THURSDAY, JUNE 13, 1907.

MEDICAL TREATMENT BY HEALTH RESORTS.

Climatotherapy and Balneotherapy: the Climates and Mineral Water Health Resorts (Spas) of Europe and North Africa. By Sir Hermann Weber and Dr. E. Parkes Weber. Being a third edition of The Mineral Waters and Health Resorts of Europe, much enlarged in respect to Medical Climatology. Pp. 833. (London: Smith, Elder and Co., 1907.) Price 15*s.* 6*d.* net.

AS the causation and character of chronic ailments are better understood, more and more reliance is placed upon baths and climates for their treatment. The health resorts combine many conditions favourable to health, and, in fact, represent more or less a return to nature, a reaction which becomes necessary in proportion to the increase of civilisation. The work of Sir Hermann and Dr. Parkes Weber upon these topics is well known in America and Europe, and is conveniently presented in the present volume, which has been much enlarged in the section of climatotherapy. It now affords the most complete account of the therapeutics of climate, waters, and baths that has yet been published in our language.

The real difficulty in the use of these natural agencies has been ignorance. Indeed, so vast an amount of detailed information of localities, which is apt to get out of date, must be combined with special experience and power of selection, that not even every physician is likely to be an expert in these subjects. In cases of difficulty, and where individual characters have to be primarily considered, the expert must, of course, have the last word, but for everyday purposes this book presents a clear account of general principles and a mine of useful information, and will form a work of reference helpful alike to the practitioner and the public.

Change of climate is but one of the objects of going abroad. The influence of environment at the health resort, and of travel *per se*, both upon bodily and mental functions, are rightly emphasised in this work. They are, indeed, often a more essential element of treatment than either climates or baths. As regards climate, it will now be generally admitted that there are comparatively few disorders for which the climates of Great Britain are not as well adapted as any other. If a necessary exception be made for some forms of consumption and of chronic joint disease and defective circulation, and for failing vitality of old age—for all of which a less humid and more sunny winter climate is sometimes advisable—our health seekers might well, as respects climate, remain within our own shores. The present authors, after a survey of many climates, give little countenance to the common complaint of the "changeable weather" of these islands, but rather affirm that "frequent moderate changes of weather are favourable to health and vigour." Although we may be limited, as the meteorologists inform us, to less than one-third of our possible sunshine, whilst Italy with a more translucent air enjoys more than one-half; although the microbes and spores in the atmosphere of our towns may reach to many hundreds or thousands in the cubic metre, whilst they are absent from the alpine, arctic, and ocean airs, yet notwithstanding our people have developed, thanks partly to the climate, a power of resistance to disease which gives them, on the whole, a standard of health and energy probably unsurpassed in the world.

We note the useful distinctions drawn between the various marine climates. The *warmer* group for winter use include the equable and humid climates like those of Madeira, the West Indies and Ajaccio, and also relatively dry climates like those of the western Riviera. Again, the *colder* seaside resorts of northern Europe and the Baltic are valuable bracing stations in summer. In dealing with the effects of climates of high altitude, an interesting fact, to which Sir H. Weber has already directed attention, is again stated, namely, that an elevation of 500 feet to 800 feet in Great Britain is equivalent or more than equivalent to 2000 feet or 3000 feet in southern Europe. The statement is well within the truth, and many instances could be adduced in confirmation, for example, the highlands of the north-east of Scotland. The quality of the air in that region appears to resemble that of the Alps without the rarefaction, and it is a remarkable fact that some of the disorders, such as degenerative vascular changes, dilatation of the heart, and nervous prostration, which are unfavourably affected by an alpine climate, are markedly benefited in our own more northern but less elevated and equally bracing climates. The effect of latitude upon conditions of disease might well receive more detailed treatment in a future edition.

The recent additions to our knowledge of soil and subsoil as factors in climate are here well summarised, but our appreciation of the effect of local variations is still very imperfect. Here, as elsewhere, there exists a body of valuable but empirical observation, which needs to be collated and systematised. For example, the influence both of soil and subsoil upon rheumatism is of acknowledged importance.

The second half of this volume is devoted to balneotherapy. This is a branch of medical science and practice in which, thanks to the conscientious work of modern spa physicians, a very salutary change has been effected of late years. Like other branches of treatment, it was once vitiated by charlatanism, and later obscured by irrational tradition and routine. Balneotherapy has been founded anew upon exact observation, and the present treatise is a striking testimony to the fact. We are here furnished with a good *résumé* of the effects of the different classes of mineral waters, of which some of the most active are but weakly mineralised. Not many years ago it was often denied by competent authority that ingredients in such dilution could have any therapeutic effect, and the curative results experienced were ascribed to the imagination. It is

now recognised that dosage is not to be measured by bulk. How far we have travelled from the older doctrine may be appreciated on reading such statements as the following:—"in very dilute solutions the salt molecules are supposed to be held in solution almost entirely in a state of dissociation, as *ions*" (p. 319); and "It must be confessed, however, that minute quantities . . . apparently too insignificant to deserve mention, may ultimately turn out to have a real importance" (p. 327).

The selection and employment of baths in chronic disorders belong mainly to the spa physician. The present volume contains much suggestive material, but there is still room for a good practical treatise on the use of baths by a practising balneologist. The need for an "after-cure" in all serious cases is here very properly insisted upon. It may be safely affirmed that the failure of health-resort treatment is due in most cases either to the neglect of the "after-cure" or else to the common error of indulgence in a too prolonged course of baths, or in baths at too high a temperature. The valuable place of *sub-thermal* baths, given at temperatures below blood heat, has never been sufficiently emphasised as a mode of treatment at all the spas.

The discussion of the indications for climatic and spa treatment in the closing chapters should be of service to all those who have to do with the selection of a health resort.

THE CORAL PORITES.

Catalogue of the Madreporarian Corals in the British Museum (Natural History). Vol. vi., The Family Poritidæ, ii., The Genus Porites, Part ii. By H. M. Bernard. Pp. vi+173. (London: Printed by Order of the Trustees of the British Museum, 1906.) Price 20*s*.

WITH the publication of the second volume of the Poritidæ it may be said that Mr. Bernard's system of cataloguing the corals in the British Museum has been given a fair trial. A great deal of skilled labour has been devoted to this work, and a great deal of money has been spent upon it. It is therefore right that the merits of the system itself should be re-considered in the light of the results obtained.

That the catalogue is of some value no one would be disposed to deny. We have now, not only a record of the existence of a number of specimens of corals in the British Museum, but a careful, detailed account of their form of growth and skeletal characters. For those whose business it is to catalogue or study certain genera of corals, it is now possible to ascertain, without making a special journey to London for the purpose, that their specimens are similar to others in the possession of the British Museum. Students of coral structure have, moreover, the advantage of considering the general remarks on the variation in the mode of growth, of the arrangement of the septa, pali, &c., made by an authority who has had a very large number of specimens to examine.

But Mr. Bernard has abandoned the time-honoured plan of arranging his specimens in groups of species and has adopted the system of ticketing each specimen with the name of the locality in which it was found and a meaningless number. Thus the specimen in the Paris Museum, which has for nearly a hundred years been known as the type of *Porites clavaria*, Lamarck, is recorded in the British Museum catalogue as *Porites americana incertae sedis secunda*.

It is true that the attempt to apply the Linnean system to the Madreporaria and other orders of Cœlenterata is beset with many very great difficulties. Everyone who has worked at the systematic zoology of these animals has met these difficulties, and has probably realised that in the present state of knowledge his solution of them is crude and unsatisfactory. But we are still in the early period of the history of coral morphology, and until our knowledge of the anatomy of the coral polyps, of their tentacles, of their mesenteries, of their mesenteric filaments, and of other features of their anatomy is considerably extended, we are not in a position to conclude that the Linnean system is not applicable to them. The advantage of using the Linnean system, however, even in the present state of knowledge, is that it enables the naturalist who has made a special study of a genus to express his opinion, by the arrangement of the specimens into specific groups, of the relations he believes they bear to one another. His opinion may not be sound, it may even prove to be misleading, but the stimulus it gives him to careful and accurate observation is the very soul of his work, and alone gives life to systematic zoology.

In Mr. Bernard's catalogues we find simply a bald statement of facts. There are descriptions and figures of specimens, there are tables and lists, but there is not one word concerning the thoughts or opinions of the man who has devoted so considerable a part of a lifetime to the collection of these facts. It is like a quantity surveyor's estimate of bricks and stones without an architect's plan of the building they are to construct. We do not get in this system what we might expect to get, the benefit of the author's long experience, and, on the other hand, for those who would follow him in the systematic zoology of corals his volumes offer nothing but discouragement.

The time has come when a new line of research should be undertaken, namely, a systematic study of the soft parts of a large number of specimens of some one genus such as Porites, and a comparison made of the relation of the anatomy of the zooids to the different forms of skeletal growth. In this investigation some of Mr. Bernard's tables may prove useful, but the naturalist will have to go through a great deal of the work again in order to make the record valuable for systematic purposes. Such a study may achieve a great deal in clearing up the difficulty of distinguishing between characters that are intrinsic and transmitted by heredity to successive generations and characters that are due to the immediate influence of the environment. It may indicate to us the characters that are of value and those that are not of value for purposes of classifi-

cation. In the meantime, it would be a serious mistake if those in charge of collections of corals were contented to adopt the *non possumus* attitude of Mr. Bernard and make no serious attempt to arrange their specimens in systematic groups.

One of the most important observations recorded in this volume is that there seems to be a fairly constant difference between the Atlantic and Indo-Pacific specimens of Porites. This difference lies simply in "the fact that the trabecular, horizontal and synapticular elements which compose the skeleton are thicker and coarser in the Atlantic and West Indian forms than they are in those of the Indo-Pacific." This difference is one which may prove to be of great importance in the re-arrangement of the species that will be made in the future, and although there are some exceptions (p. 19) that may require special investigation, it will be of interest to inquire how far a difference in the anatomical character of the polyps coincides with this difference in a skeletal character.

