pressure was forced through the wall of a porous porcelain tube from the outside. The tube was 20 cm. long and 2·8 cm. in diameter, the thickness of the wall not being stated. The fall of temperature Δt was found in two ways. In the first method, one mercury thermometer was placed in the axis of the porous tube, while a second thermometer was immersed in the large water bath containing the worm for leading in the compressed air. In the second method an iron-copper thermocouple was used, one junction being in the axis of the porous tube and the other in the compressed air just outside. The results of the thermoelectric measurements are somewhat irregular, and it seems probable that the fault was mainly with the imperfect electrical instruments of the time. The two series with the mercury thermometers are more satisfactory.

In one of these, the mean of eleven measurements in which the fall of pressure, Δp, at the porous wall was between 4·9 metres and 3·9 metres of mercury, gave $\Delta t/\Delta p = 0{\cdot}293$, the separate values ranging from 0·285 to 0·303. Nine subsequent measurements in the same series gave values ranging from $\Delta t/\Delta p = 0{\cdot}407$ for $\Delta p = 3{\cdot}1$ metres up to 0·685 for $\Delta p = 0{\cdot}65$ metre and then down to 0·312 for $\Delta p = 0{\cdot}30$ metre. In the other series, made with a somewhat thinner-walled tube, the mean of the twenty-two measurements, in which the fall of pressure was between 6·6 metres and 3·4 metres, gave $\Delta t/\Delta p = 0{\cdot}255$, the extreme values being 0·234 and 0·313, while twelve of the twenty-two values are between 0·250 and 0·260.

It is interesting to compare the mean of these values, $\Delta t/\Delta p = 0{\cdot}27°$ C. per metre of mercury, with the value obtained by Joule and Kelvin. Their results may be represented sufficiently well, in the same units, by the equation

$$\Delta t/\Delta p = 0{\cdot}36 - 0{\cdot}0017t,$$

which gives for $t = 20°$ C. $\Delta t/\Delta p = 0{\cdot}33$. Regnault does not state the temperature at which his experiments were made, but it was probably not far from 20°, so that in reality his work agreed fairly well with that of Joule and Kelvin.

EDGAR BUCKINGHAM.

Bureau of Standards, Washington, August 27.

Genetics.

IN a recent review of the report of the third International Conference, 1906, on Genetics (NATURE, August 22, p. 417), the following sentence occurs:—"Mendel's peas have already been called classical; and it is a very remarkable fact that no one has repeated Mendel's experiments with the deliberate intention of testing the Mendelian interpretation of the results." This statement is misleading, for in the following five instances many of Mendel's experiments on the pea have been repeated and confirmed:—

Correns, C., *Deutsch. Bot. Gesellsch.*, 1900.

Tschermak, E., *Zts. f. d. landw. Versuchsw. in Osterr.*, 1900 (and later).

Hurst, C. C., Journ. R. Hort. Soc., 1904.

Lock, R. H., Ann. R. Bot. Gard., Peradeniya, 1904.

Bateson, W., and Miss Killby, Rep. II. to Evolution Committee of Roy. Soc., 1905.

In each case the experimental results have led the author to accept Mendel's interpretation of the phenomena.

R. C. PUNNETT.

Gonville and Caius College, Cambridge, August 30.

THE sentence which Mr. Punnett quotes from my review is not in the least misleading. I did not say that Mendel's experiments had not been "repeated and confirmed"; I said that they had not been repeated with the deliberate intention of testing the interpretation which Mendel put upon them. This statement I repeat, and shall shortly prove to be correct. I am familiar with the work of the five authors in Mr. Punnett's list (which surely should have included a reference to de Vries's papers), and, what is more, I have a first-hand acquaintance with the facts themselves.

I do not doubt for one moment the correctness of Mendel's results, as my critic implies in his sentence which follows the quotation from my review. I do not doubt, as Weldon did, the validity of the generalisation that yellowness of cotyledons in peas is dominant over greenness, or that these characters segregate in Mendelian fashion in F_2. I do not doubt the reality of the phenomena in any of the cases described by the authors whom Mr. Punnett cites any more than I doubt the reality of the results which I have myself obtained; but does that mean that I must accept the Mendelian interpretation of them? Certainly not. The Mendelian phenomenon is a fact; but the Mendelian interpretation is an inference, and it is dangerously misleading not to lay stress on the distinction between the two.

What I mean by "testing the interpretation" is the carrying out, by one who is actively sceptical of Mendel's hypothesis, of an experiment of such a kind that the result can leave no doubt in the mind of the experimenter as to the validity, or otherwise, of the hypothesis tested. I will suggest an experiment. The proportion 75 per cent. yellow, 25 per cent. green, holds good for F_2 from crosses between pure strains of yellow-seeded and pure strains of green-seeded peas; but does it hold good for F_2 from crosses between a pure yellow *and an extracted green in* F_1, *i.e.* a green with all its parents yellow, and with all its grandparents yellow, and with all its great-grandparents yellow, and with all its great-great-grandparents yellow, and with half its great-great-great-grandparents yellow? If Mendel's interpretation of the proportion he obtained in F_2 (75 per cent. yellow, 25 per cent. green) is correct, that proportion must hold good for F_2 from such a cross as I have suggested.

When I say that "no one has repeated Mendel's experiments with the deliberate intention of testing the Mendelian interpretation," I mean that crucial experiments on the lines of that which I have suggested have not been carried out by sceptical observers. I know perfectly well that Mendel's experiments have been repeated on a large scale, that alleged exceptions have been satisfactorily disposed of, and that a number of new Mendelian characters have been discovered, not only in peas themselves, but in a host of other plants and animals. But that is not testing the interpretation; it is witnessing the phenomenon. "In each case," says Mr. Punnett, "the experimental results have led the author to accept Mendel's interpretation of the phenomena." Surely he must follow willingly who can be led by so slender a thread.

THE REVIEWER.

ARCHÆOLOGICAL DISCOVERIES IN EGYPT.

THE progress of archæological discovery in the Near East goes forward steadily without halt. Every year more is added to our knowledge of the ancient peoples of Greece, Egypt, and western Asia; with each year we have only to await the surprises that the excavators have in store for us. Egypt has contributed some very important results this season, in two remarkable discoveries at Thebes. One of these is a find of the highest interest which will appeal to the minds of all, even those entirely ignorant of archæological science; this is the discovery of the actual body of Tii, one of "the most famous of Egyptian queens," lying in her tomb, with her funeral pomp around her. The other is a discovery which will appeal more to the architect and the student of Egyptian religion than to the layman—the uncovering of the subterranean "tomb-shrine" of King Mentuhetep, and the pillared halls above it, at the western end of his funerary temple, the excavation of which has been brought to a close by this final discovery.

Both these discoveries were announced in the *Times* some time ago, but readers of NATURE may like to hear further details.

Thirty years ago nobody would have thought it possible that we should eventually recover and place in one central museum the actual bodies of all the most powerful Pharaohs of Egypt, the actual mummies of three whole dynasties of kings. But this is now the case. With but few exceptions, the mummies of all the monarchs of the eighteenth, nineteenth, and twentieth dynasties, the most imperial period of Egyptian history, now rest within the walls of the Cairo Museum. Some have been unrolled, others have not. It seems doubtful whether the actual features of these dead princes should be exposed to the gaze of every vulgar tourist, who very often has no appreciation whatever of the wonder of the sight which he is beholding; and very probably a more reverent taste will eventually withhold these august bodies from the indignity of public exhibition in glass cases. But at present those that have been unrolled may be seen by all for a shilling.

The chief discovery of royal mummies was the well-known one of 1881. In 1898 a further series was discovered in the tomb of Amenhetep II. (the only king who rests, as all should do, still in his own sepulchre). Of late years the systematic exploration of the Valley of the Tombs of the Kings has been undertaken by an American, Mr. Theodore M. Davis, who has each year made some discovery of importance. To him is due the opening of the tombs of Thothmes IV., with its interesting funerary furniture, of Hatshepsu, of Siptah, of Iuaa and Tuaa, the parents of Queen Tii, and, lastly, of Queen Tii herself. In the discovery of the first two tombs mentioned above, Mr. Davis was assisted by Mr. Howard Carter, then chief inspector of antiquities at Thebes; the discovery of the tomb of Iuaa and Tuaa was effected with the cooperation of Mr. J. E. Quibell, Mr. Carter's successor at Thebes; while in the discovery of the tombs of Siptah and Tii Mr. Davis had the help of Mr. Edward R. Ayrton, who had previously assisted Prof. Petrie at Abydos and Ehnasya and Prof. Naville at Deir el-Bahari.

Of all Mr. Davis's discoveries, that of the tomb of Iuaa and Tuaa, the parents of the queen whose grave was found this year, is the most important from the scientific standpoint. Not only were the mummies in absolutely perfect condition, but the tomb was found full of an incredible treasure of funerary furniture and other work in wood, ivory, and gold, which has become well known from various popular publications during the last two years, and has already provided many new models to our cabinet-makers. But a greater personal interest attaches to the tomb of their daughter, the Queen Tii, and more general attention has been directed to this discovery than to the former one, although, alas! the body of the queen has decayed, and nothing but the grinning skull remains which once was clothed with the most beautiful features and contained the cleverest brain in Egypt about 1400 B.C. The furniture, too, of the tomb is not in such good preservation, and, indeed, never was so fine, as that in the tomb of Iuaa and Tuaa. But personal interest is great nowadays, and Tii is more interesting than her parents.

Like the rest of the royal tombs, that of Tii was found in the Valley of the Tombs of the Kings at Thebes, "the Place of Eternity" as the Egyptians called it, where, in his "August Habitation of the West," a deceased king was laid to rest, "no man seeing, no man knowing," that tomb-robbers might not find the position of the grave and despoil it of

FIG. 1.—The Valley of the Tombs of the Kings, taken by moonlight.

its treasures (Fig. 1; photograph taken by moonlight).

But neither Tii nor, possibly, her parents had originally been buried in the Theban valley. Tii belonged, as is well known, to the heresy of the Disk-worshippers, of which her son Khuenaten was so vigorous an adherent. To her more than to any other person was probably due the introduction of this heresy as the fashionable religion of the royal court, and she instilled the principles of her peculiar belief into the mind of her son, who became a fanatical persecutor of the national orthodox religion, so much so that he removed his court from Thebes, the headquarters of the orthodox priests of Amon, to a far distant spot, the modern Tell el-Amarna. Here Tii lived and died, and was first buried. But after the fall of the Disk-worship and the re-migration of the court to Thebes under King Tutankhamon, these royal bodies were taken from their tombs and re-interred in the King's Valley at Thebes. Queen Tii, like her parents, was placed in a small private tomb of older date, hardly consonant with her royal state, and contrasting greatly with the magnificent royal hypogæa close by (Fig. 2). Here she was hurriedly laid in some confusion, her funerary furni-

ture being incomplete and its parts improperly fitted together. Before leaving the mummy, thus transferred to its final abode, careful erasure was made of every occurrence of the name and figure of the heretic Khuenaten, who had laid his mother to rest at Tell el-Amarna, and had dedicated in her tomb funerary furniture bearing the record of his filial piety. That the transference took place in the reign of Tutankhamon is shown by the discovery in the tomb of seals bearing his name.

Such are the conclusions to which Mr. Ayrton has been drawn by the study of the condition of the tomb, and there is little doubt that they are correct.

The funeral pomp of the queen had been of great splendour and unusual design, but has most unhappily been damaged by water, which at some period unknown has penetrated into the tomb. The result is that most of the woodwork will not bear handling; much, however, including the skull and bones of the queen, has been preserved by means of boiling paraffin wax, which soaks into the porous substance to which it is applied and solidifies it. Of great splendour must undoubtedly have been the

FIG. 2.—The Tomb of Tii.

great catafalque, in the form of a shrine, which covered the coffin of the queen instead of a sarcophagus. This, on which are delicate reliefs, was entirely overspread with thick gold, the remnants of which filled the tomb, so that everywhere the excavators trod upon gold when they entered. Of unusual design was the actual coffin, the woodwork of which was covered by a frame of gold, inlaid with carnelian and with blue and green glass in scale patterns and the forms of hieroglyphs recording that Khuenaten had had it made for his mother. The mummy itself, the lamentable condition of which contrasts so strongly with the splendid preservation of the mummies of Iuaa and Tuaa, was wrapped in sheets of gold. On the head of the mummy was a golden diadem in the form of a vulture with wings spread round to embrace the head. The workmanship of this diadem shows that it is merely a funerary object, and was not an actual crown worn by the queen in life.

Of the other objects found in the tomb, the most important are the "canopic jars," which contained the mummified viscera of the deceased. Usually the lids of these jars are formed in the shape of the heads of the "four genii of Amenti" (the underworld); but in this case the heads are those of the dead queen herself, beautiful portraits in alabaster, with the eyes and brows represented in lapis-lazuli and obsidian. As portraits, these heads are remarkable, and evidently are accurate likenesses of the queen.

Of other funerary furniture there was little, the reason being that it had been left behind at Tell el-Amarna.

Such is the most remarkable discovery of the year in Egypt. The completion of the excavation of the funerary temple of King Mentuḥetep at Deir el-Bahari, not far off, naturally makes a bad second in point of view of general interest, but is of much greater scientific importance to the student of Egyptian architecture and religion.

The explorations which have been carried out during ten seasons at Deir el-Bahari by Prof. Naville for the Egypt Exploration Fund have now been brought to an end with the completion of the excavation of the Eleventh Dynasty temple (see NATURE, vols. lxx., 1904, p. 155; lxxiii., 1906, p. 468). Four seasons have been occupied with this work since the discovery of this temple by Prof. Naville and Mr. H. R. Hall, of the British Museum, in 1903. For part of each season Mr. Hall has been associated with Prof. Naville as his principal assistant and coadjutor, while Mr. C. T. Currelly has also assisted during the whole of the last two seasons' work, taking the place of Mr. E. R. Ayrton, who assisted during the second season, but has since transferred his energies to the work of excavating the royal tombs, as we have seen above. During the fourth season Mr. M. D. Dalison also worked as a regular member of the Fund's staff, having in the preceding year worked as a volunteer. In the second season Mr. H. Garnett-Orme, and in the third and fourth Mr. J. T. Dennis, also volunteered their assistance. The preparation of the plans has been carried out by Messrs. C. R. Peers and Fatio, under the supervision of Mr. Somers Clarke; and Madame Naville has specially undertaken the work of piecing together the fragments of sculpture, a task which demands much study.