Mr. Bernard devotes one chapter of his introduction to what he terms "metameric" growth in Porites. This principle of growth is well known to workers in the various groups of corals, but it is not one to which zoologists have hitherto applied the expression "metamerism." The metameric segmentation of a living animal body such as we see, for example, in the developing larva of a Polygordius is one thing, a linear series of gemmations in which the last of the series alone survives is another. To confound the two by using the same word for them will certainly not assist in the elucidation of the problems of coral growth. The phenomena of "overgrowth" in corals, as this process may more conveniently be called, are not fully understood, and may be due to several natural and circumstantial causes, but none of them seems to be due to any process that is at all comparable with the metameric segmentation of a worm or of an arthropod.

Although it has been necessary to express freely an opinion as to the value of the method employed in this volume, we may express our admiration of the careful descriptive account of each specimen in the catalogue and of the excellence of the plates.

S. J. H.

REALISTIC SCHOOL MATHEMATICS.

A School Course of Mathematics. By David Mair. Pp. viii+379. (Oxford: The Clarendon Press, 1907.) Price 3*s.* 6*d.*

FOR some years past the Civil Service Commissioners have systematically set themselves the task of framing their examination questions so as to make them of practical interest instead of merely being a test of a candidate's capability in abstract mathematics.

Mr. Mair, in the present book, has given a most useful and interesting collection of such of these examples as he considers should be within the range and powers of boys while still at school. These questions are given in sets at the end of the various chapters, which are devoted to the discussion of a few typical questions. These typical questions are discussed with variations and from different points of view, the discussion being thrown into the form of questions by the teacher, and answers supposed to be given by the pupil.

It is somewhat difficult to realise how these discussions are intended to be made use of unless they are meant only as typical, to be taken merely as suggestions, and not to be followed in detail; it would certainly not do for the class to have the book open during the discussion, and it would take too long for the class to write down the questions to which they are asked to give an answer, and yet in many cases the questions are somewhat difficult to answer unless the pupils can have them in writing. Moreover, in some cases the work involved in the discussion before the pupil has satisfactorily arrived at the generalisation which the teacher is striving to bring him to is so lengthy that it could not be completed in a single sitting, and consequently the continuity of thought required would be seriously interrupted. This difficulty seems not to have been contemplated by the author.

Moreover, he does not seem to have sufficiently realised that the young pupils for whom he is catering in the earlier chapters are incapable of the sustained thought and the considerable efforts of memory and chains of reasoning which he requires, and, most serious defect of all, even if the pupils are brought to perceive and retain the mathematical truths thus presented to them, these truths are so detached from each other and are so various in kind that they do not form in any sense a *mathematical course.*

In spite of this, however, the book will be of very great use. Thus, in some schools it is already being used with the upper army classes for the sake of the excellent examples with which it is crowded, the question and answer part being for the most part ignored with these classes, and, with regard to the text, if the teacher can find time to go carefully through the book, he will find a great deal of help given him as to the best way of bringing home some mathematical facts to boys in a more realistic and vivid manner than he might otherwise be able to do. For example, the author has a special way of his own for introducing boys to logarithms. This method is very carefully worked out, and is particularly worthy of study. Possibly each teacher will elaborate some modification of his own which he prefers, but he certainly should very carefully consider the author's method, which is most ingenious and well worked out so far as he goes, though there is a gap at the end which he has jumped. The author's treatment of questions in solid geometry also is good, giving them a reality and vividness which will make this part most valuable as an introduction or as a companion to the theorems of the eleventh book of Euclid or its modern equivalent.

The impression left on the reviewer's mind is that the book in no way supersedes the regular class books on the various subjects, but that it may be a most valuable adjunct to them in two ways, first, by sug-

gesting methods of presentment of new mathematical ideas by means of concrete illustrations which will bring them home more vividly and interestingly to the pupil, the method of question and answer being often used to make the pupil think for himself—though, indeed, this is generally done now by good teachers as occasion serves—and, secondly, by the teacher taking the class from time to time through a selected set of the examples when they have assimilated the underlying book-work.

There is one thing which the author has touched on, though apparently only in an example (No. 7, p. 293), which one would have liked to see brought into much greater prominence, viz. the graphic solution of a quadratic equation $x^2-bx+ac=0$ by drawing lines $OA=a$, $BC=c$, perpendicular to a line $OB=b$, and drawing a circle on AC as diameter, cutting OB in P, Q: the roots being OP and OQ. This method gives the clue to the geometrical solution of many problems some of which would otherwise be difficult; for example, the construction of a triangle of given area when two sides are given in position, and a point in the plane through which the third side is to pass; also the construction of a right-angled triangle from the data given in the book on p. 261; also the division of a line in extreme and mean ratio; and, indeed, any problem the solution of which depends on a quadratic. It is a most valuable link between algebra and geometry. Another method which is applicable to the case of $x^2\pm bx=a^2$, and is perhaps better than the first for this particular case (though really only a modification of the above general method), is given on p. 264. The book is, in fact, bristling with ideas and suggestions, and we wish it the great success it undoubtedly deserves. A. L.

EGYPTIAN ANTIQUITIES.

Egyptian Antiquities in the Pier Collection. Part i. By G. C. Pier. Pp. 27+xxi plates. (Chicago: University of Chicago Press, 1906.) Price 17*s*.

MR. GARRETT CHATFIELD PIER, of New York, is an amateur of Egyptian antiquities, and has begun to publish a catalogue of his collection, of which the first part has reached us. The book is produced by the Academical Press of the University of Chicago, which, at the instigation of its Egyptological specialist, Prof. Breasted, is beginning to take an important part in Egyptian archæological work.

We find various traces of Prof. Breasted in Mr. Pier's book. The learned professor's "particular wanities" in the way of transliteration of Egyptian names, such as "Ikhnaton" for Akhenaten, or "Harmhab" for Haremheb, either stamp Mr. Pier as a faithful follower of Prof. Breasted or show that the professor revised Mr. Pier's Egyptology. Mr. Pier's use of the Berlinish algebraic transliteration (*e.g.* "s;-r' Nb-m;'-t-r'-nb-t;wj" for what might just as well be written *sa-ra Neb-maat-Ra neb-taui*, p. 5) points the same way. But Mr. Pier should be careful, if he uses this highly learned transliteration, to use it consistently, and not write sometimes "Nub-khprw-r'" (p. 19), sometimes "','-ḫprw-r'" (p. 22), sometimes "Mn-ḫpr'," sometimes "Men-khepr-r'" (p. 21), or "Ishrw" (p. 6) for "Jšrw," or "Thy" (p. 13) for "Tjj," in such a sentence as "Śtn-ḥmt-wr-mrj-f-Thy (surely, surely, Tjj!) 'nḫ-ty," which also exhibits confusion between the orthodox Teutonic "j" and the slightly heretical English "y." Thy is the queen whose tomb has just been discovered at Thebes; if the German transliteration is used for her name at all, it must appear as "Tjj," but in reality there is no need whatever to use pedantically, in a guide to a collection of objects of purely anthropological interest, a transliteration of ancient Egyptian which is utilised only by a few German or germanised philologists for purely philological purposes.

Mr. Pier's collection does not, so far as published, appear to contain anything of extreme interest, compared, that is, with such important private collections as those of Mr. Hilton Price or Mr. Macgregor. He seems to be chiefly interested in objects of the prehistoric period and scarabs of the XVIIIth Dynasty, of which he possesses some fine specimens. Of later scarabs he does not appear to own many, which may account for the inaccurate statement on p. 15:—"with the Twenty-sixth Dynasty richer materials are used for scarab seals and plaques, such as carnelian, amethyst, serpentine, &c., *rarely, if ever, inscribed.*" We italicise the erroneous statement, which may well seem odd to those who know how constantly the little stone scaraboid plaques of the Saïte period were inscribed with all manner of sentences, wishing a good new year, invoking Khonsu as a protection, and so forth. But probably Mr. Pier has not yet devoted much attention to these later objects. He is thinking of the fact that the XIIth Dynasty amethyst and other stone scarabs were but rarely inscribed: this is so.

Mr. Pier draws his scarabs extremely well, much better than his flint implements, of which he publishes some scratchy pen-and-ink representations [Plates v.–ix.: Plate ix. (of a slate) is especially bad]. The mirror on Plate x. is also very badly drawn, and the two dishes on Plate xi. are not much better. Mr. Pier would be well advised to reproduce these things by means of photography in future, and to confine his artistic efforts to scarabs and hieroglyphs, which he knows how to draw.

His coloured plates of ceramics are very successful, though not so successful as Mr. Henry Wallis's in his "Egyptian Ceramic Art." Mr. Pier's blues, yellows, and violets do not so perfectly reproduce their originals, and Mr. Wallis's do. But it would be indeed difficult to rival Mr. Wallis's drawings or Mr. Carter's in the publication of the "Tomb of Thoutmosis IV."

So far as the literary part of the book is concerned, quite apart from the usual aberrations of American spelling, Mr. Pier has one or two specialities of his own. One is "faun-colored" (for "fawn-coloured"), which occurs two or three times, and so cannot be a misprint. Presumably Mr. Pier has forgotten what

a "fawn" is, or what colour it is, and is thinking of a Greek faun. True, if we are to believe the sculptors, the fauns and hamadryads did live naked in the open air most of the time, so were probably slightly tanned. And what does Mr. Pier mean by "hackling" (p. 10)? Was a "hackling implement" the sort of flint you threw at a prehistoric election candidate: to "heckle" him? Or does Mr. Pier mean simply "hacking"? One talks of a dog "putting up his hackles." We pass on, unconvinced. On p. 11 we read a description of a vase as "handled for suspension or portage." By *portage* Mr. Pier probably means "carrying": his word is an odd one, and sounds as if it were of Canadian origin; we have not met with it in this particular sense before, and we do not like it at all.