The work of the third season (1905–6) was chiefly notable for the discovery of the remarkable Cow of Hathor in her shrine, now in the Museum of Cairo. This was the most sensational archæological discovery in Egypt last year, as the find of Tii's tomb is the most sensational discovery this year. Nothing so sensational has been discovered in Mentuhetep's temple this year, though the results of the work are archæologically important. At the extreme western end of the temple, immediately beneath the cliffs of Deir el-Bahari, is a pillared hall, of ten rows of eight columns each, at a slightly higher level than the rest of the temple. Within this is a small *cella* or *sekos*, which contains a white limestone altar, of unusual form—square, with a circular depression on its surface, on to which libations were poured. This altar is placed in front of a niche in the rock, which formerly contained a stone shrine.

The whole of this Western Pillar Court, with the *cella*, is placed above the most remarkable feature of this part of the temple—the Tomb-sanctuary of the *ka* of King Mentuḥetep. This is to all appearance a rock-cut royal tomb, like those of the Valley of the Kings. It descends in the regular way at a gentle slope for a distance of 450 feet until a chamber is reached, faced with splendid granite blocks like those of the Pyramids, and containing an alabaster shrine in which once stood a statue of the king. In M. Naville's view the monarch himself was not buried here; this was a sort of imitation

tomb, made for the statue of his *ka*, and perhaps commemorating his deification at the time of his jubilee, the "Festival of the End," or *heb-sed*; when, before he could be regarded as a god, the king had to be temporarily regarded as dead, in which case a funerary chamber might be built, and

FIG. 3.—West End of the XIth Dynasty Temple, Deir el-Bahari, showing descent to tomb-sanctuary.

even an elaborate tomb constructed, long before his real death, when the real tomb would be built. The real tomb of King Mentuḥetep seems to have been within the bounds of the temple. In the south-west corner of the western hall was excavated a small tomb containing a great alabaster sarcophagus which probably once contained the body of King Mentuḥetep. This may have been the real tomb, in an in-

FIG. 4.—The two Temples of Deir el-Bahari, from the south.

conspicuous spot. The imitation tomb descended with a great open dromos in the sight of all men in an open court between the Western Hall and the Pyramid (Fig. 3).

All this constitutes a considerable addition to our knowledge of Egyptian architecture and archæology, and the authorities of the Egypt Exploration Fund are to be congratulated on having brought their great work at Deir el-Bahari (Fig. 4) to a successful conclusion.

Of other work in Egypt, the most successful seems to have been that of the Oxford archæologist, Mr. Randall-Maciver, for the University of Pennsylvania. Mr. Maciver has been excavating town-ruins of the XVIIIth and XXVIth Dynasties near Amada, in Nubia, and in the XXVIth Dynasty town has found remains of a peculiar art, very un-Egyptian in type, and showing points of contact with that of Greece. The painted pottery is especially remarkable. This art would seem to be of native Nubian origin, influenced perhaps by Naukratis; Naukratite wares could easily be sent up the Nile into Nubia. We await further details of this discovery with interest.

Excavations at Alexandria have resulted in the discovery, near Pompey's pillar, of some fine sphinxes; one, headless, of the reign of Horemheb (XVIIIth Dynasty), and two others, made of fine white limestone, of the Ptolemaic period (Fig. 5).

At Asyût Mr. D. G. Hogarth has discovered and excavated many new tombs of the XIth and XIIth

FIG. 5.—Sphinx discovered at Alexandria.

Dynasties, with the usual funeral furniture, of model boats, granaries, and so forth, like those found by Prof. Garstang a few years ago at Beni Hasan.

Prof. Garstang and Mr. Harold Jones have been exploring cemeteries of the XIIth Dynasty and the Roman period at Abydos with success.

Outside Egypt, the chief discovery of the past year of interest to Egyptologists has been Prof. Winckler's find at Boghaz Köi, the ancient Pterion, on the Halys, of cuneiform tablets containing the records of diplomatic intercourse between the kings of the Khattê or Hittites, whose capital Pterion was, and King Rameses II. of Egypt. We already knew from the Egyptian records that Khetasil of the Hittites and Rameses of Egypt made an extradition treaty according to which criminals of either country were to be given up by the other, but now we have some of the correspondence between the two courts, found on the Hittite side. In these tablets the Egyptian king is spoken of as "*Ramases mai-Amana satep-ni-riya.*" This transcription of the Egyptian name is interesting, as giving us an approximate idea of how the Egyptians pronounced the name which we conventionally write "Rameses

meri-Amen setep-en-Rā." This find is a second discovery of Tell el-Amarna letters, and may prove equally important!

In connection with the relations between Rameses II. and the Hittites, an interesting little discovery may be chronicled. Last year Prof. Breasted, copying the inscriptions of the temple of Abu Simbel in Nubia, read through again the inscription which records the marriage of Rameses with the daughter of the Hittite king, contracted in order to cement their alliance. In the course of reading he came across a new word, which he identified as the Egyptian expression for *snow*; this word reads *selg*, which is evidently the Semitic *telg*, "snow" or "ice," which we have adopted to express the substance *talc*. Rameses is speeding the Hittites on their homeward way, and hopes that they will not be troubled by snow in the Lebanon passes. Hot Nubia was a curious place in which to find and first identify the hieroglyphic word for "snow"!

SCIENCE AND GOVERNMENT.

THEORETICALLY at least most observers admit that the adoption of the scientific method in the management of the affairs of State is a preliminary necessity if national efficiency is to be secured. The Secretary of State for War notably has urged again and again that we cannot expect as a people to compete successfully with other nations, whether in peace or war, unless like them we learn to take advantage of the assistance which science and men of science are able to offer.

It is only in recent years that it has begun to be understood in how many directions the methods of science are applicable. No longer is it imagined that the plan of inquiry which has proved so successful in probing the mysteries of the material universe is suitable only in the laboratory and observatory. The adoption of similar lines of approach in the study of history, language, economics, education, and other subjects at one time thought to have nothing in common with science has resulted, indeed, in unprecedented progress in all of them. So, too, in recent times industry and commerce have come under the same influence with beneficial results. The spirit of scientific research, in fact, is beginning to dominate most forms of intellectual activity.

There is growing evidence, also, that politicians in most countries are beginning to realise that statesmanship is no exception to this rule, but, like other skilled labour, is most satisfactory when conducted on scientific principles. But whether British statesmen appreciate this truth to the same extent as those of other great nations is a matter of grave doubt. Their education generally has been of such a character as to leave them with a colossal ignorance of science and scientific methods; and it is only by overcoming the bias received at the public school and university that most of them come to understand the modern outlook. One of the results of the regard in which science is held by legislators is to be found in the amount of money they vote from the public funds for scientific purposes, and it is consequently possible to institute a comparison between the importance attached to scientific investigation by statesmen in the United States on one hand, and in the United Kingdom on the other.

"The Digest of Appropriations for the Support of the Government of the United States for the Service of the Fiscal Year ending June 30, 1908," recently published in Washington, provides detailed information as to the amounts voted by Congress to enable American statesmen to secure the best scientific assistance in the different Government departments. Similarly, the various estimates—for the Army, Navy, Civil Services, &c.—ordered to be printed by the House of Commons, and procurable from Messrs. Wyman and Sons, Ltd., give full particulars as to the provision made by the House of Commons, at the suggestion of the Chancellor of the Exchequer, for similar help during 1907–8 for the British Government.

In the following comparison no reference is made to educational establishments for the technical training of soldiers and sailors or to the grants made to colleges and universities. This subject has been exhaustively treated in these columns on more than one occasion. The intention here is to compare the amounts set aside in the two countries for scientific investigation with a view to the application of the results to matters of national importance. Some amounts may have been overlooked, but it is believed that every sum of importance, so far as the comparison is concerned, has been included.

To begin with the United States, it will be best first to state simply, under the headings as they occur in the official volume from Washington, the amounts voted for various purposes, and then to explain more fully the specific purpose of the grant in cases where it seems necessary.

TABLE I.—UNITED STATES.

	£
Under Smithsonian Institution.	
International Exchanges	6,400
American Ethnology	8,000
Astrophysical Observatory	2,600
International Catalogue of Scientific Literature	1,000
Building National Museum	250,000
Preservation of Collections	38,000
National Zoological Park	22,000
Navy Department.	
Hydrographic Office	27,900
Naval Observatory	12,540
Nautical Almanac	4,250
Surveying Public Lands.	
Surveying Public Lands	87,000
Geological Survey	83,000
Surveying Forest Reserves	20,000
Analysing and Testing Coals, &c.	50,000
Testing Structural Materials	20,000
Department of Agriculture.	
Salaries, Library, Contingent Expenses	206,900
Bureau of Animal Industry	189,400
Eradicating Cattle Ticks	30,000
Bureau of Plant Industry:	
General Expenses	117,000
Grain Investigations	8,000
Distribution of Valuable Seeds	47,600
Cotton Boll-weevil Investigations	22,000
Forest Service:	
General Expenses	351,400
Bureau of Chemistry	130,000
Bureau of Soils	34,000
Bureau of Entomology:	
Entomological Investigations	22,800
Cotton Boll-weevil Investigations	8,000
Preventing Spread of Moths	30,000
Bureau of Biological Survey:	
Biological Investigations	8,880
Bureau of Statistics:	
Collecting Agricultural Statistics	44,580
Office of Experiment Stations:	
Agricultural Experiments	213,400
Nutrition Investigations	1,000
Irrigation Investigations	30,000
Weather Bureau	280,710
Department of Commerce and Labour.	
Coast and Geodetic Survey	198,000
Bureau of Fisheries	134,000
Total	2,740,360

Most of the items included under the Smithsonian Institution explain themselves, but it is worth while to say that the grant to American ethnology is "for continuing ethnological researches among the American Indians and the natives of Hawaii." The grant of a quarter of a million pounds sterling to the National Museum is stated to be for the completion of the construction of the building.

As regards the last two items under "Surveying Public Lands," the first is explained to be for "the analysing and testing of the coals, lignites, and other mineral fuel substance belonging to the United States, in order to determine their fuel value," and "for the purpose of increasing the general efficiency or available supply of fuel resources in the United States." The grant for testing structural materials is similarly "for the investigation of structural materials belonging to and for the use of the United States, such as stone, clays, cement, and so forth."

The Bureau of Animal Industry was instituted "to enable the Secretary of Agriculture more effectually to suppress and prevent the spread of contagious and infectious diseases of live stock, and for other purposes." The duties of the Bureau of Plant Industry cover every part of scientific agriculture so far as plant life is concerned. In the same way, the Forest Service includes every aspect of scientific and economic forestry; and each of the departments under the heading agriculture deals in a like comprehensive spirit with the branch of science with which it is identified. The other items are sufficiently explained by their titles.

TABLE II.—UNITED KINGDOM.

	£
Board of Education.	
Museums Purchase Grant (Science Grant in Aid)	1,800
Geological Museum	3,894
Geological Survey	18,072
Solar Physics	1,901
British Museum.	
Natural History Museum	53,724
Scientific Investigation.	
Royal Society	16,750
Meteorological Office	15,500
Royal Geographical Society	500
Marine Biological Association	1,000
Royal Society of Edinburgh	600
Scottish Meteorological Society	100
Royal Irish Academy	2,000
Royal Zoological Society of Ireland	500
Edinburgh Observatory	1,600
International Geodetic Association	419
North Sea Fisheries Investigation	12,500
International Seismic Association	210
Public Education, Scotland.	
Royal Scottish Museum, Edinburgh, Science Side (estimate)	1,500
Temporary Commissions.	
Sewage Disposal Commission, Scientific Investigations	3,750
Tuberculosis Commission, Scientific Investigations	7,673
Epizootic Abortion Committee, Scientific Investigations	1,110
Mines Commission, Scientific Investigations	1,000
Army.	
Inspection of Warlike and Engineer Stores: Seven Chemists	2,340
Ordnance Research Board: Fourteen Chemists and one Chemical Engineer	4,140
Navy, Scientific Services.	
Royal Observatory, Greenwich	9,709
Observatory at the Cape of Good Hope	8,218
Photographic Mapping of Heavens	1,580
Hydrographic Department	£38,506
Coast and other Surveys	22,280
Naval Museum, Greenwich	703
Compass Department	1,897
Nautical Almanac	4,369
Chronometers	2,393
Contributions to Scientific Institutions	625
Total	242,863

The second table will explain itself to most readers of NATURE, but one or two variations in the amounts which have been introduced during the year deserve a few words of comment. The Royal Society grant is 425*l.* less than in 1906–7, and the reason is chiefly that the grant in aid of new buildings and equipment for the National Physical Laboratory was this year reduced by 500*l.* The grant-in-aid of salaries and other expenses of the laboratory was increased by 75*l.* The grants to the society for scientific investigations undertaken with the sanction of a committee appointed for the purpose and for scientific publications has undergone no change, and remains at 500*l.*

The grant towards the expenses of the Meteorological Office shows an increase of 200*l.*; that towards the expenses of the Royal Society of Edinburgh an increase of 300*l.*, or, in other words, the grant was doubled this year; that to the Royal Irish Academy an increase of 400*l.*, the increase being intended to provide for the cataloguing of Celtic MSS. now in the custody of the Academy; that to the International Geodetic Association an increase of 119*l.* to pay the expenses of the British delegate in respect of his attendance at the conference of the association held in 1906. The contribution to the International Seismic Association, however, shows a decrease of 40*l.*

As regards the grants enumerated under the heading "Temporary Commissions," the detailed estimates show that the amount received on behalf of the Commission on Sewage Disposal shows an increase for the year of 250*l.*, and that the total sum of 3750*l.* is expended in the remuneration and expenses of bacteriological and chemical experts and their assistants, apparatus, and so on. The amount voted for the Tuberculosis Commission represents a decrease of 675*l.* on the amount of the grant for the previous year, though why the "expenses of experimental farms, buildings, and laboratories, the remuneration of scientific experts, &c., should be less this year is not made clear. The Committee on Epizootic Abortion received an increased grant of 260*l.* this year towards its work of inquiring, "by means of experimental investigation and otherwise, into the pathology and etiology of epizootic abortion," and this year's grant of 1110*l.* covers the expenses of the experimental farm, buildings, and laboratory. The Mines Commission, which was appointed on June 6, 1906, receives its grant of 1000*l.* for experimental work.

To sum up, the State grant for the current year towards scientific research in the United States amounts approximately to two and three-quarter millions sterling, that in the United Kingdom—allowing generously for items which may have been missed in examining the estimates—reaches a quarter of a million sterling. The revenue of the United States for 1906 reached the total of 152,477,381*l.*, and that of the United Kingdom 143,977,575*l.* In broad terms, therefore, it may be stated that with approximately the same revenue the United States attaches eleven times as much importance to scientific assistance as the mother country of Newton, Darwin, Maxwell, Kelvin, and a great host of other scientific pioneers. Who shall say that there is to-day no need for missionary enterprise on the part of the British man of science?