Real misprints are rare. We notice "Chelleen" for "Chelléen" (p. 6), and one or two others of no importance.

The disadvantages of the book are such as the author can easily remedy in the succeeding parts, and we hope that he will continue his plan to its end. Such catalogues of private collections are extremely valuable to the student, and those collectors who publish them are to be congratulated on the scientific spirit that impels them to make their antiquities known. H. H.

OUR BOOK SHELF.

Heat Shadows. By Walter Jamieson. Pp. viii+30. (London: Blackie and Son, Ltd., 1907.) Price 6*d.* net.

THIS pamphlet describes some new experiments in conduction and radiation of heat. The author has prepared a series of grades of paper sensitised to heat by impregnating them with a "sympathetic ink" which turns green on heating (*i.e.* on drying). The tint attained in any experiment may be considered as depending roughly upon the amount of heat absorbed; thus the paper acts as a calorimeter rather than as a thermometer. This law would be true if the absorbed heat were all transformed into the latent heat of steam; since, however, the paper sensibly warms (and, therefore, radiates), the law is not so exact; though even so there is a time-temperature compensation. The double iodides sometimes employed for the purpose are thermoscopes rather than calorimeters, for their transition points are somewhat too high, and when reached the transformation is rapid and automatic; that is, it is independent of the heat supply.

Specimens of the sensitive paper were received along with the pamphlet, and we have been able to test it. We think that it will prove very useful for demonstrating the phenomena of conductivity and radiation in schools where thermopiles are out of the question. Too much stress must not be laid, of course, upon quantitative experiments. The first experiment is to fasten a strip of the paper, sensitive side up, upon a board with a thick copper wire between. If the wire is heated at one end the green tint spreads out more widely near the heated end. We do not think that the teacher is justified in *measuring* the width of the coloured band and in thus trying to find the law of the decrease of temperature; he should be content with the inference of "more or less." Most of the experiments are excellent. We think those on radiation are the best.

As a bright surface Mr. Jamieson employs a test tube coated with a metallic paint. This forms a very good coating, but the inquiring child (and teacher) may wonder whether the varnish with which it is applied has anything to say to the result.

This metallic coating is also employed by the author for coating electrical condensers, proof planes, &c., and is very readily applied both to the inside and outside of any jar

Handbook of American Indians North of Mexico. Edited by Frederick Webb Hodge. Pp. ix+972. In two parts. Part i. (Washington: Government Printing Office, 1907.)

THIS volume is Bulletin 30 of the Bureau of American Ethnology in connection with the Smithsonian Institution. The handbook contains a descriptive list of the stocks, confederacies, tribes, tribal divisions, and settlements north of Mexico, accompanied with the various names by which these have been known, together with brief biographies of Indians of note, sketches of their history, archæology, manners, arts, customs, and institutions, and the aboriginal words incorporated into the English language. All the tribes north of Mexico are dealt with, including the Eskimo and those tribes south of the boundary more or less affiliated with those in the United States. Under the tribal descriptions a short account of the ethnic relations of the tribe, its location at various periods, and statistics of population are included. There are many illustrations. Though confessedly incomplete, the handbook represents a vast amount of research by an army of observers, and students of ethnography will look forward to the publication of the second part with keen anticipation.

A German Science Reader, with Notes and Vocabulary. By Dr. W. H. Wait. Pp. vii+321. (New York: The Macmillan Co.; London: Macmillan and Co., Ltd., 1907.) Price 4*s.* 6*d.*

THE greater part (180 pages) of this book consists of selections from standard German works on the chief departments of science. The extracts describe some fundamental facts and principles of chemistry, physics, geology, mineralogy, astronomy, and anatomy; and they have been selected from the point of view of interest as well as that of instruction. Helpful notes are given on each division of the book, and also lists of words commonly mispronounced and of words and phrases with special or idiomatic meanings. A vocabulary at the end of the book gives the English rendering of words used in the German text. Any student of science having a slight acquaintance with German grammar will find in the book all the assistance required to enable him to read the extracts with interest and profit. As an introduction to German scientific literature, the volume will be found of real service both by teachers and students.

Les Bases de la Philosophie naturaliste. By André Cresson. Pp. iv+179. (Paris: Félix Alcan, 1907.) Price 2.50 francs.

THE title of this little volume serves to define its purpose. The author provides a short and impartial explanation, likely to be understood by a reader of average intelligence, of the fundamental principles upon which modern philosophy rests. The scope of the book will be clear from the titles of the six chapters into which it is divided: the first deals with the old anthropocentric view of things, and this is followed by chapters on science and the inorganic world, science and life, science and mind, science and society, and conclusions.

LETTERS TO THE EDITOR.

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

The Origin of Radium.

I CANNOT let Prof. Rutherford's letter in NATURE of June 6 pass without directing attention to one striking consequence, in which I personally am interested. During 1904 and 1905 I published (NATURE, May 12, 1904, January 26, 1905, and *Phil. Mag.*, June, 1905, p. 768) the result of an experiment which went to show that a kilogram of uranyl nitrate, purified initially from radium by precipitating barium as sulphate in its solution, and kept 550 days, generated a quantity of radium which, although only one-thousandth part of what is theoretically to be expected on the view that a direct change of uranium X into radium takes place, was still one hundred times the amount initially present. Boltwood (*Am. Journ. Sci.*, September, 1905, xx., 239), working with one hundred grams of uranyl nitrate purified from radium initially by repeated crystallisations from water, was unable to observe any detectable increase after a period of 390 days, and concluded that "the results obtained by Mr. Soddy are without significance," and averred that my results were due to the introduction of radium salts during the tests.

Now such a criticism and such an imputation on the part of one investigator dealing with the work of another surely ought only to have been made if it was the only possible explanation of the discrepancy. As it was, to me at least, it was not even the most obvious explanation. Boltwood did not give consideration to the all-important influence of the method of purification of the uranium from radium on the results obtained. My result, that the rate of production of radium from uranium was only one-thousandth of the theoretical, brought into being the present theory of the existence of several hypothetical intermediate transition forms between uranium and radium. It is obvious that, according as the method of purification employed does not or does remove these transition forms as well as the radium, so one will or will not expect to observe an initial production of radium in a solution of uranium. Now the method of precipitating barium as sulphate in a uranium solution is designed to *remove only* the radium, whereas the method of repeated crystallisation from water adopted by Boltwood is well calculated to *purify* the uranium, that is, to free it from all other accompanying substances. Hence there is no necessary discrepancy between the results of the two experiments. This view has been put forward by Rutherford ("Radio-active Transformations," p. 159).

I would not now have raised this matter had not history apparently repeated itself, and Prof. Rutherford's most recent results (NATURE, June 6, p. 126) enabled me, without making any special claim to infallibility, to exhibit clearly the real nature of Boltwood's criticism. In the *American Journal of Science* for December, 1906, p. 537 (NATURE, January 3), Boltwood published a "Note on the production of Radium from Actinium" in which evidence was given that actinium is the parent of radium. This was quickly followed (NATURE, January 17, p. 270) by some confirmatory evidence of a similar character by Rutherford, who, however, pointed out that there was no proof that actinium was itself the true parent of radium, although this parent was undoubtedly present in the actinium solutions employed. Now Rutherford shows in last week's issue that actinium *purified from radium in a different manner* yields no appreciable growth of radium. Is Boltwood's previous positive result then "without significance"? Surely not. But if Boltwood's result on the production of radium from actinium can be explained, as, of course, it can be explained, without charging him with introducing radium into his solution, so in the same way can mine with uranium. Indeed, whereas the intermediate product, which is the parent of radium, is a *necessary* companion of *any* uranium preparation which has not recently been subjected to a purification process capable of removing it, it has yet to be shown that the association of this parent with actinium is genetic and not purely fortuitous.

I hope this exposure of an old criticism, made without due consideration of the complexity of the problem, will clear the way for the publication of some further results. In the two years that have elapsed since the publication of my last paper I have had the advantage of the co-operation of Mr. T. D. Mackenzie in the steady and continuous prosecution of the work under the most favourable conditions. We have from the commencement, which dates prior to Boltwood's first communication on the subject, had as the basis of the work the all-important influence of the method of purification adopted, and we have used throughout a new method of purification, which, though not without difficulty and danger in its application to the purification of large quantities of uranium salts, was deliberately chosen as affording a reasonable guarantee that it would separate the uranium from all other substances present. Mr. Mackenzie has purified with the utmost care three separate kilograms of uranyl nitrate by this method, and I may anticipate our results to the extent of saying that, so far, they entirely confirm and extend the results obtained by Boltwood in which re-crystallisation was the method of purification employed. The first preparation, containing after purification about 500 grams of uranyl nitrate, has been kept for 600 days, and has not shown the slightest detectable increase in the amount of radium initially present. Now that these three purified preparations have been set up in a form to allow of continuous and extended observation, our attention is being directed to the residues from the three kilograms, which should contain the parent of radium, if my earlier positive result was correct. After all, it would be a little surprising if this parent of radium was entirely absent from commercial salts of uranium, for although Boltwood and Rutherford have found it in preparations of actinium, it must not be forgotten that the only source of actinium is that from which commercial uranium salts are prepared.

FREDERICK SODDY.

The University, Glasgow, June 8.

The Structure of the Æther.

IN the current number of the *Philosophical Magazine* I have given in some detail certain objections to identifying the magnetic vector with translational æthereal motion, and to a large extent these are on all fours with Prof. Hicks's objection, which is cited by Sir Oliver Lodge in the same number, and of which I had lost sight. Very briefly, thus: if bodily æther flow were (within a constant factor) identical with magnetic induction, or were even an essential feature thereof, our judgment as to whether or not a given region was pervaded by magnetic induction would depend on the arbitrary origin of coordinate axes relatively to which we chose to measure velocities, motion of bodies through the æther being physically indistinguishable from an equal and opposite motion of the æther with those bodies at rest.