A. T. S.

NOTES.

SUCCESSFUL trials were made with the British military airship at Farnborough on Tuesday. The airship is cylindrical in shape, its length being about 100 feet and diameter 30 feet. Four bands which encircle the cylinder support a light framework under which the car of the balloon is suspended. The motor driving the propellers is fixed in the forepart of the car, and in the stern of the framework there is a large six-sided rudder, which is controlled by rudder lines from the car. Above the car are six aëroplanes, three over the bow and three over the stern. The trials on Tuesday demonstrated that the airship could be controlled and steered in a very satisfactory manner; and the success attained shows that real advance has been made in aëronautics during the past few years.

OFFICIAL announcement is made that on and after September 26, the colony of New Zealand and the territory belonging thereto will be called and known by the title of the Dominion of New Zealand.

Science states that Prof. J. J. Stevenson, of New York University, and Prof. W. M. Davis, of Harvard University, are among the Americans who will attend the celebration of the centenary of the foundation of the Geological Society of London at the end of this month.

IT is stated in the *Engineer* of September 6 that the deepest bore-hole put down for coal in Great Britain has just been completed at Cameronbridge, Fifeshire. The bore-hole attained a depth of 4534 feet before the mountain limestone was reached. At the instigation of the Scottish Geographical Society, steps are to be taken to ascertain the earth temperature at the bottom of the bore.

A REUTER message to Winnipeg from Athabasca Landing reports the loss near Fort Anxious of the *Duchess of Bedford*, the vessel of the Anglo-American Polar Expedition under Captain Ejnar Mikkelsen. The expedition sailed from Victoria on May 20, 1906, with the object of exploring the unknown regions lying to the west of the Parry Archipelago, and of discovering whether there was land to the north of the Beaufort Sea. Though the vessel is lost, a message received on September 7 from Mr. V. Stefansson, the ethnologist of the expedition, reports "Expedition all safe." The telegram was sent to the U.S. National Geographic Society from Eagle City, Alaska, on the Upper Yukon River.

A COMMITTEE to inquire into and report upon certain matters relating to the improvement of forestry in Ireland has been appointed by the Vice-President of the Department of Agriculture and Technical Instruction. The committee consists of the following members:—Mr. T. P. Gill (chairman), Lord Castletown, Mr. W. Redmond, M.P., Rev. D. Kelly, Lord Bishop of Ross; Mr. H. de Fellenburg Montgomery, Mr. W. F. Bailey, Mr. W. R. Fisher, and Prof. J. R. Campbell. The terms of reference are to inquire into and report upon the following matters relating to the improvement of forestry in Ireland, viz.:—(1) the present provision for State aid to forestry in Ireland; (2) the means whereby in connection with the operation of the Land Purchase Acts existing woods may be preserved, and land suitable for forestry acquired for public purposes; and (3) the financial and other provisions necessary for a comprehensive scheme of afforestation in Ireland.

THE Rome correspondent of the *Times* states that the palace which is being erected for the International Agricultural Institute in the gardens of the Villa Borghese is rapidly approaching completion, and before the end of September will be roofed in. Invitations for the meeting of the permanent committee and for the inauguration of the institute will probably be issued in the course of November next, and with the first meeting of the committee in the spring of next year the institute will enter upon its career of activity. The Italian Royal Commission has appointed Prof. M. Pantaleoni to superintend an inquiry for the purpose of ascertaining exactly the extent of the information which the different countries that have adhered to the convention are in a position to supply with regard to their agricultural production. Prof. Bodio, of the General Bureau of Statistics, has been entrusted with a mission to Germany and Austria to study on the spot the systems pursued by those countries for the collection of agricultural reports.

THE latest example of the close connection between science and industry in Germany is afforded by the foundation of an institute for milling research in the Seestrasse, Berlin, adjoining the two already well-known institutes for research in the sugar and fermentation industries. The new institute was formally opened on July 30; it consists of a main building containing the administrative offices and laboratories, together with an experimental granary, a wheat and rye mill, and a bakery. The granary has a storage capacity of more than one million kilos., and the dimensions of the elevators, conveyors, and other apparatus and machinery are such that 17,500 kilos. of grain per hour can be dealt with. The mill is electrically driven throughout, and fitted with the most modern machinery; it contains two complete separate plants, each capable of milling two tons of grain every ten hours. The bakery is similarly fitted with the latest improvements of bakehouse machinery, and contains a laboratory. The institute was built out of a grant of nearly 30,000*l.* from the Minister of Agriculture, who also gives a yearly subsidy; it is carried on and maintained jointly by the Prussian Chamber of Agriculture, the German Millers' Union, and the Central Bakery Union of Berlin. The objects of this research institute as set forth in the contract with the Minister of Agriculture are of interest. It is proposed to carry out practical research and scientific investigation on grain during storing, milling, working up and baking; to experiment with the baking of home and imported grain; to conduct research work for the Government, and to carry out official and private analyses of grain, flour, fodder stuffs, &c., thereby supplementing the income. Everything has been done to ensure a proper and complete investigation of the many problems which the milling and baking industries present. It is of interest to contrast this new sign of German thoroughness with the state of things in this country, where it is left to private enterprise to initiate research. Thanks, however, to the work of the Home-grown Wheat Committee of the National Association of British and Irish millers, in co-operation with the Rothamsted Experimental Station and the Agricultural Department of the University at Cambridge, much valuable work on problems connected with wheat and flour has been and is being carried out in this country.

WE have received the report of the meeting of inspectors of apiaries (U.S. Department of Agriculture, Bureau of Entomology, Bulletin No. 70). It contains much information respecting the diseases of bees; in particular, the American and European foul broods are discussed as regards ætiology and prevention.

FROM the Economic Proceedings of the Royal Dublin Society (vol. i., part ii., August) has been reprinted, as in previous years, a very valuable report on some of the injurious insects and other animals observed last year in Ireland, and reported on by Prof. Carpenter. The report consists of only thirty-one pages, and yet is full of new, interesting, and important matter, and such that one can thoroughly rely upon. Amongst the thirty pests reported on, the most interesting is the cabbage stem-borer (*Psylliodes chrysocephala*, Linn.), of which an excellent account of the larva is given, of scientific as well as practical value. Another new pest is dealt with, the long-horned barley-fly (*Elachyptera cornuta*, Fallen) attacking barley in Ireland. A willow beetle (*Phyllodecta vulgatissima*, Linn.), as yet unrecorded as a pest in England, where its place is taken by *P. vitellinae*, is also dealt with, owing to the harm caused by it in Lurgan. Amongst the parasites of domesticated animals, notes are given on the sheep louse (*Trichodectes sphaerocephalus*), known also as the red louse. Prof. Carpenter wisely recommends dipping twice at an interval of ten days to clear the sheep of these pests. We hope he will insist on this necessary treatment also in sheep scab, for just as in red lice so in the sheep Acarus, eggs hatch out some days after dipping, not having been affected by it, and thus the disease is carried on, and dipping "orders" lose much of their value. Amongst other pests mentioned we note the lackey moth in the south of Ireland, small ermine moths in Waterford County, mussel scale attack, the turnip moth (*Agrotis segetum*) feeding on mangolds in Queen's County, the beet carrion beetle in County Wicklow, and the pine bark beetle in County Dublin. There are eleven figures in the text, three being original, and six plates, two excellent ones giving details of the larval *Psylliodes chrysocephala* and damage caused by it. A plate (xli.) showing the life-history of the lackey moth is given, photographed from a museum preparation; this does not seem to us to give a natural representation of the larvæ feeding, &c.

ACTING on the instructions of M. Maspero, Directeur général du Service des Antiquités, Prof. Elliot Smith removed the wrappings from the mummy of Ménephtah—the Pharaoh engulfed in the Red Sea while in hot pursuit of the Egyptians. From the writing on the shroud, the process of embalming, the resemblance to Rameses II. (Ménephtah's father) and to Seti the Great (his grandfather), there is every reason to believe that M. Maspero is right in the identification of this as the mummy of Ménephtah. From a very thorough examination of the mummy, Prof. Smith infers that Ménephtah at the time of his death was "a somewhat corpulent old man of rather more than medium height (1·714 m.), almost completely bald, with only a narrow fringe of white hairs," with calcareous patches in the walls of his arteries, calcified costal cartilages, and with few remaining teeth. The mummy had suffered much at the hands of plunderers, while there is also evidence that the embalmers had taken liberties with the Pharaoh of the Exodus. Prof. Smith's report appears in the *Annales des Antiquités de l'Egypte*, 1907.

THE first Bulletin for the current year of the Société d'Anthropologie de Paris contains the annual address of the president, M. Zaborowsky, which is mainly devoted to a review of the work in recent years, and to an appeal for the recognition of anthropology as an exact science by "the official hierarchy" of the Académie des Sciences. The most important contribution is that of M. E. T. Hamy, on representations of the human figure in the monuments of ancient Egypt, supplementary to other studies by the author on the same subject. He discusses the influence of the system of hierographs on the attitudes of the figures, which usually face the right, and he reviews the characteristics of the persons depicted by comparison with existing races. Incidentally, he criticises the classification adopted by Prof. Flinders Petrie in his communication on the same subject published in vol. xxxi. of the Journal of the Royal Anthropological Institute. The committee appointed to allot the Broca prizes has conferred the first on M. A. M. Lapique, for his researches on Negro races, and awarded medals and honourable mention to M. A. M. Choquet, for his contribution on teeth with reference to sex and race, and to M. A. M. Fischer, for his investigation of the variations of the radius and ulna.

THE Linnean bicentenary was celebrated in Washington, U.S.A., by a joint meeting of scientific societies, at which Mr. E. S. Greene delivered a Linnean memorial address. In the address, published in the Proceedings of the Washington Academy of Sciences, vol. ix., the author presents a description of Linnæus's chequered career and his associations with contemporaneous European botanists and physicians.

As a method of stocking forest land in dry districts of the Deccan, Mr. L. S. Osmaston recommends a combined system of agriculture and tree planting, which he describes in the June number of the *Indian Forester*. The land is let out to cultivators for two years; after the preliminary clearing, the lessee is allowed to plant the whole area with his crops during the first year, but in the following year is required to sow a proportion of seed for trees. In the case of the experiments quoted, the trees planted were *Melia azadirachta*, *Hardwickia binata*, *Albizzia Lebbek*, and *Tamarindus indica*; the crops cultivated were sesamum, cotton, and Indian hemp. An interesting experiment of planting live teak stakes is recorded by Mr. T. R. Singh. Shoots from the buds developed favourably for two or three months, but subsequently died, as the stakes became rotten before roots were developed.

DR. J. C. WILLIS takes the opportunity afforded by the completion of ten years' service as director of the Royal Botanic Gardens in Ceylon to review the work of that period in his annual report for 1906. In 1897 he discovered the "wound response" of Para rubber trees, that the first tapping leads to an increased yield of latex, and Mr. J. Parkin introduced the system of preparing rubber in biscuit form. Impetus was given to camphor cultivation by Mr. K. Bamber's work on the distillation of camphor. Green manuring and treatment of cacao canker have been profitable subjects of investigation at the experiment station. Cotton cultivation has been tried with some measure of success in the north of the island since 1903. The advances made in these subjects and in the exploitation of numerous minor products, the preparation of practical leaflets, and a considerable amount of scientific research furnish a remarkable record of material progress.

THE methods and objects of keeping land in good tilth are explained in *Irish Gardening* (August), to which Mr. A. D. Hall contributes a practical article, and Prof. J. Wilson also writes on the same subject. The editorial article refers to the passing of the Destructive Insects and Pests Act, and the speedy issue of an order applying

to the counties of Gloucestershire and Worcestershire compelling growers to take measures against the gooseberry mildew disease.

IN the *Agricultural News* (July 27) particulars are given regarding the efforts that are being made to establish an industry in Sea Island cotton in Tobago; with this object in view seed has been distributed, and a ginnery is in course of erection at Scarborough. In connection with the disinfection of cotton seed with corrosive sublimate in wooden vessels, experiments have shown that the mercury salt is absorbed, so that it is recommended to give the vessels a preliminary soaking before disinfecting the seed with a fresh solution. A note on the exhibition of limes from Dominica records the award of a gold medal at a recent show of the Royal Horticultural Society.

THE Engineering Standards Committee has issued the British standard specification for steel castings for marine purposes (No. 30, price 2*s.* 6*d.* net). The present specifications of the Admiralty, the Board of Trade, and the three leading registry societies were carefully compared, and from these the specification has been prepared.

A SPECIAL number of the *Far Eastern Review* (vol. iv., No. 1) has been published devoted to the mining industries of the Philippine Islands. The important part played by the mineral industry in the American development of the Philippines is clearly shown. In at least one district gold has been taken out in payable quantities, and the development of the coal deposits is making satisfactory progress.

A LENGTHY paper on the origin of the gold in the Witwatersrand banket, by Prof. J. W. Gregory, is published in the Bulletin of the Institution of Mining and Metallurgy (No. 35). He considers that the theory in best agreement with the facts appears to be that which regards the banket as a marine placer in which gold and black sand (magnetite with some titaniferous iron) were laid down in a series of shore deposits. The gold was in minute particles, and it was concentrated by the wash to and fro of the tide, sweeping away the light sand and silt, while the gold collected in the sheltered places between the larger pebbles. The black sand deposited with the gold has been converted into pyrites, and at the same time the gold was dissolved and re-deposited *in situ*. The absence of conclusive evidence of any considerable impoverishment in depth is an argument in favour of the alluvial origin of the gold, and is favourable to the further extension of the banket in depth.

THE facilities provided by liquid air are leading to a rapid extension of our knowledge of the properties of substances at low temperatures. Mr. H. G. Dorsey, of Cornell University, is at present engaged in investigating the coefficients of expansion of solids, and gives in the August number of the *Physical Review* an account of the results obtained for quartz glass, ordinary glass, and several pure metals and alloys. For quartz glass the coefficient is negative below and positive above 190° absolute, remaining very small throughout, while for all the other substances tested it is positive, and increases with rise of temperature. In the case of gold, the curve connecting temperature and coefficient is undulating. The method used by Mr. Dorsey is a modification of Fizeau's, the interference taking place between rays reflected at the top surface of a sheet of black glass, on which a hollow cylinder of the material to be tested stands, and those reflected from the under surface of a sheet of clear glass supported on the cylinder. Temperature corrections are obviated by placing the apparatus in an exhausted chamber.