Much the same difficulty (concerning the essential relativity of motion) seems to me to arise when resultant æthereal momentum is taken to correspond to the vector product of the electric and magnetic vectors; in this case, moreover, further difficulties are encountered. Consideration of a progressive train of electromagnetic waves shows that, with this æthereal-flow interpretation of the Poynting vector, we should have a resultant æthereal motion made up of a steady flow in the direction of wave propagation, together with to-and-fro motions parallel to that direction and kinematically exactly simulating the motion of a gas which is transmitting waves of sound. This clearly implies *compressibility of the aether*, not merely as a minute residual phenomenon, but as a fundamental relation of electromagnetism.

And what would happen in the case of such a body as the sun, which consistently radiates more energy than it receives by radiation? There would be a flow of æther outward in all directions, maintained throughout immense periods of time. This difficulty seems almost insuperable.

There appears to me to be much evidence in favour of the view that the resultant velocity of the æther (referred

to suitable axes) is everywhere zero—at least so far as electromagnetic phenomena are concerned.

Though I find myself in agreement with Prof. Richardson's conclusion that magnetic intensity is not to be identified with speed of æthereal flow, as explained in his letter to NATURE of May 23, I venture to dissent from his arguments. These proceed from the contention that, on the contested assumption, certain integrals would become infinite. Now, in the first place, it appears to me from mere inspection that both these integrals (which I have not actually evaluated) are in reality finite; in the second place, neither integral expresses a magnitude which bears directly on the point at issue, one of them being justly criticised by Sir Oliver Lodge in NATURE of June 6 as apparently devoid of mathematical meaning. The question proposed is as to the momentum due to an electric charge upon a moving sphere, and in this connection the really significant magnitude is the kinetic energy, expressed in terms of the translational velocity. Differentiating this expression with respect to the velocity, we have at once the momentum, the result obtained being independent of any physical theory as to the ultimate nature of the energy in a magnetic field.

C. V. BURTON.

Cambridge, June 8.

Decomposition of Radium Bromide.

YESTERDAY, on opening a glass tube containing 1 milligram of radium bromide which had been hermetically sealed for almost exactly twelve months, there was a very strong odour of bromine which hung about the tube for about ten minutes. The amount of the bromide decomposed in this period would be about $5{\cdot}4\times10^{-7}$ grams according to Rutherford; the amount of bromine corresponding to this would be about 2×10^{-7} grams. Perhaps some chemist could say definitely whether this amount of bromine would be detectable by its odour. The volume of the tube was about 4 cubic centimetres.

ALFRED W. PORTER.

University College, London, June 8.

The Mass of the α Particle.

APPARENTLY the following simple and obvious method of calculating the mass of the α particle has been overlooked.

According to Rutherford, the number of α particles emitted per second by a gram of pure radium is $2{\cdot}5\times10^{11}$. Of these particles, one-quarter comes from each of the four elements Ra, RaEm, RaA, RaC. The particles from these four elements are emitted with velocities $0{\cdot}82\ V_0$, $0{\cdot}87\ V_0$, $0{\cdot}90\ V_0$, $1{\cdot}00\ V_0$ respectively, where V_0 is $2{\cdot}6\times10^9$ cm./sec.; they all cease to produce ionisation when their velocity is $0{\cdot}43\ V_0$. Hence the loss of kinetic energy of all the α particles emitted from one gram of radium in passing over their ionising ranges is

$$\frac{2{\cdot}5\times10^{11}}{4}\times\tfrac{1}{2}m\times\tfrac{1}{2}\{(0{\cdot}82)^2+(0{\cdot}87)^2+(0{\cdot}90)^2+1^2-4\times(0{\cdot}43)^2\}(2{\cdot}6\times10^9)^2=m\times5{\cdot}3\times10^{29},$$

where m is the mass of an α particle.

At the same time, it is known that one gram of radium gives out 105 gram-calories per hour (mean value), or $1{\cdot}22\times10^6$ ergs per second. If we may identify this quantity of heat energy with the kinetic energy lost by the α particles in ionisation we have

$$m\times5{\cdot}3\times10^{29}=1{\cdot}22\times10^6$$

or

$$m=2{\cdot}3\times10^{-24}.$$

The ratio e/m for the α particle is $1{\cdot}56\times10^{14}$ electrostatic units. The two most probable theories of the nature of the α particle are (1) that it consists of an atom of helium carrying a charge 2ϵ, where ϵ is the electronic charge $3{\cdot}4\times10^{-10}$, and (2) that it is a molecule of hydrogen carrying a charge ϵ. On the hypothesis (1) the mass of the particle is $4{\cdot}26\times10^{-24}$; on the hypothesis (2) it is $2{\cdot}13\times10^{-24}$. The calculation given indicates that (2) is correct, and explains the failure of Greinacher and Kernbaum to obtain helium from the α rays of polonium (*Phys. Zeit.*, 1907, p. 339).

If it be assumed that the whole of the kinetic energy of the α particles, and not only that part of it which is spent in ionisation, appears as heat energy, the value for m is found to be

$$1{\cdot}78\times10^{-24}.$$

I have thought it best to give the maximum estimate of that quantity which can be attained by this method.

NORMAN R. CAMPBELL.

Trinity College, Cambridge, June 3.

The "Renal-portal System" and Kidney Secretion.

I RECENTLY published a short paper (Proc. Zool. Soc., 1906) on the significance of the so-called "renal-portal system" found in most of the lower Vertebrata. In this paper I advanced strong reasons for supposing that the "renal-portal system," or, as I prefer to call it, renal cardinal meshwork, is non-excretory in nature. I showed that, both developmentally and structurally, there was every reason to doubt whether the renal cardinal meshwork takes any part in the formation of the plexus of blood-vessels which surrounds the urinary tubules (although, of course, these are connected with each other), and that therefore the blood apparently supplied to the kidney by the "renal-portal" (post-renal) vein is in all probability not utilised in the production of the kidney secretion. This conclusion, opposed to that held by most physiologists and morphologists, I supported by citing the physiological experiments of Nussbaum (*Pfluger's Archiv*, xvi., xvii., 1878; *Anat. Anzeig.*, i., 1886) and Beddard (*Jour. Physiol.*, xxviii., 1902), which afforded valuable confirmation. These experiments, as is well known, proved that after the arterial supply of the frog's kidney had been eliminated all secretion immediately stopped, notwithstanding the facts that the "renal-portal" circulation was still in full swing and that powerful diuretics were employed. The sole objection to regarding these experiments as conclusive was that, in consequence of the kidney being deprived of oxygenated blood, the tubular epithelium had degenerated, and was therefore not in a condition to secrete. While recognising this objection, yet for the other reasons which I had already advanced I ventured to maintain that, even if the blood in the post-renal vein could be artificially oxygenated, no secretion would occur.

Unfortunately, I was not aware of more recent physiological work on this subject when I made this last suggestion. Since then, however, Prof. Halliburton has kindly directed my attention to the papers of Bainbridge and Beddard (*Biochemical Journal*, i., 1906) and Cullis (*Jour. Physiol.*, xxxiv., 1906), in which the reverse result has been obtained; that is to say, according to these later experiments, a secretion can be obtained from the "renal-portal" circulation provided that the tubule epithelium is maintained in a healthy condition by means of a sufficient supply of oxygen, and that powerful diuretics like urea and phloridzin are employed. This result at first sight appears to be contradictory of my previous conclusion and confirmatory of the generally accepted "portal" theory of the renal cardinal meshwork, but it is the object of these remarks to show that such is, after all, not necessarily the case.

In the first place, these recent experiments have clearly shown that the "renal-portal" circulation will not yield the slightest secretion in the absence of powerful diuretics; in other words, the result obtained by Bainbridge, Beddard, and Cullis is at best an abnormal one. Under more normal conditions, *i.e.* in the absence of diuretics, with a healthy tubule epithelium and with the "renal-portal system" alone working, no secretion whatever occurs.

Secondly, the very fact that when the venous blood contained in the renal cardinal meshwork alone "supplies" the kidney, the tubule epithelium degenerates, proves that in the normal living animal this blood is not in contact with the tubules, *i.e.* does not take part in the formation of the blood-plexus surrounding the tubules, since, as the experiments prove, these latter require the oxygenated blood derived from the renal arteries in order to live and much more to secrete.

Thirdly, it must be remembered that in the experiments of Bainbridge, Beddard, and Cullis, the elimination of the

arterial circulation of the kidney does away with the blood current which normally flows *away from* the region of the tubules, and, this being the case, the venous blood of the renal cardinal meshwork, encountering no resistance, is enabled to penetrate to the tubule plexus, carrying with it the injected diuretics which cause the secretion observed. There is no reason why the secretion should not occur under these abnormal conditions. The tubule epithelium is well supplied with oxygen, the veins are gorged with impure blood, and in experiments in which at all large secretions were obtained the pressure was artificially raised by forced injection or otherwise.

It is easy, then, to account for the secretion obtained by the investigators named, and at the same time to believe that the venous blood takes no share in the formation of the kidney secretion under normal conditions.