THE merits of aluminium conductors are likely to be freely discussed, owing to the fact that insulated aluminium cables have recently been placed on the market by one of the well-known cable companies. Bare aluminium conductors have been used already in this country and largely used in America, but insulated aluminium cables have up to the present been practically unknown. The difficulty of making sound joints has been the trouble which has prevented a larger use of aluminium for commercial purposes, but this difficulty, it is stated, has been overcome, and both mechanical and "sweated" joints can be made as desired, and the makers claim that the electrical and mechanical properties of the joints are superior to those of the wire itself. Owing to the conductivity of aluminium being only 60 per cent. that of copper, the diameter of the cable carrying the same current is, of course, greater. How this will affect the cost when insulated aluminium conductors are employed still remains to be seen, as no figures are given as yet as to the price as compared with insulated copper cables. A 50 per cent. saving in weight is claimed over copper conductors of the same capacity, with an increase in diameter of 28 per cent. The insulation used is vulcanised bitumen, as being lighter than paper, for the same degree of insulation. Doubtless practical experiments in the use of these cables will now be made, since the jointing difficulties have been overcome, and the commercial utility of insulated aluminium cables will be tested.

THE *Electrician* for August 30 contains a note on a new system of wireless telephony described by the inventor, Prof. Majorana, at a recent meeting of the Associazione Elettrotecnia Italiana, which is based on the use of a spark gap. For generating the spark a special rotating arrangement is used, and it is claimed that 10,000 single sparks per second can be obtained. These conditions entailed a special microphone, and the Majorana hydraulic microphone, which depends on the capillary action of fluid jets, answers this purpose. With this microphone Prof. Majorana has obtained telephonic currents of very great clearness and strength. The microphone consists of the usual mouthpiece and of a membrane fixed to a glass tube which moves freely under the oscillations of the membrane, and through which slightly acidulated water flows. A special opening in the tube allows the liquid to pass out and strike the upper surface of two cylindrical pieces of platinum which are insulated from each other. This is called the "collector." On striking the middle of the "collector" the fluid spreads over the surface, making contact permanently between the two halves. If a battery is connected in circuit with a telephone and the "collector," so long as the membrane is not disturbed by sound waves, a constant current will flow. As soon, however, as the membrane vibrates the aperture oscillates and varies the flow of drops, so that the thickness of the fluid on the collector is always altering. Prof. Majorana conducted his experiments with a spark gap, and got some satisfactory results, but at the same time he found that by using the Poulsen arc in nitrogen certain advantages accrued.

THE report of the Meteorological Committee for the year ended March 31, 1907, recently presented to Parliament, records great activity in all branches of the useful work of the office, and is more than usually interesting from various points of view. Both the daily and weekly

weather reports have been improved; the maps of the former now include *in situ* observations from Iceland and the Azores, and the statistical portion contains observations by wireless telegraphy from commanders of His Majesty's ships. The Icelandic reports are of the greatest value for weather prediction, and the successful inauguration of the service is due in a great measure to the exertions of the Danish Government and the Copenhagen Meteorological Office. The most important change in the weekly report is the inclusion of a table in which the week's warmth, rainfall, &c., for districts are characterised verbally; to obtain this result the weekly values of the various elements for the years 1881–1905 have been re-examined from the point of view of their frequency distribution. The committee notices with satisfaction that the weather forecasts for the year show a considerable increase of accuracy; the percentage of complete and partial success for the whole of the British Isles of the forecasts published in the morning newspapers was ninety-one, or 3 per cent. higher than in any year since they were first issued in 1879. The operations of the marine branch are carried on with great vigour; we have before us the monthly pilot charts of the North Atlantic and of the Indian Oceans for September, 1907, both issued about the middle of August. These charts afford an amazing amount of useful information brought down to the latest time, and although they represent but a small part of the work of that department, their publication monthly at a regular date is of itself a very onerous piece of work. The committee, recognising the importance of observations made in British colonies and dependencies, fully supports a proposal, emanating, we believe, from correspondence between Dr. Shaw and Mr. R. F. Stupart, of Canada, for holding a meeting of colonial meteorologists at Ottawa in 1908, with the view of promoting mutual cooperation in dealing with meteorological questions generally.

THE third volume (pp. x+528), which deals with linguistics, of the Reports of the Cambridge Anthropological Expedition to Torres Straits has now been published by the Cambridge University Press. The volume is by Mr. Sidney H. Ray, and consists of four parts, dealing respectively with the languages of Torres Straits, the languages of Cape York Peninsula, North Queensland, the languages of British New Guinea, and the linguistic position of the languages of Torres Straits, Australia, and British New Guinea. These reports will occupy six volumes, of which the fifth—the first to be completed—dealing with sociology, magic, and religion of the western islands, was noticed in NATURE of June 23, 1904 (vol. lxx., p. 179). The following general linguistic summary gives the results of Mr. Ray's work on the material collected by himself and Dr. A. C. Haddon with the assistance of numerous other workers:—(1) The western language of Torres Straits is Australian. (2) The eastern language of the Straits is morphologically related to the Papuan of New Guinea. (3) There is no genealogical connection between the two languages of the Straits. (4) There is no evidence of an African, Andaman, Papuan, or Malay connection with the Australian languages. There are reasons for regarding the Australian as in a similar morphological stage to the Dravidian, but there is no genealogical relationship proved. (5) The Papuan languages are distinct from the Melanesian. They are in some respects similar to the Australian, but their exact positions are not yet proved. (6) Languages of the Papuan type are found in German New Guinea. There is no direct evidence of their existence in Netherlands New Guinea. (7) There is insufficient evidence to connect the Papuan with the Andaman or Halmaheran languages. (8) In the northern Melanesian Islands a few languages are found which have Papuan characteristics. (9) Differences of grammar and vocabulary which appear in other island languages appear to be remains of an archaic Melanesian speech. There is no grammatical evidence to connect them with the Papuan, but they show the Papuan diversity of vacabulary. (10) The Melanesian languages of New Guinea and those of the islands are closely (genealogically) related in grammar and vocabulary. (11) The Melanesian languages of New Guinea and the islands stand in the same position with regard to the Polynesian. Both the former represent an older and fuller form of speech of which the Polynesian is a later and more simplified descendant.

WITH reference to a note in NATURE of August 29 (p. 449), Prof. B. Brauner asks us to say that the penultimate sentence should read:—"The atomic weight of nitrogen cannot be higher than 14·01 (*not* 14·10) and lower than 14·008 (*not* 14·08), and so the atomic weight of silver must lie between Ag=107·880 and 107·883."

FROM the author, Mr. Angel Gallardo, we have received a copy of a paper from the *Revista de la Universidad de Buenos Aires* devoted to a discussion of the methods of zoological teaching in that University.

WE have received a copy of vol. v., parts xvii. and xviii., of Prof. G. O. Sars's "Account of the Crustacea of Norway," dealing with a section of the copepod family Canthocamptidæ.

THE July number of the *Trinidad Bulletin* contains several notes on cacao, in which varieties, diseases, and pruning are discussed. On the subject of varieties, Mr. J. H. Hart affirms that clear distinctions exist between Venezuelan and Trinidad Criollo, both in the matter of shape and toughness of skin, and refers to the inconstancy of colour inheritance in cacao pods. With regard to the raising of new seedling varieties of sugar canes, the opinion is expressed that it is more advantageous and quite suitable to make a first selection according to the results of cultivation, and subsequently to test the canes so selected for sugar content, thereby saving extensive chemical investigations.

WE have received from Messrs. R. and J. Beck their illustrated catalogue of microscopical apparatus. It should be useful to microscopists, as hints are given on the use of the apparatus figured.

STUDENTS of the mollusca will be interested in the description, by Dr. W. Gadzikiewicz, of the biological station at Sevastopol, in *Biologisches Centralblatt* of August 1, of a new species of doris (*Staurodoris bobretzkii*) from Sevastopol Bay.

THE ovaries of Hemiptera (by Mr. A. Köhler), the nervous and excretory systems of various fresh-water planarians (by Mr. H. Micoletzky), and the tracheal muscles of ephemerids (by Mr. E. Dürken), constitute the contents of vol. lxxxvii., part iii., of *Zeitschrift für wissenschaftliche Zoologie*.

IN vol. lxiii., part ii., of *Verhandlungen des naturhistorischen Vereins der preussischen Rheinlande und Westfalens*, Dr. O. le Roi completes his synopsis of the birds of the Rhine province.

AMONG others, the *Bio-Chemical Journal* for August (ii., No. 9) contains a paper by Dr. MacLean on safranin as a test for carbohydrates. It is concluded that this is one of the most suitable reagents for determining the presence of traces of carbohydrates in liquids.

OUR ASTRONOMICAL COLUMN.

SEPTEMBER METEORS.—September has long been known for the abundance of fireballs which it supplies, and apparently the present month will justify this reputation. On September 3 a large meteor was observed from Redruth and Falmouth, in Cornwall, falling among the stars in the south-east region of Pegasus. On September 7 two fireballs were seen from near Bishop's Stortford. The first of these was observed at 8h. 56m. descending almost vertically a little to the right of the planet Saturn. The other made its appearance at 11h. 22m., but details are wanting.

DANIEL'S COMET, 1907*d*.—Numerous reports of observations and photographs of Daniel's comet are now coming to hand, and show this object to be one of unusual interest.

The *Comptes rendus* for August 26 (No. 9) contains a preliminary description of spectrograms obtained by MM. Deslandres and Bernard. The chief bands shown are those typical of the hydrocarbons and of cyanogen, but there are other, fainter bands which are unfamiliar. An as yet inexplicable difference is noted between the spectrum of the comet's head and that of its tail. A multiple tail 6° in length was shown on a photograph obtained by Mr. Plaskett at the Dominion Observatory, Ottawa, on July 20.

As reported in the *Observatory* for September (p. 364, No. 387), Mr. Melotte photographed the comet with the Greenwich 30-inch reflector on August 10, 11, 12, and 13, and the photographs show a tail some 100′ long with fifteen to twenty streamers. On a small-scale photograph secured with the Dallmeyer R.R. lens on August 13, the tail can be traced for about 7° from the head, its general direction being west. The streamers curve to the south and spread out in a fan-like form.

In No. 4198 of the *Astronomische Nachrichten*, Herr H. H. Kritzinger points out that the earth will, on September 12, pass through the straggling portions, if there be any so far behind the main body of the comet, and that any meteors occasioned by the collision will have as their apparent radiant $\alpha = 23$h. 8m., $\delta = +3°$.

COMET 1881 V.—A note by Mr. Denning, published in No. 387 (p. 363, September) of the *Observatory*, recalls the fact that the return of the periodical comet discovered by him on October 4, 1881, is due this year.

According to Dr. Matthiessen's elements, the period is 8·68 years, and it therefore returned in 1890 and 1899, but its position rendered it invisible. This year its position indicates the same favourable conditions as obtained in 1881, when it was calculated to have been visible to the naked eye in August, before its discovery. The comet is of interest from the fact that at one point in its orbit it approaches to within 3½ million miles of the earth. The following is from a search-ephemeris calculated by Dr. Smart on the assumption that perihelion passage will take place on October 6 next:—

Ephemeris 12h. (G.M.T.)

1907	R.A. h. m.	Dec. ° ′	log Δ	Brightness.
Sept. 12 ...	7 44·7 ...	+17 50 ...	9·897 ...	1·71
,, 16 ...	8 13·6 ...	+17 28 ...	9·912 ...	1·74
,, 20 ...	8 40·8 ...	+16 50 ...	9·930 ...	1·72
,, 24 ...	9 6·6 ...	+15 59 ...	9·951 ...	1·67
,, 28 ...	9 30·9 ...	+14 58 ...	9·973 ...	1·58
Oct. 2 ...	9 53·7 ...	+13 49 ...	9·995 ...	1·47
,, 6 ...	10 15·3 ...	+12 33 ...	0·017 ...	1·34

From this it will be seen that the comet should now (September 12) be about 21m. west of ζ Cancri, and should rise, about 30° north of east, some 5 hours before the sun. On October 3 it will pass a little to the north of Regulus.

THE PARIS OBSERVATORY.—The annual report, for 1906, of Prof. Lœwy, the director of the Paris Observatory, is full of interesting items, of which only a few may be given here. After outlining the present state of the Eros work, the director mentions some instrumental alterations and improvements, and states how satisfactorily a registering micrometer has been found to work used in connection with the Cercle meridien du Jardin. Five hundred and eighty plates of the moon were obtained with the large equatorial *coudé*, and a number of enlargements of other plates have been made for the tenth section of the *Atlas photographique de la Lune*. A number of photometric observations and experiments on atmospheric absorption were carried on by M. Nordmann with interesting and important results, whilst M. Bigourdan continued his researches on the nebulæ. The work on the *Carte du Ciel* proceeds steadily, and 116 enlargements for the chart were prepared during the year; forty-one of these were from Paris, the others from Algiers, Bordeaux, and Toulouse.

THE LATE PROF. S. P. LANGLEY.—No. 1720 (vol. xlix.) of the Smithsonian Miscellaneous Collections is devoted to three interesting addresses delivered, respectively, by Messrs. White, Pickering, and Chanute, at the memorial meeting held on December 3, 1906, "to commemorate the life and services of Samuel Pierpont Langley, secretary of the Smithsonian Institution from 1887 to 1906." Dr. White's address dealt with Langley's work in general, dwelling especially upon his invaluable services to the institution and his ever-readiness to promote the cause of scientific research in every direction. In Prof. E. C. Pickering's address one finds a brief *résumé* of Langley's contributions to astronomy and astrophysics; whilst Mr. Chanute dealt with his work on aërial navigation. An apparently complete bibliography of Langley's published works from 1869 to 1905 is also included in the publication.

THE DISTRIBUTION AND CONTROL OF STANDARD TIME.—A paper of general interest on the subject of time-control is reproduced as an extract from the *Bulletin astronomique* (vol. xxiv.) for May. In it M. Jean Mascart describes the apparatus and method employed for this purpose at the Paris Observatory, discussing each operation separately, and illustrating the text by diagrams of various parts of the system. The causes of accidents and the special artifices adopted for eliminating their possibility form an important part of the paper.

GEOGRAPHY AT THE BRITISH ASSOCIATION.

THE geographical section of the association met at Leicester under particularly favourable conditions, the quarters provided being the airy and spacious assembly rooms in Hotel Street. The meetings were generally well attended, and only in a few cases was any serious falling off in the audience noticeable. The papers were, so far as possible, grouped under the broad subdivisions of the subject, but as some deviations from this arrangement were necessary, in order to suit the convenience of the readers, it will be well here to disregard the strict order, and bring together the subjects of a more or less similar character.