It has always surprised me, speaking as an outsider, that physiologists have so readily assumed that they possess in the frog and other animals with "portal" kidneys so many convenient anatomical contrivances in which the glomeruli and the renal tubules are supplied by separate vessels. It is true that the renal cardinal meshwork is continuous with the blood plexus surrounding the tubules, but surely it is very unsafe to assume from this one fact that the venous blood is used by the tubules for secretory purposes. Another equally patent fact, that the similar tubules of mammals employ arterial blood, should suffice to cast doubt on the assumption. And when we recall to mind the statements of Hyrtl (*Wiener Akad. SB.*, xlvii., 1863) and Vialleton (*C. R. Hebdom. Séances Soc. Biol. Paris*, liv., 1902), among others, that in those "portal" kidneys in which the vascularisation has been histologically examined, viz. those of the frog and certain sharks, the renal cardinal meshwork is structurally distinguishable from the tubule plexus (the former consisting essentially of large channels putting the post-renal vein into communication with the post-caval, and the latter consisting of capillaries which open into the channels), there is still more reason for supposing that the flow of blood is from the tubule plexus into the renal cardinal meshwork, and not in the contrary direction. The numerous experiments which have been based on the aforesaid assumption have, I should imagine, given rise to incorrect ideas as to the normal functions of the urinary tubules.

If I needed any additional physiological evidence in support of my contention that the post-renal vein has nothing to do with the vascular plexus of the urinary tubule, *i.e.* does not supply the kidney for excretory purposes, I find it to hand in the recently issued British Association Report for 1906, York. In a report on "The 'Metabolic Balance Sheet' of the Individual Tissues," p. 427, it is shown to be exceedingly probable, by the relative amounts of oxygen used up by the kidney tissue of a frog and a mammal respectively, that the "renal-portal" vein of the frog bears a very different relation to the kidney tubules as compared with that of the renal vein of mammals—which is the conclusion I am maintaining. It is further stated that "when the same kidney is perfused at different times through the aorta and through the renal-portal system, there is a greater consumption of oxygen in the former case than in the latter (double to treble in four experiments)." If we assume what is generally held to be a well-established fact, viz. that the kidney-tubule epithelium plays quite as important a part in kidney secretion as the glomerular epithelium, then it is difficult to understand, on the portal theory of the kidney, why the quantity of oxygen absorbed by the kidney tubule is totally out of proportion to the work done by it. Obviously the only rational conclusion to draw is that in the above experiment the oxygen perfused through the "renal-portal" vein did not come into contact with the tubule.

To sum up, I think I may say that I have clearly shown that the recent work of Bainbridge, Beddard, and Cullis does not disprove my original contention that the renal cardinal meshwork is, under natural conditions, non-excretory, that, in short, the so-called "renal-portal" vein does not supply the renal tubules, as physiologists commonly assume, and that, in consequence, experiments based on this assumption are liable to give rise to misleading ideas.

W. WOODLAND.

Mendelism and Biometry.

IN the striking and suggestive review of Mr. Punnett's work on "Mendelism," in NATURE of May 23, the reviewer cites, without naming the author, a view expressed by Mr. A. D. Darbishire (*Manchester Memoirs*, 1906) to the effect that "the Mendelian deals with units and the biometrician with masses," and states that this idea, "though plausible, is based on a fallacy," for "the Mendelian's units *are* the biometrician's masses, except when the latter exceeds his limits and includes within his masses more than one such unit."

I have no doubt that Mr. Darbishire read the review with as much enjoyment as myself, but it seems to me that his statement of the case is dismissed with scarcely sufficient consideration. The reviewer's points, if I understand aright, are two:—(1) that Mendel's laws (by which he seems to mean, not merely the law of segregation, but the laws of observed proportions) are really mass-laws and not laws of the individual; (2) that the biometrician's masses are the masses to which Mendel's laws apply. But surely (1) Mendel's laws are based on definite conceptions as to the germ-cells of the *individual*—and that is the important point—and are true of the *individual* to a degree of approximation which is the higher the greater the number of offspring (quite a high degree in such a case as Mr. Lock's maize). Further, (2) if the "Mendelian's units" were the "biometrician's masses," there should be inheritance of individual variations, within each of two races A and *a*, for any character to which Mendel's laws applied on crossing those races; for inheritance of individual variations is what the biometrician has observed for nearly all characters in his masses.

I indicated the importance of an investigation on this point some time ago (*New Phytologist*, i., 234)—for it is almost a fundamental question whether a single determinant, such as may be assumed to exist for a unit Mendelian character, is or is not capable of variation from individual to individual—but I am not aware that any such investigation has been made. The reviewer's assumption may, therefore, be true, but it is unproven, and theories at present in the field (Pearson, *Phil. Trans.*, 1904; Yule, *Conference on Genetics*, 1906) are based on the opposite assumption, viz. that heritable individual variations are due to the character concerned being determined by *n* allelomorphic couplets, and not by one. If this be true, the "biometrician's masses" are precisely masses to which Mendel's laws, in their simplest form, do *not* apply.

The question referred to above, whether a unit Mendelian character exhibits heritable individual variations or no, seems to be one that urgently calls for experimental investigation.

G. UDNY YULE.

MR. YULE is probably right. The question is this: Is the inheritance which the biometrician always finds within the limits of his masses due to the fact that he is dealing with a large number of Mendelian units, or that he is measuring the intensity of heredity *within* such a unit?

If the former, Mr. Yule is right in saying that I criticised the view expressed by Mr. Darbishire unjustly. If the latter, the mass of the biometrician *is* the unit of the Mendelian. But before we can give an answer to this question we must know, as Mr. Yule points out, whether there is inheritance of fluctuating variations within the limits of a single Mendelian character such as "tall," in peas. If we may argue from stature in man to stature in peas, we should compare the character tall (or normal) in peas to tall (or normal) in man, and dwarf in peas to dwarf in man. We know that there is inheritance within the character tall in man, and, if this analogy is legitimate, we should expect to find it so in peas. If it were, the answer to the question whether the view expressed by Mr. Darbishire were right or not would depend on whether we still called the character tall the unit or extended the conception of unit to the smallest heritable variation within the category tall.

THE REVIEWER.

SOME INSTANCES OF UNSCIENTIFIC ADMINISTRATION.

IN recent letters to NATURE and the *Times*, I had occasion to criticise the lack of science displayed by the Indian authorities during their conduct of the operations against plague in the great outbreak of 1896. The Editor of NATURE, who has so frequently and ably urged the claims of science on the public, now asks me to give any more instances of the same nature which I may have observed.

Probably few any longer accept the teaching of Hume, that the object of government is no other than "the distribution of justice." The function of an ideal civilised government might be described as the performance of all acts for the good of the public which individual members of the public are by themselves unable to perform—that is, the organisation of public welfare. The individual can certainly add much by intelligence and virtue to his own welfare; but these qualities do not suffice to protect him altogether against those evils which can be combated only by concerted action, such as the depredations of disease and of external and internal human enemies; and where he is powerless, the Government, and only the Government, can help him. Now such concerted action is likely to be successful only when it is based on sufficient knowledge; and a scientific administration differs from an unscientific one just in this particular, that it seeks the necessary knowledge, while the other acts blindly. In nothing is this more manifestly the case than in connection with that departmen of public administration which is charged with the protection of the public against disease—a department second to none in importance, because it concerns not only our sentiments and our pockets, but our health and our lives. Before such protection can be obtained, two things are absolutely necessary—first, an exact knowledge of how diseases are caused and how best they may be checked, and, secondly, an efficient organisation to act upon that knowledge when it is obtained. I will now try to examine how far, within the range of my own subject and experiences, this ideal of a scientific administration has been reached.

My experiences commenced in the Indian Medical Service in 1881. The Indian governmental machine is a bureaucracy placed mostly in the hands of soldiers and Indian civilians, who are selected from the British middle-classes by competitive examinations in branches of knowledge among which (be it noted) science, except mathematics, does not hold a very prominent position. The medical establishment, to the care of which the health of about three hundred millions of people is mostly entrusted, is divided into a civil and a military branch with corresponding duties, and contains, I think, more than a thousand qualified medical men, chiefly British, belonging to the I.M.S. and R.A.M.C., with a large subordinate staff of apothecaries, hospital assistants, and so on. The heads of this organisation are medical men, but they do not generally, I think, have seats on the supreme executive councils.

When I entered the I.M.S. it had a great reputation, which it still possesses, and, together with the Army Medical Department, had done fine work. Both these services were on the whole very well organised; but I could not help noticing several anomalies. Many of the Indian diseases are, of course, different from those met with at home. Our knowledge of them was then chiefly in the clinical stage, and very insufficient, both for treatment and prevention; and what we possessed was due, not to any organised official inquiries, but to the efforts of individuals. I remember being struck even then with the absence of organised research. It is true that pathological laboratories existed in the universities (under men burdened with other duties); that Government had specially appointed two commissioners, Lewis and Cunningham, to study this subject; that temporary inquiries had been made on leprosy and on certain local outbreaks; and that there was a good Indian medical journal; but these were obviously insufficient to enlighten us on the multitude of strange and mysterious diseases we were called upon to deal with. Why did not Government carry on much more extensive researches? The time-worn answer always was, because they could not afford it. But, surely, if they could afford such a large and expensive medical establishment, they should also be able to afford those researches which were essential to making that establishment effective. Of what use was the one without the other? An inefficient machine is the most expensive of all. Did they think that we medical men should know all about these diseases by intuition? But no!—content with having appointed a legion of "doctors" to fight disease, they never seemed to consider that it was necessary for those doctors to know how to do it.

But this invariable cry of "no funds" was palpably untrue. Many of the administrative and judicial offices in India were being paid above their market value, and were of little public importance compared with medical research. Huge sums, which would pay for such research for years, were being spent on engineering works of only local value. Even within the medical budget, money was being wasted on certain sinecures and useless administrative posts. Indeed, logically it would have been wise in the Government to sacrifice almost anything in the department in order to obtain the necessary information about disease, for the simple reason that without such information the work of the department was largely useless—the old castor-oil treatment and conservancy-cart sanitation had their limits! But what struck me most was the fact that Government failed to make use of literally hundreds of potential investigators whom it could have set to work for almost nothing. The medical services in India must be always kept on something approaching a war footing—that is to say, with a staff in excess of peace requirements. In other words, there must always be a large number of medical men, generally juniors, who in times of peace have little to do and are employed doing it in the military hospitals. I was one of these for about twelve out of my eighteen years' service, and therefore know the facts about which I write. For most of this time my official duties occupied me for less than, say, two hours a day, and I knew scores of my colleagues who were equally busy—we amused ourselves for the rest of the time. Now why did not, and why does not, the Government make use of all these men for investigation? Young, ardent, vigorous, intelligent, "spoiling" for work they were, and are, of the stuff that is now doing most of the scientific work of the country—precisely the same as those who have been labouring in my department in this university—who have even sacrificed their lives for Athena Hygieia. They had, and have, leisure and opportunities unparalleled. A microscope, a few test-tubes, a word from the chief, a little approbation, some evidence that scientific work leads, if successful, to preferment, and the authorities could have had almost for nothing scores of enthusiastic and, I will expressly add, capable workers for the great cause of medical science. But the pigeon-holed report and the official snub awaited us, and we returned disappointed to our idleness.

It is advisable to emphasise this point, because it illustrates the brainless character of much of the administration. In 1884 (I think) I asked my chief

if he would like me to investigate fevers during my abundant leisure; he replied that my duty was not to investigate, but to cure—as if we could do the second without the first! Many men have told me that they have received similar replies, and two brothers of mine quite rightly left the naval medical service because of this attitude in the authorities. A man who discourages enthusiastic juniors from doing gratuitous work in addition to their duties must be a fool of a very advanced type, and it is surprising that such men should ever be able to find their way into administrative posts. In addition to the actual discouragement of voluntary research (which I will discuss further presently), the organisation made no adequate provision to ensure scientific efficiency in the staff. There were no examinations for promotion. Leave and opportunities for study could scarcely be obtained, and even now there are difficulties—see, for instance, *British Medical Journal*, May 11, 1907, p. 1156. That first essential, recent scientific literature, was most difficult of access, and the authorities still seem to have made no adequate attempt to improve matters in this respect. Microscopes and bacteriological apparatus were generally wanting, although they are absolutely necessary in tropical clinical practice for the detection of numerous parasites, and this fault has not even yet been entirely removed, to judge by the report of the Army Medical Department for 1905, p. 224. The heads of the department frequently showed ignorance of recent scientific advances, as was apparent from their antiquated statistical methods and regulations for dealing with epidemics and their general lack of ideas; and, lastly, the annual "Records of Service" of officers, upon which their preferment was supposed to be based, was a hopelessly stupid form which made no attempt to distinguish their real scientific and professional ability—so that, as everyone remarked, appointments, like kissing, went by favour!

About the year 1880 occurred that important epoch in human history when we first learned the nature of the great transmissible diseases which afflict us—when Koch and Laveran threw open the gates of medical bacteriology and protozoology, and special laboratories sprang up everywhere in Europe and America, and even at last in Britain. As may be supposed from the foregoing, India was not in haste to follow, and the authorities, who had done so little for research themselves, did not trouble to utilise the researches of others. In 1883 Koch discovered the cause of cholera, that scourge of India, and the discovery should have been immediately followed by numerous official investigations. But, though the disease destroys about half a million people annually in India alone, little was done in that country, and neither the Government nor the people have, I believe, ever taken the trouble to thank Koch for his work. Ten years later, however, Hankin, of Agra, carried out his admirable researches on the mode of propagation, and enunciated his method of prevention by the treatment of wells. This again should have received close official scrutiny with a view to its general adoption or rejection, but from recent reports it appears to be still *sub judice*—as if it were not worth troubling about; and no one has ever dreamed of acknowledging indebtedness to Hankin. Tyhpoid, perhaps the principal enemy of Europeans in India, has never received adequate official inquiry as regards its modes of propagation in that country, and the discoverer of the prophylactic no longer enjoys State employment.

An amœba which is probably the cause of one form of that important disease, dysentery, was well studied for the Indian Government by Cunningham long ago, but the matter was not followed up. The cause of another form was discovered by Shiga in Japan. Some of the most prevalent and distressing complaints in many parts of India are those caused by *Filaria bancrofti*; but Manson's discovery of the carrying agent, a mosquito, though confirmed in India by Maitland, James, and others, has never, to my knowledge, been followed by sufficient practical action. The spirochætes of relapsing fever, though finely studied by Vandyke Carter, of Bombay, many years ago, still require a determination of their carrying agent. Sprue, ankylostomiasis, beri-beri, unclassed fevers, guinea-worm, and other parasites received little official attention. The case of malaria is perhaps the most astonishing. It causes about a third of the admissions into hospital, and a mortality, directly and indirectly, possibly of some millions a year in India; while nothing does more to hamper military, engineering, and agricultural undertakings. Its cause was discovered in 1880 by Laveran in Algeria—a discovery which enabled us generally to make an immediate definite diagnosis with the microscope. Excepting Vandyke Carter's confirmation, in 1887, literally nothing of consequence was done on the subject in India for fifteen years, though during that period the Italians and others were piling research on research. Not only did these momentous advances seem to be quite unknown to the authorities, but they were almost entirely neglected in the hospitals, and not even the necessary microscopes were provided—equivalent to a failure to supply surgeons with instruments.

My own researches on this subject, commenced about 1901, gave several illustrations of these curious defects. Literature and apparatus were for the most part unobtainable, except by purchase from England, and advice or instruction on scientific details were equally hard to acquire, though arrangements for these should have been organised long previously. In 1895 a rich native State asked for my services to investigate the malaria which seriously incommoded its population, and offered to pay the expenses; but the presiding Civil Service genius vetoed the suggestion. I was even refused ordinary leave of absence to undertake researches at my own cost, although my services could easily have been spared. In 1897, just at the moment when I had at last succeeded in cultivating the parasites of malaria in gnats, and after I had reported this important fact, to my surprise I was suddenly ordered off for months to a place where malaria was almost absent. I was then, very wisely, placed on special duty to continue my work, but, a year later, after I had worked out the life-history of the parasites in mosquitoes, as I could not obtain definite assurance that my special duty would be prolonged, I left the country. Before doing so I gave advice as to the best method of dealing with malaria (by appropriate drainage), but for years no serious effort was made to act upon the advice. It is, or was, usual to thank officers who had been placed on special duty for their services if successful, but mine, I suppose, were not thought to be sufficiently important for this little *douceur*.

I have mentioned some cases of neglect to recognise work done because they involve an important general principle. A scientific administration, if it cannot afford to pay for research, would at least attempt to encourage voluntary investigations by such inexpensive methods as promotion, good conduct pensions, special thanks, and recommendations for State honours. But I cannot remember a single instance in British administration in which the two former have been given for medical researches, even of the most distinguished character (though it is done in America); while the two latter, if offered at all, are offered on the lowest scale. While soldiers, judges, and governors who have merely performed their

ordinary duty are often covered with decorations in consequence, the men whose exceptional work will affect the lives of millions now and in the future are not considered good enough. Even in the medical profession it is generally the practitioner, who is already rewarded by his fees, rather than the pioneer, who is lucky if he is not ruined, who receives most of the public recognition. I may add that there are cases where men have actually suffered for their investigations. Many years ago, King, of Madras, succeeded in preparing a good vaccine from a calf inoculated with variola, but was immediately accused of trying to disseminate small-pox, was deprived of his appointment, and was not reinstated without strong efforts on the part of his friends. More recently, Haffkine, in spite of his immense services, lost his appointment because some cases of tetanus poisoning were attributed to his plague prophylactic; and still remains out of employment, although it has been clearly proved that the disaster was not possibly due to him or to his laboratory. The fact is that the public has little sense of the value of scientific investigations, and absolutely no sense of gratitude towards those who carry them out, usually at the cost of much trouble and expense to themselves.

The obvious retribution for all this childish unwisdom is that the public itself suffers on an enormous scale—millions sicken or die from diseases which a little more investigation and scientific administration would probably bring under comparatively easy control. Perhaps the most dramatic example of this was the terrible outbreak of plague in India in 1896. The people besotted with superstitions, the sanitary organisation insufficiently developed on its scientific side, and the Government knowing nothing of these matters and too weak to exert the necessary discipline, were caught unprepared. Although the disease had been raging for two years previously in Hong Kong, the authorities made no sufficient arrangements to exclude it from India, or to detect and suppress it should it effect an entry. When it came it was allowed to remain undetected for months, and was then met only with vacillating counsels and a painful feebleness of action. Only those who are utterly ignorant of the manner, and the only manner, in which epidemics must be fought against will attempt to justify such a story of ineptitude. The result for India alone has been the loss of more than four millions of lives, and the people are still dying of plague at the rate of seventy-five thousand a week!

In 1897–9 we ascertained definitely that the malarial infection was produced by the bites of mosquitoes, and this discovery immediately disclosed several methods of prevention, such as drainage of the breeding pools of the insects, protection from bites by means of gauze, and so on. Considering that the disease is a most serious, ubiquitous, and continuous pest in most tropical countries, causing an untold amount of inconvenience, expense, sickness and death, we had a right to expect that the new knowledge would be immediately acted upon everywhere for the protection of the public, as all Governments possess sanitary officials and funds specially appointed and allotted for such work. I have been watching the progress of events ever since—with mingled feelings of amusement and dismay. What a tragi-comedy could be written on the subject! There were the officials, there were the funds, there was the knowledge; but to persuade the first to apply the second for the purposes of the third was often an impossibility. They said they had no funds, that they did not accept the proofs, that there was no malaria in their district, that there were no mosquitoes—any and every excuse. The simple truth was that they did not like the trouble. Years passed, but little or nothing was done. The officials remained in undisturbed possession of their leisure. We wrote, lectured, demonstrated, undertook expeditions, sent up deputations, interviewed ministers; but even now, after nearly ten years, but little has been accomplished compared with what might have been done from the first had our Governments possessed those essentials of good administration, science, and discipline. One asks why, if the State thinks it worth while to employ sanitary departments at all, it does not see that they do the work for which they are paid?