Besides the opening address of the president, Mr. G. G. Chisholm, which has already been printed in full in these pages, several papers dealt with the specially human and economic aspects of geography, which it had been felt desirable to emphasise as suiting well with the industrial activities of the place of meeting. Communications had been received from distinguished exponents of this side of geography both in France and Germany. Prof. Vidal de la Blache, of Paris, whose writings are noteworthy for the admirable way in which they apply the geographical method to the consideration of human relations, was unfortunately unable to be present in person, but his paper, on the geographical evolution of communications, was read in his absence. Starting from the earliest devices evolved by primitive man as aids in the movement of loads, it traced their gradual improvement under varying conditions of local environment, and especially through the adaptation of animal power to purposes of transport; showing how the vast open plains of Central Eurasia, with the peculiar facilities they offered for the employment of the horse and wheeled vehicle, encouraged the movements of peoples, and brought about the development of long-distance traffic, in which the internal commerce of modern States may be said to have itself originated. While the early beginnings of commercial activity were especially dealt with in this paper,

the most recent developments of economic geography were the subject of the communication by Prof. Max Eckert, the author of one of the best treatises on that subject which has appeared in Germany. Prof. Eckert pointed out that the geography of mankind, understood as the study of the relations of man to his environment, had really only come into existence within the last few decades. While supplying the one adequate bond of union between the natural and moral sciences, it bases all its considerations on the physical conditions of the earth, and evolves general laws regarding the influence of the soil on man and of man on the soil. Commercial or economic geography, which was more specially considered in the latter part of the paper, was defined as a study in which the earth is viewed as the theatre of human production and commerce, one of its most important tasks being the determination of the factors which govern the occurrence of industrial products, though the methods and apparatus of traffic fall also within its purview.

A third paper on the economic side supplied an example of the application of such general principles to a special problem. It was by Mr. J. McFarlane, of Manchester, who set himself the task of determining the limits of the area served by the Port of Manchester, and the character of the trade so carried on. The inquiry had involved much laborious research, the necessary data being obtainable, if at all, only through correspondence with a large number of individuals or bodies engaged in such trade. The material collected, while not permitting a complete answer to the question, was enough to give some indication of the influence exercised by the ship canal as a factor in the commercial relations of the region behind Manchester—an influence which the reader considered likely to increase with time.

One of the afternoon lectures, that by Mr. Mark Sykes, also dealt with the human side of the subject. The attendance was, unfortunately, somewhat small, owing to the counter-attraction of a social gathering, but those who were present listened to a most graphic account of the Kurdish tribes of Asiatic Turkey, among whom Mr. Sykes has travelled very extensively, and whose intricate subdivisions and varying characters he has studied with great care. The number of the separate tribes is astonishingly great, and they differ, not only in religion and language, but in physique, character, and mode of life. The lecturer traced the regional distribution of the principal main groups, and brought home to the audience the physical characteristics of the people by a striking series of photographs. One other short lecture, by Mr. J. D. Rogers, should be mentioned here. It was entitled "Explorers and Colonists," and traced in an instructive way the various motives which have led men to explore—exploration for exploration's sake being, as the lecturer pointed out, a thing of quite modern growth, unless we go back to the first beginnings of travel, and place men like Ulysses in the category of explorers pure and simple. Mr. Rogers spoke of the influence exercised by the imagination in sending the early explorers into remote corners of the world, and traced the connection which in later times grew up between exploration and colonisation.

The mathematical side of geography, which had received attention, outside Section E, both in the address of Sir David Gill and in that of the president of Section A on the figure of the earth, was represented within the section by two papers, both dealing with survey work in Africa. Major Close, R.E., gave a lucid outline of the present state of the official surveys in the several British possessions, showing what a large amount of excellent work is being carried out, often under great difficulties. Captain Behrens, R.E., spoke more especially of the methods of survey adopted, illustrating his subject by instances from special surveys, particularly that of the southern frontier of Uganda, in which he had himself taken part. He also showed upon the screen a number of views in the Ruwenzori range, taken during the expedition of the Duke of the Abruzzi.

Three papers only were concerned with physical geography pure and simple, which it is the modern tendency to leave more and more to the geologist, so far as studied independently of its bearing on man's activities. Prof. J. W. Spencer, who for many years has devoted his attention to the recession of Niagara, put before the meeting the results of his latest survey, carried out some two years ago on behalf of the Geological Survey of Canada. This has permitted conclusions as to the rate of recession since the date of earlier surveys, and Prof. Spencer finds that this rate is more variable than has been supposed, much depending on the shape of the crest at the time and the varying manner in which the rock is worn away. He has endeavoured to trace the state of affairs in the days of the early visitors to the falls, such as Hennepin, and has found what he considers must have been an old channel of the river in their time. He also spoke of the results of his soundings of the river below the falls. The physical geography of the Etbai desert of Egypt was spoken of by Mr. H. T. Ferrar, of the Geological Survey of that country, who exhibited a large-scale map specially drawn to bring out the physical characters of the country. He discussed various morphological features in regard to their mode of origin, and explained the meanings and mode of use of a number of Arabic geographical terms. Lastly, Mr. M. Allorge described the recently discovered cave of Atoyac, in Mexico, paying special attention to the relation borne by the passages and chambers to the structural planes of the limestone formation in which the cave occurs.

An afternoon lecture by Dr. Vaughan Cornish, on the Jamaica earthquake and its effects as witnessed by himself and Mrs. Cornish, dealt with a physical phenomenon, though much of its interest lay in the vivid way in which the effects of such a catastrophe on the life of the people were pourtrayed. A thrilling account was given of the personal experiences and sensations of the lecturer and his wife during the earthquake, and the effects on the buildings of Kingston were well illustrated by photographs. Dr. Cornish investigated the place of origin of the earthquake, the character of the shock, and the effects on buildings of different kinds, and he briefly described the methods by which these researches were carried out.

An interesting paper by Mr. R. B. Woosnam described briefly the recent British Museum expedition to Ruwenzori, giving a general account of the features of the range, and especially of the life-zones upon it. The differences between the east and west sides, due to the greater humidity of the latter, were explained, and the question of the modifications or variations of type with change of altitude was briefly touched upon. Nothing very remarkable in the way of special adaptation to the wet and cold of the mountain slopes was noticed, and it was pointed out that the bird most commonly met with in the wettest and coldest zone is a sun-bird of brilliant colour. On the other hand, a species of sun-bird which occurs below 7000 feet is represented above 10,000 feet by another twice the size, though otherwise an exact facsimile; and a similar case occurs among the plants.

Two papers presented detailed studies of special regions from the all-round point of view. Mr. O. J. R. Howarth described the district of Jæderen, in southern Norway, which he showed to possess special characteristics separating it entirely from the typical scenery of that country. The hills rise in partially isolated groups, the whole forming a practically unbroken tract of naked rock, which reveals, to an extent dominating every other feature, the work of the glacier which once covered it. The coast presents exceptionally clear evidences of the upward movement of the land, in the form of old fjords and islands, as well as an old beach, dating from a period of subsidence following that of glaciation, in which last the land stood even higher than at present. The paper indicated briefly some ways in which the distribution of the population had been influenced by the diverse physical characters. The other paper, by Mr. A. W. Andrews, described the Land's End peninsula, an isolated area of old rock separated from the rest of Cornwall by a neck of low land, and thus presenting characteristic features of its own. This granite plateau forms in its higher parts a bare and wind-swept moorland, with undulating hills rising above it. The coast is, as a rule, lofty, with striking granite and greenstone cliffs, and is almost harbourless. The whole area is but little inhabited, though mining was once more actively prosecuted, and there are some signs of a resumption of activity in this direction.

Mr. Andrews showed a number of views illustrating the structure and other features of the district and its coastline.

On one afternoon the section joined with Sections C and K to listen to an illustrated lecture by Prof. Conwentz on the need of preserving what may be called "natural monuments" (typical scenery, flora and fauna, &c.), and the measures adopted or to be recommended to this end. Another lecture, by Mrs. Leonidas Hubbard, presented a graphic account of a journey in Labrador, during which the lecturer completed the work begun by her late husband in the survey of two previously unexplored rivers, the navigation of which is rendered difficult and dangerous by the many falls and rapids. Lastly, a short extempore account of the general and economic characters of British New Guinea was given by Dr. W. M. Strong, a Government official who had just arrived in England on furlough.

Reports were presented by the committees for investigations in the Indian Ocean (Mr. J. S. Gardiner); for the study of the relations between rainfall and river discharge (Prof. McCallum and Dr. Herbertson); and for that of oscillations of land-level in the Mediterranean (Mr. R. T. Günther); and grants were obtained for the further prosecution of the work of the two first.

EDUCATION AT THE BRITISH ASSOCIATION.

TWO joint conferences were held, the first with Section H, on *Anthropometrics in Schools*. The report of a committee of Section H on anthropometric investigation in the British Isles was presented by Mr. J. Gray (secretary). The anatomical subcommittee reported on methods of taking chest measurements, on hair colours, and on iris colours. A series of schedules of proposed anthropometric measurements for the use of schools has been drawn up, suggestive as to what could be done with limited opportunities. A psychological subcommittee has drawn up a list of thirty-four mental characters, on which they suggest observations on a scale indicating average or more or less marked over or under development of each character. The educational subcommittee (Mr. E. N. Fallaizè, convener) states some of the aims of anthropometric observations in schools as the determination of averages and standard deviations, the correlation of physical and mental growth, the detection of the unfit, and the testing of the efficiency of different systems of education. Mr. J. Gray recommended that measurements and observations in all schools should be made in accordance with the scheme of the Anthropometric Committee of the British Association, that the data obtained should be entered on the card schedules, and each subject's dossier kept in an envelope as recommended by the committee. Dr. F. C. Shrubsall showed some lantern-slides of the results already obtained by anthropometric methods, including a comparison of the relative statures of Jewish and British children, the Jews leading at first, but both alike at age twenty-two; the heights of the professional, commercial, and artisan classes, the professional always leading; the percentage distribution of stature in Scotland, Liguria, and Sardinia, showing the Scottish stature as taller than the Sardinian; a map showing the average statures in different counties of the British Isles; the range of variation at different ages in schoolboys, showing that the tallest aged five was taller than the smallest aged ten. This demonstration was most impressive, indicating both the importance of the results already obtained and the risks of generalising from imperfect statistics or with inadequate knowledge.

The discussion thus begun was adjourned and continued throughout the afternoon. Sir Victor Horsley read a resolution already accepted in the committee of Section L:—"Resolved that, in view of the national importance of obtaining data on the question of physical deterioration, this association urges upon the Government the pressing necessity of instituting, in connection with the medical inspection of school children, a system of periodic measurement which will provide definite information on their physical condition and development." This resolution was afterwards adopted by the general committee of the association, and, pending further consideration by the council in November, it was agreed that it should be communicated to persons interested without delay.

Prof. M. E. Sadler hoped that a medical bureau would be instituted, preferably by the Board of Education, but with the cooperation of the medical staff of the Local Government Board and of the Home Office. It was desirable that the central authority should give supervision in order that observations may be made on a uniform basis. Mr. J. Ramsay Macdonald, M.P., regarded anthropometrics in schools as a necessary scientific basis for social legislation and educational policy. Mr. E. Meyrick, F.R.S., of Marlborough College, spoke on the practical difficulties in obtaining measurements of growth in schoolboys, perturbations and inaccuracies being so considerable that the final results were nearly valueless. Subsequent speakers, thinking perhaps of height rather than of growth (or difference of consecutive heights), freely declared that the accuracy of the measurements did not much matter so long as there were plenty of measurements used in the average, but no one indicated exactly what standards of accuracy were possible or desirable. Mr. Cecil Hawkins, of Haileybury, read a paper on types of physical development in schools. A series of diagrams was distributed having in each case age as the abscissa, and for ordinate either height, weight or girth. Across each of these a series of nearly equidistant curves was drawn to show the progressive development of twenty different grades of boys (each equally probable). This system makes it easy to plot the course of any individual boy and to compare him, not merely with the average, but also with his own type, and to see how his height, weight, and girth are losing or gaining relatively to each other. Prof. Findlay referred to the suggestions of Prof. Armstrong that more might be done to interest the scholars themselves in these measurements and in the necessary calculation of results.

The discussion on *The Scholarship System* afforded a full day's work, the morning being devoted to the transition from the primary school to the secondary day school, and the afternoon to the preparatory school, public school, and university. The opening paper, by Prof. M. E. Sadler and Mr. H. Bompas Smith, greatly assisted the discussion by focusing attention on points raised by their recent inquiry, the results of which will be most welcome on fuller publication. New sections of the community are demanding access to secondary schools, and it has become necessary either to extend the scholarship system or to embark upon a policy of free, or nearly free, secondary education under public control. Maintenance allowances are also necessary. The demand for secondary education has been accelerated by new regulations for the training of pupil-teachers. A scholarship system must give the opportunity of long training for individuals of unusual capacity, and not merely brief but widespread encouragement to average ability. The records kept of the later careers of scholarship holders are at present inadequate, but the evidence points to an overwhelming majority passing into literary, clerical, and other non-industrial callings. The scholarship question should be looked at from a national point of view, not only from the standpoint of the personal advantage and preferment of the individual scholar. Ability should be directed towards those callings in which the individual, by natural aptitude and by physical stamina, can best render valuable service to the nation. Hitherto preferential treatment has been given to the recruiting of the more literary professions. At present special advantage is given to urban districts. The fixed values of the scholarships at public schools and universities might well be reduced, but ample supplementary allowances should be given to those scholars who need them, after private inquiry into the circumstances of each case. The best examinations now conducted for junior scholarships are confined, so far as written tests are concerned, to papers in English and arithmetic. A simple oral test is desirable. The examiners should also have access to the pupil's school record. Stress should always be laid upon physical fitness; this would be an incentive to the healthy up-bringing of children and discourage neglect of the candidate's health. Mr. R. Blair,

executive officer L.C.C., reported that the 2000 scholars selected annually were about the number who were fit to take advantage of secondary education, but this number was much less than the 25 per cent. of free places which secondary schools, aided by the Board of Education, were required to provide. He agreed to the principle of an oral examination and to making a fair standard of physical development a condition of eligibility, but he warned the audience as to the difficulties in applying such tests; for instance, a missing limb was an obvious defect, but doctors might differ as to disqualifying for anæmia. Mr. H. Bompas Smith said that we needed scholarships to train girls for callings other than that of primary teaching, and a greater variety of secondary schools to meet different needs.