Probably a similar state of things prevails in most departments of our administration. Look, for instance, at our large cities with their unspeakable slums filled with pale, dirty, and unhealthy people lounging round the innumerable public houses, or at the crowded mud hovels of the Indian towns—a constant reproach to our systems of municipal management. Then what clearer evidence of the increasing irrationalism, irresolution, and weakness of party government could we have than that given by the successive Vaccination Acts, culminating in the ridiculous "conscientious objection" and "statutory declaration"; or by the appointment of a Royal Commission to consider the utility of experiments on animals—which is like appointing one to consider the truth of the multiplication table? Or, going into another field, we shall find that military men make precisely similar complaints about want of science and discipline in regard to their department, complaints which are certainly causing grave uneasiness among the more thoughtful of our citizens.

To what is all this attributable? In official life it is probably due to the fact that even notorious inefficiency does not always retard advancement, nor even notorious merit accelerate it, with the result that the upper grades are often filled with men of no ideas who have reached their position, not by public services, but by seniority, wire-pulling, or even by the mere inertia of their mediocrity. Going still higher, it is attributable, I think, to our system of party government, because the ministers who should be constantly engaged in a rational State with the organisation and conduct of their departments are, under party government, constantly engaged in that party warfare which, when carried to the present excess, becomes a mere idle game played for the amusement of the mob. Lastly, it is due to our defective public education, which lays too much stress on literary, philological, and dogmatic trifles, and not enough on the hard facts and still harder methods of science, so that the whole nation is tending to become irrational in thought and unpractical in action. We frequently have to look in vain for that wise and strict organisation without which the vast machine of the State cannot perform its proper work. We hear only the jangling of wheels and cranks out of gear, and the cries of the inexpert engineers who think to mend matters by belabouring each other.

Those who have not considered the subject from my point of view will certainly think that there is too much black in this picture, but I could easily cite innumerable more instances, and, personally, have no doubt of my main proposition, that British administration is generally not scientific enough and not strict enough—it does not sufficiently seek knowledge or enforce action. But I do not, of course, deny that it possesses great virtues. It is imperturbable, scrupulous, just, and pure, and, I may add, is rapidly beginning to attach more importance to science. For example, India, which formerly spent, I suppose, less than one-thousandth part of the medical budget on investigation, is now spending perhaps as much as a hundredth part. More laboratories have been equipped, and

there have been official investigations on kala-azar, malaria, Malta fever, plague, typhoid, and other diseases, and on veterinary subjects; the Government has long set an example to other countries in the sale of cheap quinine in malarious areas, and something like a third of many municipal budgets is spent on sanitation, mostly water supply, conservancy, and drainage. Outside India we have recently seen very fine official researches on Malta fever and sleeping-sickness, so that matters are improving. But in my own humble opinion even this is not enough, and I think that the expenditure on research should reach 5 per cent. of that on all medical and sanitary work. Numbers of subjects, such, for example, as measles and scarlet fever in this country, remain almost untouched, greatly to the disadvantage of the public, and in a hundred directions we find action crippled by want of knowledge, and, therefore, correspondingly expensive and inefficient.

But the whole subject of science and the State possesses a most important, and indeed ominous, political significance. The invention of locomotives, by reducing the time required in travelling to about one-third or less, has, so to speak, diminished the world's diameter in the same proportion, and, by bringing the nations more closely face to face, has greatly increased the acuteness of international competition. In this competition scientific organisation becomes more and more vital to success, and in the wars of the last decade we have actually witnessed the complete collapse of two unscientific peoples before their more intelligent adversaries. Now no one will deny that the British stand in the front rank of scientific nations, but it is equally evident that this eminence is due entirely to private individuals, and not at all to the Government, that is, to the party politicians. For years they have allotted only about one three-thousandth part of the national income for scientific work, that is, for obtaining knowledge, equivalent to the annual expenditure for that purpose of six shillings and eightpence by a person possessing a thousand pounds a year; and it may be suggested that the amount of scientific intelligence and knowledge shown in our party political administration should be calculated at about the same rate. Nor can it be contended that the people at large show a much greater interest in science, a much greater knowledge of scientific facts, or a much greater proficiency in scientific habits of thought. Quite recently the Boer war gave us an explicit warning of what such nescience is likely to lead to, and we can only hope that the nation will have the sense to reform its methods in consequence before it is too late. For a full discussion of the subject, however, I must refer the reader to a recent book called "The Problem of National Defence," by my brother, Major Charles Ross, D.S.O. (Hutchinson and Co.), in which he examines from a military standpoint the same defects as I have alluded to above in connection with medical matters. The two cases are really parts of the same problem—how are we to be governed in the future by science rather than by nescience? But whether a nation so wedded to old habits will be able to change in time to save itself is another question which it is impossible to touch upon here.

I fear that some of these remarks will appear to many to be too severe, or perhaps too personal; but I can only state my own opinions, however small their value; and have attempted to do so as frankly as possible, because otherwise there is little use in writing on the subject at all. I should like to add, in conclusion, that my object is not to find fault, but to suggest lines of improvement for the future; and, unfortunately, the one cannot be attempted without the other.

RONALD ROSS.

INCANDESCENT ELECTRIC LAMPS.[1]

THE closing months of 1906 and the opening months of 1907 are likely to be long remembered by electrical engineers as a period of a remarkable recrudescence of interest in the subject of incandescent electric lamps. For many years the familiar carbon filament lamp has been the only commercial incandescent electric lamp, in spite of its threatened extinction by the invention of the Nernst lamp in 1897–1898. The feeling of uncertainty caused by this discovery was short-lived; after a wealth of prophecy on its probable effect on the industry it was soon found out that months, even years, of experiment were necessary to perfect the Nernst lamps commercially, and the drastic changes recommended to supply engineers were postponed for a time in consequence. Finally, the lamp, capable though it proved of taking a definite place in the art of electric lighting, was found to be hardly even a serious competitor of the carbon filament lamp.

In spite, therefore, of the predictions of 1898, the electrical world settled down with the conviction that the threatened revolution was not destined to be achieved. But in the meantime inventors were busy—foreign inventors that is to say, the English manufacturers being always too busy to invent—and from time to time rumours were heard of other approaching revolutions. Rendered callous, possibly, by the history of the Nernst lamp, little attention was paid to these warnings until the introduction of first the osmium lamp of Dr. Welsbach and then the tantalum lamp of Messrs. Siemens proved the truth of the old saying connecting smoke with fire. Finally came the practical realisation of the tungsten lamp almost simultaneously by Kuzel, Just and Hannaman, and Welsbach, and this for some unknown psychological reason seems to have suddenly awakened English engineers. Once awake they atoned for their long slumber by a copious use of ink, and the technical Press of the period referred to at the beginning of this article simply teems with matter relating to the new lamp developments.

All that is valuable in these articles will be found conveniently crystallised in the papers and discussions in the Journal of the Institution of Electrical Engineers. A paper by Mr. Swinburne on the new lamps opens the latest volume; it is followed by one on light standards and the present condition of high-voltage carbon filament lamps, by Mr. C. Paterson, and the series is rounded off by a paper on carbon filament, Nernst and tantalum lamps, by Messrs. Haworth, Matthewman, and Ogley. Combining these papers with M. Rodet's excellent little book on incandescent electric lamps, the reader can obtain a very fair idea of the present position of this subject.

So far as the carbon filament lamp is concerned, the position is far from satisfactory, as the study of Mr. Paterson's paper shows. It may justly be argued that the test results shown by the author are hardly numerous enough to justify the title. Six lamps each from ten British makers is a small number on which to base a condemnation of British methods, and a lamp-maker who manufactures four or five million lamps a year may rightly complain on being judged by the performance of a chance six. But making all allowance, it must be admitted that there is still much to be desired; nor does it seem probable that a much nearer approach to perfection is likely to be attained without cooperation between manufacturers and supply engineers. To make a lamp for a given voltage to have a definite candle-power and take a definite cur-

[1] "Les Lampes à Incandescence électriques." By J. Rodet. Pp. xi +200. (Paris: Gauthier-Villars, 1907.) Price 6 francs.
"Journal of the Institution of Electrical Engineers." Vol. xxxviii. No. 182. Pp. 211–371. London: E. and F. N. Spon, Ltd., 1907.) Price 5s.

rent involves the solution during a difficult manufacture of two simultaneous equations, and the percentage of lamps correctly solving them is small. It is the unavoidable outfalls which play such havoc with his balance-sheet, so that it is small wonder if the lamp-maker is tempted to be a trifle lax in his rating. If cooperation existed and station engineers would see the sweet reasonableness of adjusting their supply voltages in different districts or different towns, so as to afford a market for all the lamps a manufacturer produces, it would be possible for him to turn out a better article at a lower price with undeniable advantage to the industry generally.

The information concerning the new lamps is much more meagre and conjectural. It would seem that the osmium lamp is already moribund or dead, and that we have only to reckon with the tantalum and tungsten filament lamps, the former taking 2 to 2·5 watts and the latter 1 to 1·2 watts per candle. The tungsten lamp appears to have a brilliant future before it. A lamp working at a little more than 1 watt per candle brings electric lighting almost to the level of gas for cheapness. The light units, though at present large (30 candles and upwards), are no larger than the gas mantle units, and so it may reasonably be supposed that the public will not object to them, though they undoubtedly do away with one of the benefits of electric light. The chief drawback in England is the low voltage, the lamps being at present only suitable for voltages of about 100. It is conceivable, should lamp-makers fail in producing a high-voltage tungsten filament lamp, that engineers will change back to low voltage, in spite of the eagerness with which they struggled to enforce the change to high voltage a few years ago. The competition of gas is excessively severe, and in some way must be met; at present the tungsten lamp offers the only means of meeting it in interior lighting.