In the afternoon Mr. G. Gidley Robinson spoke on the scholarship system as affecting preparatory schools. The Rev. A. A. David, headmaster of Clifton College, thought that the money value of all scholarships might be reduced to something quite nominal, but sufficient to serve as a symbol of the intellectual distinction; the remainder of scholarship revenue might then be converted into augmentation funds. Dr. H. B. Baker, F.R.S., reported that at Cambridge about 17 per cent. of scholars could have resided at the University without their scholarships, while at Oxford the proportion was only 6 per cent. There might be a voluntary relinquishment of the emoluments of a scholarship by a wealthy parent, the other privileges of the scholar being retained. Not infrequently a former scholar, on attaining to fatter fortune, has paid back in some way the money that was the foundation of his fortune. Prof. H. A. Miers, F.R.S., thought that scholarships should be awarded by examinations of a less special character, and should be administered by the university. The present system of grouped colleges is a step in this direction. Any exhibitions given otherwise than by examination should be administered by the colleges. Scholarships are required for advanced and post-graduate work. The whole discussion indicated a marked advance of thought on the scholarship question. The difficulties were clear, especially the poverty question. Suggestions were numerous and helpful. The general agreement on the proposals made was very clear, and was emphasised by other speakers.

Sir Oliver Lodge read the report of the committee, consisting of Sir Oliver Lodge (chairman), Mr. C. M. Stuart (secretary), Mr. T. E. Page, Profs. M. E. Sadler, H. E. Armstrong, and J. Perry, Sir Philip Magnus, Principal Griffiths, Dr. H. B. Gray, Prof. H. A. Miers, Mr. A. E. Shipley, Prof. J. Findlay, and Sir William Huggins, appointed to consider and to advise as to the *Curricula of Secondary Schools*; in the first instance, the curricula of boys' schools. "The committee submit for consideration the following conclusions which they have reached as the result of their debates:—(1) There is need for secondary schools of different types, with different curricula or combinations of curricula, because (*a*) all boys are not suited to the same course of study; (*b*) the requirements of the various callings upon which the boys will subsequently enter differ considerably; (*c*) the needs of the schools differ in a considerable degree according to the economic conditions of the districts in which they are situated. . . . (2) The committee consider that one modern foreign language should in all cases be begun at an early age, but are of opinion that it would be a wise educational experiment to postpone the *systematic* teaching of Latin as an ordinary school subject until twelve years of age, and that such a change will prove sufficiently successful to warrant its adoption. . . . The committee also desire to record their opinion that the continued teaching of either of the two dead languages to boys who after serious trial have shown little or no progress in, or capacity for, such linguistic study, has little or no educational value; and that, though the mental training afforded by such study is of great value in the case of many boys, yet in the case of others such study not only produces no good results, but does positive harm to their mental and moral progress by reason of their incapacity to grapple with its difficulties. The committee go further, and express their doubt whether the authorities in some secondary schools have sufficiently recognised this fact or have provided sufficient alternatives to such linguistic study. (3) The committee deprecate any form of early specialisation in the education of children, and therefore regard with grave concern the fact that the entrance examinations at the great English public schools give undue prominence to the study of Latin (and Greek) in the course of education at the preparatory schools, the result being that too little time is available for (*a*) the teaching of the mother tongue, (*b*) manual training, (*c*) science and mathematics. (4) The committee would deprecate anything like State-imposed rigidity in the organisation and studies of secondary schools. . . . (5) The committee are of opinion that the curriculum in secondary schools suffers gravely from the number of subjects which have been crowded into it. . . . (6) The committee desire to see a great simplification in the arrangement of examinations for secondary schools, and they strongly recommend that examination and teaching should go hand in hand, the examiners cooperating with the teachers and acting in conjunction with them in order to further the interests of real education. The committee would urge upon the universities and professions to accept as qualifying for entrance the leaving certificates granted by each university to the schools which submit to its inspection. . . . The committee particularly deprecate any uniform or centrally administered examination applied to all the schools of the country. . . . (7) The committee feel that no scheme of secondary education can be satisfactory unless it is carried out by teachers of learning and force of character, and they would urge that every effort should be made, by conditions of appointment, by scale of salaries, and by retiring allowances, to attract a high class to the teaching profession, which should be regarded as a very laborious, but very honourable, form of public service. . . ."

In this and other discussions there was much keen criticism of the Board of Education. The burden of it was distrust in matters which could be put on a scientific foundation. A subcommittee of the curriculum committee has been appointed at the request of Mr. G. F. Daniell to report on the sequence of scientific studies. Prof. Armstrong directed attention to the dangers of State control, to the importance of manual training as a branch of intellectual education, and to the administration of the examination system, not with altruistic motives, but as a lucrative business. A committee of Section L has been appointed to watch legislative and administrative action. Dr. Anderssen, of Christiania, reported the gymnasium for boys of fifteen to eighteen years as divided into three branches, one with mathematics and science as the centre, one with modern languages, chiefly English and history, as the centre, and one with Latin as the centre. Prof. L. Morel, of Paris, spoke of France as a field for experiments. For the years fourteen to seventeen, boys are grouped in four sections. Section A is characterised by Latin and Greek, B by Latin and foreign languages, C by Latin and sciences, and D by sciences and foreign languages. The last is the normal course for those who learnt no Latin before fourteen or who choose to abandon it.

Mr. R. E. Thwaites reported the results of his inquiry into the *Conditions of Science Work in Secondary Schools*. The average number of boys in a class is twenty-one or twenty-two, but twenty should be the maximum for a laboratory class. The average expenditure per boy on apparatus and chemicals is about 1*l*. per annum in public schools and 8*s*. 6*d*. in secondary day schools. From two-thirds to three-quarters of the schools are satisfied with the number of the science staff, the laboratory accommodation, and the equipment of apparatus, but little more than half have any laboratory assistant, the more expensive time of the science master being spent on details which could be performed less expensively by an assistant.

A joint meeting was held with Sections D and K on *The Teaching of Biology in Schools*, introduced by a paper from Mr. O. H. Latter, of Charterhouse. In the preparatory school and lower forms of public schools the standard indicated as "nature-study" seems the best form of science training. Common animals involving direct personal observation were more suitable in the next stage than the "type-method" with its underlying idea of

evolution. A year of chemistry and physics might be interpolated before physiology. With older and cleverer pupils pure nature-study methods become insufficient. As the mind matures it must have more solid matter to digest. The theory of evolution was beyond the grasp of any but the best class. Prof. Hickson agreed that the ordinary course of biology was unsuitable for schools, but possibly best for the teachers. Prof. Marcus Hartog advocated accurate detailed descriptive and systematic work in botany as the remedy for a certain fluffiness of observation and description in nature-study.

The report on curricula deals in the first instance with boys' schools. The girls' schools had their turn when Prof. H. E. Armstrong addressed the section on *The Need of a Scientific Basis to Girls' Education from a Domestic Point of View*. Women should cease from competing with men to the neglect of their own interests and natural duties. A scheme of scientific education for girls might radiate from the household. Instead of chalk and salt, the common materials of the household, flour, starch, coal, meat, sugar, &c., might be used as starting points for a girl's study of science. The science of bread-making would lead to a general cooperation of all studies helpful to that end. The committee of Section L would like Prof. Armstrong's paper to have been published in full. It was a powerful enforcement of ideas advocated by Prof. Smithells in York.

The remaining hours were devoted to a discussion on *Types of Specialised Teaching*. Mr. J. H. Hawthorn, of Leicester, spoke on the teaching and the teacher in evening technical schools. The type of evening student has been changing, there are fewer adult workmen, and the average age is lower than ten years ago. No student should take a trade class until he has laid a foundation of pure science. Good results were obtained by a science teacher with a competent artisan demonstrator. The teacher keeps abreast of the trade when he is known to local factory owners, appreciated by them, and encouraged to visit factories. Mr. C. T. Millis, of the Borough Polytechnic spoke on problems of trade education considered in relation to our school system. Reforms are needed in our elementary-school education to make it an effective preparation for the battle of life, especially for those children who will take up industrial work. Too much attention has hitherto been given to those going into clerical occupations. The types of schools required are specialised trade schools for boys and girls of fourteen to sixteen years of age teaching definite trades, and also preparatory trade schools teaching practical mathematics, drawing, and science. The course must be planned to fit the elementary school at one end, and also to fit the system of apprenticeship followed in each trade. The labour market must be watched to guard against mistaken specialisation. The teacher of trades must have had trade experience in the factory. Cooperation of parents, teachers, employers, and trade-union leaders was necessary. Mrs. J. Ramsay Macdonald described the day trade schools for girls in greater detail. Women's work is double, wage-earning in factory and responsibility at home. To look upon the former as unimportant is disastrous to women wage-earners. There are now day classes in waistcoat-making, dressmaking, corset-making, and ladies' tailoring. The pupils mostly hold scholarships with maintenance grants. Six half-days are devoted to trade teaching, four half-days to general instruction. The trade teachers have come straight from good positions in the workroom. The pupils' development, not customers' convenience, is the first consideration.

An excellent paper on technical training of the rank and file, by Mr. J. C. Legge, of Liverpool, was in reserve, but under pressure of time and in his regretted absence it was distributed in abstract and taken as read.

It was most gratifying to have so good a discussion on these matters of technical and industrial training, which have been a special interest to the president, Sir Philip Magnus. Although not referred to in Section L, no account of technical education at the British Association would be complete without mention of Prof. S. P. Thompson's suggestions in Section G for the abolition of premium apprenticeship, and the opening of the best opportunities in engineering works to merit and not to wealth. From Section D we cull another pregnant idea. The little procession of blue-eyed and brown-eyed school children brought by Mr. Hurst from Burbage inevitably suggests the possibility of our pupils having Mendelian minds as well as Mendelian eyes.

The brief interim report on the conditions of health essential to the carrying on of the work of instruction in schools, presented by Sir Edward Brabrook, may seem inadequate to represent the interest of the association in such matters. But papers on school hygiene were deliberately avoided this year as the most effective method of supporting the simultaneous congress in London.

Two exhibitions were organised, one an exhibition of work representing practical and observational studies collected from the Leicester Council Schools by Mr. Charles Bird. The exhibition of school-science apparatus collected from several important schools by Mr. R. E. Thwaites was conveniently adjacent to the section room.

H. R.

LOCAL SOCIETIES AT THE BRITISH ASSOCIATION.

THE number of delegates from the local scientific societies which are in correspondence with the British Association was exceptionally large at the conference held during the Leicester meeting. Mr. H. J. Mackinder opened the session, in the council chamber of the municipal buildings, by an address on the advancement of geographical science by local scientific societies. He pointed out that in France there are about twenty local societies devoted to geographical study, each taking a region nearly corresponding with one of the old provinces, whilst in Germany there are many societies working specially for the furtherance of local geography. In this country each provincial scientific society should seek to correlate, from a geographical point of view, all the facts obtained by specialists in its own locality, taking as a basis a natural area rather than a county boundary. From such correlation, if undertaken by a person of special training, deductions could be drawn which would be of great value to specialists in the future. Until systematic work of this kind is accomplished on uniform principles throughout the country, no complete geographical conception of our land is possible. Captain Dubois Phillips, representing the Liverpool Geographical Society, referred to the stimulus which should be given to the rational study of geography by local societies through the influence of the British Association; and Dr. H. R. Mill bore testimony to the inspiriting character of the discourse, but feared that the complete realisation of Mr. Mackinder's scheme must be far distant.

At last year's conference of delegates it was suggested that the British Association should be asked to appoint a committee to organise a general photographic survey of the country, county by county. The suggestion was carefully considered by the Corresponding Societies Committee, but it was felt that the scheme was too vast to be taken up by the British Association. At the same time, it was considered that some section of the suggested work, such as archæology, might perhaps be advantageously undertaken. A discussion was therefore initiated by the Rev. R. Ashington Bullen, who read a paper at the Leicester conference on the advisability of appointing a committee for the photographic survey of ancient remains in the British Islands. The anthropological section held, however, that such work might be fairly undertaken by the committee which already exists for the collection and registration of anthropological photographs. As the result of much discussion the following resolutions, on the motion of Mr. W. Jerome Harrison, of Birmingham, were sent up to the Committee of Recommendations and ultimately referred to the Council:—That it is advisable to obtain information as to the present state of things in Britain, in connection with photo-survey work; to publish instructions, or give advice, for the execution of a scientific photographic survey; and to endeavour to found or promote a photo-record of the town and district in which the British Association holds its annual meetings.

At the second meeting, presided over by the Rev. J. O. Bevan, the local societies were urged to give greater

attention to the study of the fungi occurring in their districts. The subject was introduced by Mr. Carleton Rea, of Worcester, at the instance of the British Mycological Society. It was pointed out by Mr. Rea that British botanists generally omit fungi from the county floras, or give lists that are compiled without the necessary local knowledge. Yet the group ill deserves neglect, for it is one of great economic importance. It is said that the cereal rusts cost Prussia in one year 20,900,000*l*. To encourage the study of British fungi, the Woolhope Naturalists' Club in 1868 instituted a series of autumnal forays, and some other natural-history clubs, like the Essex Field Club, have followed the example; but this occasional study is insufficient. The fungi should be studied throughout the year, and specimens displayed for exhibition at all times in the society's rooms or in the local museum. In the course of the discussion, Prof. J. W. Carr, of Nottingham, and some other naturalists, dwelt on the difficulty of working out the fungi of a given district in consequence of the general lack of expert knowledge. Mr. Rea, however, considered it the duty of each society to be able to determine the fungi of its own area, without submitting them, except in difficult cases, to a mycological referee. A large collection of hand-coloured photographs of fungi, taken by Mr. A. Wallis, of Kettering, was exhibited by Mr. H. N. Dixon.

Several delegates from the sections explained in what way the local scientific societies might aid the sectional committees. Mr. Wilfrid Mark Webb appealed for specimens of centipedes in illustration of a work on which he was engaged, but the Rev. Thomas Stebbing explained that his repeated request for well-shrimps had met with no response from any of the local societies through their delegates.

HEALTH AND EDUCATION.

THE Health Education League of Boston, Massachusetts, U.S.A., has issued a series of small pamphlets dealing with the common aspects of our daily life from a health point of view. Mrs. Ellen H. Richards appears to be the moving spirit in this useful sanitary campaign, and with her are associated as writers of pamphlets and directors of the league several medical men. The usefulness of the hints contained in these tiny publications is undoubted, all the more so because they are tiny, and because the facts they set forth are stated in terms readily to be understood by everyone.

The first of the series gives "Hints for Health in Hot Weather." In it we find sensible remarks, under the heading of "Rules for Children," "Cleanliness," &c., concerning the general bringing up of children, but, except the benefits of sunshine and the use of wire screens to keep out mosquitoes, we are told all too little about bodily protection in hot weather.

No. 2 of the series deals with milk. The story of milk as a food and as a vehicle of disease is admirably told. The meaning of unwholesome milk, how it is brought about, and how prevented by chilling and sterilising, is described and fully explained; the information contained in this pamphlet is an education to the public in the very best sense.

"Colds and their Prevention" is dealt with in series No. 3. Under this heading the subject of ventilation is skilfully introduced. The care of the skin and of the feet is also incorporated in the text.

No. 4 of the series is concerned with "Meat and Drink." Good nutrition is held to be of vital importance to our courage, cheerfulness, and physical efficiency, and the meaning of cooking and the effects of boiling, roasting, frying, &c., scientifically yet simply explained.

"Healthful Homes" is the subject of No. 5. The moral atmosphere of family life is dwelt upon as an important factor in national life, and the practical details of elementary hygiene and sanitation are here collected and set forth in admirable fashion.

"The Successful Woman" (series No. 6) pamphlet tells the business woman how to keep well, and good and sensible rules and suggestions are laid down for her guidance. Most of us would hesitate to stamp a business woman, that is, one whose chief ideal is to keep well, so "that she may earn a full salary," as one of nature's successful productions. That women should be compelled to, or by choice, take to business cannot but be regarded as one of the blots of our civilisation of which we ought to be heartily ashamed. To stamp a woman so engaged as a successful woman is rather encouraging woman along a side-path of doubtful benefit to the race.

"The Boy and the Cigarette" (series No. 7) should be read by everyone, and the recommendations against this poisonous and harmful practice should be stringently enforced by law in the case of boys. Women are warned that neither their brothers nor their admirers think better of them for smoking cigarettes. A woman who smokes is spoken of in a ribald manner, did women but know it, by men in private, and their morality made a subject of question and banter.

"The Care of Little Children" (series No. 8) is replete with good advice, and can be heartily commended; and the fact that the future health and welfare of the individual is mostly determined by the wisdom or folly bestowed upon the infant during the first few weeks of life pointedly brought home.

"The Plague of Mosquitoes and Flies" constitutes the subject of series No. 9. It is a timely contribution, and contains the most recent lessons we have learned concerning the spread of disease. We know within recent years that our household pests and pets, the flies, fleas, bugs, and other vermin which inhabit our houses, and our dogs, cats, fowls, mice, rats, &c., are frequent media of the transmission of diseases. It is a great advance in knowledge, one of the greatest hygienic advances since Parker first brought the subject systematically before the world. This pamphlet should be distributed broadcast, and the subject it deals with taught in every school.

No. 11 of the series points out, under the title of "Tonics and Stimulants," the necessity for temperance in the use of alcohol, tea and coffee, and drugs. The lessons in this short pamphlet are well taught, and the advice wise and wholesome.

The series as a whole is an unfortunate necessity. It implies that mankind, in modern days, has so lost touch with nature and nature's ways that the instinct of the care of the young, which belongs in common to all animals, is a lost attribute of modern men and women. Perhaps it is wise to recognise the fact; and being recognised, we can conceive no better method of repairing the loss than by the publication and wide distribution of information such as we find in the series before us.

THE INSTITUTION OF MINING ENGINEERS.

THE annual meeting of the Institution of Mining Engineers, held at Sheffield on September 4, 5, and 6, was attended by a large number of members. Cordial addresses of welcome were delivered by Mr. J. R. R. Wilson, president of the Midland Institute of Mining Engineers, by the Lord Mayor of Sheffield, and by Mr. A. J. Hobson, speaking on behalf of the Chamber of Commerce and of Sheffield University, who kindly lent the Firth Hall for the occasion. Mr. C. E. Rhodes was elected president for the ensuing year, and the report of the council, read by the secretary, Mr. M. Walton Brown, recorded a year of satisfactory progress. The institution is a federation of seven local mining societies, and its membership has grown from 1239 since the foundation in 1889 to 3100 at the present time. During the past year sixty-eight papers of a varied nature were published in the Transactions. Mention was made of the efforts being made, in conjunction with the British Science Guild, to secure a reduction of postage on the publications of scientific societies, and of the reports submitted by Mr. J. A. Longden, representative of the institution at the British Association, and by Mr. Bennett H. Brough, representative of the institution at the testing congress in Brussels. It was also noted that Mr. Arthur Sopwith, senior past-president, represented the institution on the governing body of the Imperial College of Science and Technology.

Three papers were read and discussed. The first, by Mr. J. W. Fryar and Mr. Robert Clive, described the

sinking of two shafts through 100 feet of quicksand at Bentley Colliery. In the second Mr. H. T. Foster dealt with the subject of roof weights in mines, his views being deduced from observations in long-wall workings. Lastly, Mr. H. St. John Durnford described a deep boring put down on the Earl of Londesborough's estate, near Selby, in the hope of finding a workable seam. Although some 1060 feet of Middle Coal-measures strata were proved, boring was continued to a depth of 2371 feet without any good seam being encountered. It is probable that the bore-hole passed down through the limb of a fold where the seams had either thinned or pinched out altogether. In the afternoon of September 4 the members visited the Tinsley steel, iron, and rope works, and the East Hecla works of Hadfield's Steel Foundry Company, Ltd. At the dinner in the evening Sir William Clegg, in proposing the toast of the Institution of Mining Engineers, incidentally referred to the new Imperial College of Science and Technology, and stated that a deputation from Sheffield had waited upon Lord Crewe to urge that mining and metallurgy should be taught at Sheffield in the centre of mining and metallurgy, rather than centralised in London.

On September 5 the members visited the Clyde Steel Milling Works, Bentley Colliery, and Silverwood Colliery; and the meeting concluded with a drive, on September 6, to the Derwent Valley waterworks.

METEOROLOGICAL OBSERVATIONS.

SEVERAL reports of meteorological observatories have recently been received, and four of them are of noteworthy interest. The report of the observatory department of the National Physical Laboratory for 1906 shows that the value of the instrumental certificates is very generally appreciated; the increase in the number of instruments verified during the year amounted to more than 2900, the total being 29,567. There was a marked increase in the number of marine chronometers submitted to trial, more than 20 per cent. of which failed to pass the test. In the magnetic department the curves were free from any large disturbances. The largest movements of the seismographs occurred on January 31, April 18, and August 17, the dates of the Colombian, Californian, and Chilian earthquakes. The meteorological observations show that shade temperatures exceeding 80° were recorded in each of the four months June–September, the extreme reading being 91°.8 on September 1. Rainfall amounted to 23.68 inches (nearly half an inch below the average for Greenwich for the sixty-five years 1841–1905); the greatest daily fall was 2.36 inches on June 28, and was within half an inch of the total amount for that month.

The report of the director of the Bombay Government Observatory for 1906 gives room for little comment, excepting that the operations, which deal especially with terrestrial magnetism, meteorology, and seismology, were carried out with the usual care and punctuality. The maximum temperature was 94° on October 23, being only about 2° higher than the extreme reading recorded at the Kew Observatory. Owing to concussion from exceptionally heavy gun-firing at Colába the dry-bulb thermograph was broken in June. The yearly rainfall amounted only to 56.3 inches, being nearly 19 inches below the normal of twenty-four years (1873–96). Milne's seismograph registered fifty-nine earthquakes during the year; of these three were very great disturbances, viz. January 31, August 17, and October 24; the two first mentioned correspond to the dates of the Colombian and Chilian earthquakes.

The fiftieth year-book of the Austrian Central Meteorological Office, for 1905, contains hourly and daily observations at some selected stations, as before; the results at other stations are arranged either according to the international scheme or in tables showing monthly and yearly means and extremes. The stations number 412, of which fifty are more than 1000 metres (3280 feet) above sea level; this number in no way represents the whole of the valuable Austrian meteorological work, as there are several independent organisations dealing more particularly with rainfall and temperature, the principal of which is the hydrographic department, with more than 1000 stations, for eighty of which the observations are printed *in extenso*. The Hungarian and other meteorological services also issue separate year-books. The Vienna Meteorological Office deals specially with earthquake phenomena and with the collection and discussion of thunderstorm observations, the results of which are printed separately; it also publishes a daily weather report, and takes an active part in the investigation of the upper air by means of balloons.

In the annual report of the meteorological department of the Transvaal for the year ended June 30, 1906, the results of observations are well arranged in appendices, as before; the hourly readings at Johannesburg are not now printed *in extenso*, but MS. copies are available, on loan, for special inquiries. The stations have increased in number to 376, most of which record rainfall only; all the observers are volunteers, or are attached to other departments. The rainfall was considerably below the average in all parts except in the S.W., where the defect was only slight; no snowfall was reported during the year. A forecast of the weather for the ensuing twenty-four hours is now exhibited at every postal telegraph station in the Transvaal. The director (Mr. R. T. A. Innes) seems dissatisfied with the Campbell-Stokes sunshine recorder, which only shows the time during which the sun is sufficiently powerful to burn the cards; in future reports both the duration and burning times will be given.

RUSSIAN SCIENTIFIC WORKS.

THE Imperial University of Kazan, with its society of naturalists, is noted for excellent work in many departments, and we are greatly impressed with the magnitude of Mr. M. Ruszky's volume "The Ants of Russia" (*Formicariae Imperii Rossici*), of which the first part lies before us. It consists of 800 pages, with 176 sketches, comprising an introduction, bibliography, systematic examination of Russian ants, list of collectors to whom the author is indebted, and indexes. Mr. Ruszky began the study of Russian myrmecological fauna in 1892, when he undertook a zoological excursion in the Kazan and Simbirsk governments on behalf of the Society of Naturalists. He was induced to take up this investigation partly because Russian ants had been very little studied, and partly for the collection of materials for the solution of biological and zoo-geographical questions. This work is to be understood as a preliminary array of results, being an attempt at a description of Russian ants in systematic geographical and biological respects. The author anticipates criticism for omission of questions of internal morphology and embryology, and observes that such exhaustive treatment of the Formicidæ by a single investigator would occupy, not one, but many decades. In the important bibliography of writings on ants, occupying with addenda about seventy pages, very few works are devoted to Russia, chief among the number being twelve by the author. Mr. Ruszky estimates the approximate total of species and subspecies known at the time of writing at 3500, and groups Russian ants under the subfamilies Camponotinæ, Dolichoderinæ, Myrmecinæ, and Ponerinæ. Representatives of Dorylinæ, principally found in the tropics, have not been seen in Russia, though one species (*Dorylus juvenculus*) is European, being found in southern Italy, Sicily, &c. After some useful preliminary notes and tables of species of Russian ants, the author proceeds to detailed descriptions of smaller groups. In all, 258 forms are described (155 species and races, 103 varieties), of which sixty are new and treated for the first time (subfamilies, Camponotinæ, 109; Dolichoderinæ, 7; Myrmecinæ, 138; and Ponerinæ, 4). The regions richest in myrmecological fauna are the Caucasus, with 130 forms; Russian Central Asia, about 112; European Russia, 92; Siberia, 71; Crimea, 43; and Finland, 32. All these figures are approximate, and it is probable that since this work appeared more results have been recorded. This first part gives geographical distribution, locality, and biological information, and in the second Mr. Ruszky proposes to deal with this fauna from the bio-geographical point of view.

Vol. xxxiv. of the Transactions of the St. Petersburg

Society of Naturalists, edited by Mr. J. Borodine, is devoted to botany. Mr. Y. N. Voronoff describes his botanical excursion in the summer of 1902 in Abhasia (Caucasus). The whole region is rich in Alpine flora, of which the writer collected thousands of specimens and hundreds of species. Mr. Voronoff supplements Alboff's work on the flora of Colchis, and gives a list of 129 plants, of which four are newly described. Mr. E. Ispolatoff's article on the vegetation of the eastern portion of the Novgorod government contains descriptions and lists of that found in forest, marsh, and meadow land respectively, with observations on the influence of man upon local vegetation. He notes that localities suitable for human habitation are also favourable to vegetation. The presence of primitive Siberian flora in certain districts is accounted for by the wild, sparsely populated nature of the country, as contrasted with the more cultivated areas of western Russia. Mr. Ispolatoff gives a list of local names of plants, *e.g. Cypripedium calceolus* (Adam's head), *Aegropodium podagraria* (bear's paw), Ranunculus (jaundice, hen's blindness). The bulk of the journal is occupied with Mr. Leonid Ivanoff's papers on phosphorus and its relations to plant life, with results of experiments. Mr. J. L. Serbinoff furnishes preliminary notes on water plants and fungi of the Crimea, a field scarcely studied. The mountain districts are poor in water plants, while there are more in the south, but on account of their comparative rarity considerable time must elapse before a complete list can be compiled.

There is a wealth of interest for the geologist in part v. of vol. xxxiii. of the Transactions of the St. Petersburg Society of Naturalists, devoted to geology and mineralogy. Mr. W. Lemann writes on the Jurassic deposits of Orlovka, and furnishes a plate of fossils. Mr. B. Popoff describes a new method of investigating spherolithic formations, with diagrams. Besides notes on diabasic rocks on the shores of Lake Onega, by Mr. S. A. Jakovleff, and on the island of Pargas, by Mr. Sustchinsky, Mme. Jeremina and Mr. Loewinson-Lessing describe expeditions in the Mugodjaren (Ural) mountains, and the former writes on the spherolithic formations in this range, with numerous illustrations. *Résumés* of the articles appear, mostly in German.

In part ix. of vol. xxxvii. of the Journal of the Physico-chemical Society of St. Petersburg University appears a list of minutes and papers, the volume containing more than 1300 pages. Mr. V. Menschutkin writes on the action of water on etherates and combinations with ether-salts, and Mr. A. Gorboff on the static character of the equilibrium of physicochemical systems. Mr. E. Orloff furnishes a new synthesis of benzylideneimides, and a lengthy paper on the phosphorescence of some organic compounds between $+100°$ and $-190°$ appears from the pen of Mr. P. Borissoff. The purpose of Mr. Borissoff's work was to examine the influence of temperature on the phosphorescence of certain organic compounds, and to determine the relation of fluorescence to phosphorescence. A memoir of Mr. V. A. Mokievsky, a promising laboratory worker cut off all too soon, is given by Mr. S. Lebedeff.

In part ii. of vol. xxxv. of the Transactions of the St. Petersburg Society of Naturalists, Mr. V. N. Tonkoff describes experiments in embryology in connection with dual formations, and gives a bibliography of works on embryology, development, abnormal formations, &c. The writer appears to be of opinion, judging by results of experiments by pressure and osmosis on the eggs of frogs, fish, and medusæ, that similar results would be produced in the case of other ova. This article is illustrated by two plates. Mr. A. V. Zhuravsky contributes notes of a zoological journey in the Siberian tundra. This region, largely volcanic, has been summed up as "dead land (*i.e.* clay) and lakes." For the naturalist there is abundant material for study in the lakes and on the sloping shores. Of the fauna, *Mus amphibius* is very prevalent, and finds its way on board steamers and other craft as an emigrant. A list of mollusca occupies several pages. A short *résumé* in German follows each article.

Vol. xxxv., part iv., of the Transactions of the St. Petersburg Society of Naturalists, devoted to zoology, is chiefly taken up with articles by Mr. W. M. Schimkevitch, one of the editors. He is responsible for notes on the development of Thelyponus, experimental observations of the eggs of *Philine aperta*, and a preliminary article on the theory of mutation. His paper of more general interest is that on the instincts of domestic animals, in which certain well-known habits of the dog are discussed, as burying of bones, &c., without apparent reason. Most of these are followed by a German *résumé*. The concluding article, by Mr. S. Susloff, treats of phagocytes in relation to insects, with diagrams and a bibliography.

Mr. N. Andrussoff has issued part i. of his materials for the geology of the Aralo-Caspian region (Transactions of the Aralo-Caspian Expedition), which he has studied for twenty years at intervals. The places covered in this part include the Krasnovodsk peninsula, Great and Little Balchan, Djanak, and Ustiurt. Notwithstanding its proximity to Krasnovodsk and the railway, the geological features of the Kubadagh have been very little studied. In his first chapter Mr. Andrussoff summarises the work of previous explorers since Eichwald visited the neighbourhood in 1825. The work is illustrated with plans, sections, and views.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

THE professor of mechanical engineering at the City and Guilds Technical College, Finsbury, is about to appoint a chief assistant to take charge of the new engineering laboratory. Particulars of the appointment will appear in our advertising columns.

THE question of the extent of the training in science, and especially in physics, which one who intends ultimately to become a physics teacher should receive at the high-school stage of his career, is treated with great insight by Dr. K. T. Fischer, of Munich, in a recent article in *Natur und Schule*. It will be remembered that Dr. Fischer spent some time in this country investigating our methods of teaching science, and that his observations are embodied in his book "Der naturwissenschaftliche Unterricht in England." His present article is largely a plea that even at this stage the future teacher should be brought into close contact with physical apparatus, and should be taught to handle simple tools and fit together apparatus. Dr. Fischer's ideal of a teacher is one who by the end of his training has not only learnt to read with understanding the original work of the great masters, but has carried out a piece of research himself. He recognises, however, the difficulty of his last demand even in his own country, and we in this country must, we fear, look on it as a counsel of perfection for many years to come.

THE new syllabus of classes at the Sir John Cass Technical Institute, Aldgate, shows that the work of the various departments has been considerably re-organised since last year. Apart from systematic courses in physics, mathematics, and chemistry, special courses of instruction are now given in physical chemistry, brewing and malting, and in several branches of advanced physics, including radio-activity. The course in physical chemistry includes general physical chemistry, electrochemistry, and a laboratory course of practical work; the instruction in brewing and malting also includes laboratory work of a technical character in addition to a course of lectures designed for those engaged in the brewing and malting industries. The teaching in metallurgy, which for the past four years has formed a distinctive part of the work of the institute, has now been established as a separate department, and a full graded curriculum extending over three years is provided.

THE London County Council desires to direct attention to the facilities offered for evening instruction in the various institutions maintained by it or under its control. In the various polytechnics, technical institutes, and schools of art situated in the county, classes in science, art and technology, music, artistic handicrafts, &c., will be re-opened towards the end of the present month. These institutions provide instruction of an advanced or technical character. The council offers annually scholarships and exhibitions to the total value of 1500*l.* for competition among students of polytechnics, technical insti-

tutes, and art schools. In thirty-six London County Council schools, centres for instruction in commercial and science and art subjects will be opened. These centres are in a degree contributory to the polytechnics and technical institutes mentioned above and are primarily intended for students not sufficiently advanced for the polytechnic classes. Advanced work, however, is taken in many of the subjects. In 237 London County Council school buildings situated in every part of London, ordinary evening schools will be opened this session. The instruction will, as a rule, be of a character preparatory to that given in the centres.

THE educational demands of the organised workers of this country are expressed in the following points of a resolution adopted at the Trade Union Congress at Bath last week:—(1) The State maintenance of school children. (2) Scientific physical education with individual medical inspection, and records of the physical development of all children attending State schools, and skilled medical attendance for any requiring it, and in order to secure this:—(*a*) The formation of a properly staffed medical department at the Board of Education, the head of which shall be directly responsible to the Minister of Education, to whom he shall report annually. (*b*) The payment of an adequate grant from the Imperial Exchequer for purposes of medical inspection. (*c*) The establishment under every education authority of scientifically organised open-air recovery schools, the cost to be borne by the community as a whole, and not in any part by charitable contributions. (3) The complete dissociation of reforms (1) and (2) from Poor Law administration. (4) A national system of education under full popular control, free and secular from the primary school to the university. (5) That secondary and technical education be an essential part of every child's education, and secured by such a reform and extension of the scholarship system as will place a maintenance scholarship within the reach of every child, and thus make it possible for all children to be full-time day pupils up to the age of sixteen. (6) That the best intellectual and technical training be provided for the teachers of the children, that each educational district shall be required to train the number of pupil teachers demanded by local needs, and to establish training colleges, preferably in connection with universities or university colleges. (7) That the provision of educational buildings and facilities be obligatory upon the local authority, who shall always retain administrative control of the buildings and facilities so provided. (8) That the cost of education shall be met by grants from the Imperial Exchequer, and by the restoration of misappropriated educational endowments. (9) That it be an instruction to the Parliamentary Committee of the Trade Union Congress to formulate these proposals in a Bill to be laid before Parliament during the forthcoming session.

FROM tables published in *Science* of August 30, it appears that the total number of degrees of doctor of philosophy and doctor of science conferred by the universities of the United States this year was 327, which is almost exactly the same as in 1905 and 1906, when the numbers were, respectively, 325 and 326. The average number for the past ten years is 271. Of 2715 doctorate degrees conferred during the past ten years, 1232, somewhat less than half, have been in the natural and exact sciences. The relative proportion of degrees in the humanities and in the sciences has not altered appreciably in the ten years covered by the statistics. The Johns Hopkins has conferred more degrees in the sciences than any other institution, but is closely followed by Chicago, and at a not very considerable distance by Harvard, Columbia, and Yale. Fifty-five per cent. of the degrees conferred at the Johns Hopkins have been in the sciences, and 57 per cent. at Cornell, whereas in the other leading institutions the percentage is decidedely less—46 at Chicago, 42 at Harvard and Columbia, and 40 at Yale and Pennsylvania. Of the 1232 degrees conferred in the sciences during the past ten years, chemistry leads with 320 doctorates; then follow in order of numbers, physics, 155; zoology, 147; psychology, 134; botany, 126; and mathematics, 121. The remainder of the degrees are divided among fourteen other sciences, meteorology and geography being at the bottom of the list with one doctorate each.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, June 27.—"On the Force required to Stop a Moving Electrified Sphere." By G. F. C. **Searle**, F.R.S.

If F be the force which must be applied to the sphere at any time t, after it has been brought to rest at $t=0$, the positive direction of F being opposite to that of u, the initial velocity, the momentum given up by the electromagnetic field from $t=0$ to $t=t$ is

$$\int_0^t \mathrm{F}dt.$$

During this period the force F does no work, since the sphere is at rest, and hence the energy is unchanged during this period.

At the time t let the sphere be restarted with the same velocity u without change of direction, and let G be the force which must be applied to the sphere at any subsequent time in the direction of u in order to maintain the velocity u. This force lasts from $t=t$ to $t=t'$, where $t'-t$ is determined by the condition that in the time $t'-t$ the pulse formed on restarting the system has completely passed over the sphere. During the interval $t'-t$, the momentum is increased by

$$\int_t^{t'} \mathrm{G}dt,$$

and hence the total gain of momentum is

$$\int_t^{t'} \mathrm{G}dt - \int_0^t \mathrm{F}dt.$$

During the interval $t'-t$, the energy has been increased by

$$u\int_t^{t'} \mathrm{G}dt.$$

The stopping and the restarting of the sphere each give rise to a pulse, and the compound pulse so formed carries off energy W′ and momentum P′. Before the system was stopped the energy of the electromagnetic field was U+T and its momentum was M, and at an infinite time after the stopping and restarting the energy is U+T+W′ and the momentum is M+P′, since the energy and momentum in the parts of the field outside the compound pulse ultimately vanish.

Equating the two expressions for the gain of momentum, we have

$$\int_t^{t'} \mathrm{G}dt - \int_0^t \mathrm{F}dt = \mathrm{P}'.$$

Similarly,

$$u\int_t^{t'} \mathrm{G}dt = \mathrm{W}'.$$

Hence

$$\int_0^t \mathrm{F}dt = \mathrm{W}'/u - \mathrm{P}', \qquad (1)$$

and thus we find that the force required to stop the system is given by

$$\mathrm{F} = \frac{d}{dt}\left(\frac{\mathrm{W}'}{u} - \mathrm{P}'\right). \qquad (2)$$

This force will become zero as soon as $\mathrm{W}'/u-\mathrm{P}'$ becomes constant, which will occur as soon as t is so great that the two pulses due to the stopping and restarting do not overlap.

It follows from (2) that, if F_0 be the force required to stop a sphere of radius a with a uniform surface-charge Q,

$$\mathrm{F}_0 = \frac{\mathrm{Q}^2}{2\mathrm{K}a^2}\left(\frac{v}{u} - \frac{v^2-u^2}{2u^2}\log\frac{v+u}{v-u}\right),$$

where v is the velocity of light. When the sphere has a uniform volume-charge

$$\mathrm{F} = \tfrac{3}{8}a^{-4}(16a^3vt - 12a^2v^2t^2 + v^4t^4)\mathrm{F}_0.$$

PARIS.

Academy of Sciences, September 2.—M. A. Chauveau in the chair.—Caryolysis in the nidorian glands of *Genetta senegalensis*: Joannes **Chatin**. A study of nuclear degeneration in the perineal glands. It is shown that this is a case of true caryolysis, exactly corresponding to the disappearance of the nucleus in the true sebaceous cell.—Physically similar fluids: M. **Jouguet**.—The action

of gravity on the deposit of induced radio-activity: Mme. **Curie.** Metallic plates were submitted to the action of a fixed amount of emanation for a fixed time, and the induced radio-activity measured. The results obtained were as if the induced radio-activity suspended in the gas surrounding the plates behaved as solid particles, possessing weight, and falling through the gas. The activity of plates turned towards the top of the vessel was always greater (two to five times) than that of those turned towards the bottom or hanging vertically. The presence of a gas was found to be indispensable to this phenomenon, the effects not being observed when the pressure was reduced below 2 cm. of mercury. The presence of water vapour was also a necessary condition.—The radio-activity of uranyl molybdate: B. **Szilárd.** In a recent note M. Lancien stated that he had prepared a uranyl molybdate the activity of which was much higher than that of the original uranyl nitrate. In all previous researches on the subject the activity of uranium preparations has always been found proportional to the amount of uranium present in the salt, and less than that of pure uranium. The author has therefore repeated the experiment of M. Lancien, preparing the molybdate in the same manner, but with opposite results. The activity found was about 0·3 that of metallic uranium, a normal figure for the amount of uranium present in the salt.—The effect of metallic wire screens on the secondary radiation of induced radio-activity: Ed. **Sarasin** and Th. **Tommasina.**—*Cyperus tuberosus* in the auriferous strata of Madagascar: H. **Jumelle** and H. Perrier **de la Bathie.**—Intra-organic oxidation and the electric charge of leucocytes as important agents of immunisation: Alexandre **de Poehl.**—The relation which exists between the distribution of petroleum-bearing regions and the distribution of seismic zones: L. C. **Tassart.** A comparison of the seismic maps of M. de Montessus de Ballore and the map of the petroleum-bearing regions of B. Redwood shows that all the petroleum deposits which are found in relatively recent strata are situated in the maximum seismic zones or in their immediate vicinity. In these seismic zones there may be petroleum deposits in relatively ancient strata, but this is exceptional. Petroleum deposits which are found outside the seismic zones are situated in ancient strata, and in regions which at some time or other have been the seat of important seismic disturbances.

NEW SOUTH WALES.

Royal Society, June 5.—Mr. H. Deane, president, in the chair.—Some peculiarities in our coastal winds and their influence upon the abundance of fish in inshore waters: H. C. **Dannevig.** Careful comparison between the catches of fish in certain coastal waters and the number of men employed has shown that the average catch per man in each locality is greater in some years than others. Also it is apparent that this fluctuation in abundance of fish is uniform all along the coast; thus in 1898 there was a general scarcity of fish; each man then captured less than during previous and succeeding years. This was followed by a gradual increase until 1901, when a climax was reached; a gradual decrease in the catches followed, until in 1905, when the results were as poor as in 1898. Last year shows a tendency to improvement. These periodic increases and decreases in the abundance of fish all along the coast at the same time are not traceable to the action of the fishermen, but can alone be due to certain climatic changes. A careful examination of the wind records from this coast for the last twenty-four years has furnished important evidence in explanation; it is this: by measuring the winds' influence by the number of *inches* they blow from each point during a twelvemonth, it is found that almost every year the atmosphere is on this coast pushed *northwards* to the extent of many thousands of miles, and not in the opposite direction as usually thought. But this northerly movement—or the yearly dominating wind—as the resultant may be called, does not invariably follow the same direction; it has an easterly or westerly tendency or direction from the normal in different years. This difference in the direction of the yearly wind-force has a corresponding influence upon the coastal current; the latter flows normally along the coast in a southerly direction, and is pushed *on* to the land or *away* from it according to circumstances. The current carries the bulk of our floating fish eggs, and these, therefore, are some years kept close inshore and at other times carried out to sea, in which case they are lost to us. Year after year there are good hatching seasons and bad ones, and in a number of years afterwards there ought to be correspondingly plenty of fish or scarcity. This is the case: most of our market supplies consist of four years old fish—the average of maturity—and by comparing the periodic deviations of the winds on to the coast and away from it with the richness of the catch of fish per man four years afterwards, a very striking correspondence is found. This comparison has been made over a period of ten years, and in no case is there any important discord, so it would seem that a very interesting and also important answer has been found to the otherwise inexplicable fluctuation in abundance of fish. It follows that as this year's winds control the abundance of fish four years hence, it may be possible some day to make a fairly accurate forecast as to what the next succeeding years will bring.

July 3.—Prof. Liversidge, F.R.S., in the chair.—Note on action of nitric acid in neutralising alkaline soil: R. S. **Symmonds.** Culture-pots were filled with alkaline soil and treated with various proportions of nitric acid. Seeds of wheat were sown in these and in pots containing untreated soil. Photographs of the plants were taken, and show an enormously increased growth, due to the neutralisation of the sodium carbonate and its conversion into sodium nitrate. A further series of experiments is being carried out on a large scale, which will form the subject of a future communication. The author discusses the possibility of the manufacture of the required nitric acid on the spot from the atmosphere by utilising the power derivable from the pressure given in the outflow from the artesian bores.

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