The next few years promise to be of exceptional interest so far as the development of electric lighting is concerned; a radical improvement has long been wanting, and there seems every reason to believe that it has at last been made. The present condition of affairs is full of possibilities, and no one can say what the position will be a few years hence. Perhaps to his interesting account of the birth of the carbon filament lamp M. Rodet may be able to add in his next edition the melancholy tale of its death.

MAURICE SOLOMON.

DR. MAXWELL T. MASTERS, F.R.S.

THE botanical and horticultural world has sustained a severe loss by the death on May 30 of Dr. Maxwell T. Masters, the well-known editor of the *Gardener's Chronicle*, and the author of many botanical works.

Dr. Masters was born in 1833, and was educated at King's College, subsequently removing to Oxford, where he became sub-curator of the Fielding Herbarium under Dr. Daubeny. He was botanical lecturer at St. George's Hospital from 1855 to 1868, and was elected to the fellowship of the Royal Society in 1870. He was a corresponding member of the Institute of France, and was also an officer of the Order of Leopold. He achieved distinction in his earlier days by the publication of his "Vegetable Teratology," a most valuable work, which has been translated into several European languages. But his most definite contributions to botany in later years were those dealing with the Coniferæ, a difficult group which had long interested him, and in which he displayed a remarkable and detailed knowledge. He contributed many papers on the structure and taxonomy of the species to the publications of the Linnean and Horticultural Societies.

But it is especially in matters appertaining to horticulture that he will be best known to most people. His position as editor of the *Gardener's Chronicle* gave him considerable influence, and he always used his best efforts with single-hearted devotion to promote the welfare of horticulture and to look after the interests of those who were engaged in gardening as the practical business of their lives.

He always took the keenest interest in the Royal Horticultural Society, and for many years presided over the Scientific Committee.

He will be sorely missed by a large circle of friends, as well as by many others in the gardening world, to whom his name has become almost a household word.

NOTES.

AT the meeting of the council of the British Association on Friday last, June 7, Mr. Francis Darwin, F.R.S., was unanimously nominated to the office of president for the year 1908–9.

WE have to deplore the deaths at Cambridge, on Friday last, June 7, of Prof. Alfred Newton, F.R.S., professor of zoology and comparative anatomy in the University, and Dr. E. J. Routh F.R.S.

THE ladies' soiree of the Royal Society will be held at Burlington House on Wednesday next, June 19.

SIR WILLIAM PERKIN, F.R.S., has been elected president of the Faraday Society for the session 1907–8.

TWELVE tablets were unveiled in the Hall of Fame of New York University on Memorial Day, May 30, among them being one in memory of Maria Mitchell, the astronomer, and another in memory of Louis Agassiz.

DR. NANSEN, president of the Social and Political Education League, will deliver his presidential address, on "Science and Ethical Ideas," at University College, Gower Street, on June 26. Sir Oliver Lodge will preside.

REUTER reports that a typhoon occurred in the Caroline Islands in the latter part of March and devastated the Olcai group of those islands. A great wave swept the land and buried it under a layer of sand.

WE learn from *Science* that Dr. C. R. Wieland, of the Peabody Museum, Yale University, has left America for a stay of five months in Europe, where he will visit the plant collections of northern and southern Europe for a special study of cycads. The results of his investigations will be published in his second volume on cycads.

A MEETING of the International Council for the Exploration of the Sea is being held in London during the present week. In the absence through illness of the president of the council, Dr. W. Herwig, his place is being taken by the vice-president, Dr. Otto Pettersson, of Stockholm. Among the members of the council and experts now present in London are Dr. P. P. C. Hoek, general secretary, and his assistant, Dr. H. M. Kyle; Dr. Lewald, Prof. Krümmel, Prof. Brandt, Prof. Heincke, Dr. Henking, and Dr. Ehrenbaum, from Germany; Mr. A. Hamman and Prof. Gilson (Belgium); Captain Drechsel, Mr. Martin Knudsen, and Dr. C. G. J. Petersen (Denmark); Dr. Homen and Mr. J. A. Sandman (Finland); Prof. Nansen, Dr. Hjort, and Dr. Helland Hansen (Norway); Prof. Max Weber, Dr. Redeke, and Dr. Wind (Holland); Prof. Otto Pettersson, Dr. F. Trybom, and Mr. G. Ekman (Sweden); Mr. Walter Archer, Prof. D'Arcy Thompson, Dr. Mill, Dr. Garstang, Dr. Masterman, Dr. H. Reid, Mr. E. W. L. Holt, Dr. Wemyss Fulton, Dr. E. J. Allen,

and Mr. D. J. Matthews (Great Britain). His Majesty the King will receive the delegates at Buckingham Palace on Friday afternoon. The first formal meeting of the council takes place to-day, June 13, at the Foreign Office, when Sir Edward Grey will open the proceedings. The members of the council are being entertained at dinner during the week by Lord Carrington, the Lord Mayor, the Secretary for Scotland, the Fishmongers' Company, and the Royal Geographical Society, whilst the chairman of the council of the Marine Biological Association will give a luncheon at Christ's College, Cambridge, on June 16. On Monday, June 10, Dr. Pettersson delivered a lecture at the Royal Geographical Society on some features of the hydrographical work done in connection with the international cooperation, and Tuesday and Wednesday were occupied by meetings of various committees of the council.

THE first meeting of the science group of the Franco-British Exhibition, to take place next year, was held on Tuesday. The following were present:—Sir Norman Lockyer, K.C.B., F.R.S., in the chair, Major Baden-Powell, Sir John A. Cockburn, Captain Creak, C.B., F.R.S., Sir David Gill, K.C.B., F.R.S., Colonel Hellard, R.E., Sir Thomas Holdich, Dr. H. R. Mill, Prof. Perry, F.R.S., Mr. F. W. Rudler, Dr. W. N. Shaw, F.R.S., and Dr. T. E. Thorpe, F.R.S. The question of classification was considered under the headings of historical apparatus, instruments of observation, and methods used in exploration of the land, the sea, the air, and the heavens. Special committees were appointed to deal with these subjects.

AT the fifth annual general meeting of the British Academy, held on June 11, Lord Reay presiding, Dr. Henry Bradley, Mr. H. A. L. Fisher, Dr. J. P. Postgate, and Prof. J. Cook Wilson were elected fellows of the academy. The corresponding fellows also elected were:—M. Émile Boutroux (Paris), M. Leopold Delisle (Paris), Prof. B. L. Gildersleeve (Baltimore), Prof. Adolph Harnack (Berlin), Prof. Höffding (Copenhagen), Mr. Justice Holmes (U.S.A.), Prof. William James (Harvard), Prof. Frederick de Martens (St. Petersburg), Prof. Karl Eduard Sachau (Berlin), and Prof. Ulrich von Wilamowitz-Möllendorff (Berlin). In a valedictory address the president, Lord Reay, announced that an anonymous donor had presented to the academy the sum of 10,000*l.*, to endow a fund to be called "The Leopold Schwach Fund" for the furtherance of research in the archæology, art, history, languages, and literature of ancient civilisation, with reference to Biblical study. Lord Reay remarked that this first benefaction was of good augury, for although they might well claim aid from public funds, and maintain that the State should give encouragement to scientific studies promoted by the academy, he would repeat what he said in his first address, viz. that the academy may also stimulate private benefactors, on whose munificence we depend to a large extent in this country for the advancement of scientific knowledge. The British Academy is probably the only academy which is not State endowed, and has not even a domicile, but Lord Reay expressed the conviction that ere long it will be recognised at home as it has been recognised by the sister academies, which have assigned to the British Academy a place of distinction. Sir E. Maunde Thompson was elected president in succession to Lord Reay.

THE adjudicators of the Hanbury medal have decided to award the Hanbury gold medal this year to Mr. David Hooper, curator of the economic and art sections of the Indian Museum at Calcutta. The medal is awarded biennially for high excellence in the prosecution or promotion of original research in the chemistry and natural history of drugs. Mr. Hooper, as recipient of the medal, will also receive the sum of 50*l.*, presented in the name of the late Sir Thomas Hanbury, as an expression of his desire to be associated with the memorial to his brother. He is the author of numerous papers dealing with vegetable materia medica, his latest contribution to scientific literature dealing with the anti-opium plant, and was associated with Brigade-Surgeon Dymock (a former medallist) in the compilation of "Pharmacographia Indica."

IN connection with the celebrations of the bicentenary of Linnæus, described in another part of the present issue, the trustees of the British Museum have had specially printed in honour of the occasion "A Catalogue of the Works of Linnæus (and publications more immediately relating thereto) preserved in the Libraries of the British Museum (Bloomsbury) and the British Museum (Natural History) (South Kensington)." Copies of the catalogue were sent to accompany the addresses presented by Dr. Bather on behalf of the trustees of the British Museum to the Royal University of Uppsala and the Royal Swedish Academy of Sciences at Stockholm. The catalogue was prepared by Mr. B. B. Woodward, the assistant in charge of the general library at the Natural History Museum, with the collaboration of the general catalogue consultative committee as regards the books at South Kensington, and of Mr. W. R. Wilson, of the printed book department, as regards the books at Bloomsbury.

THE annual meeting of the Association for Maintaining the American Women's Table at the Zoological Station at Naples and for Promoting Scientific Research by Women was held on April 20 at Mount Holyoke College. Miss S. E. Doyle, of Providence, was elected president, Mrs. E. L. Clarke treasurer, and Mrs. A. W. Mead secretary. The table of the association at the Zoological Station at Naples has been occupied at different times during the past year by Miss G. Watkinson, Miss F. Peebles, and Miss A. G. Newell. It has been assigned for the spring of 1908 to Miss M. J. Hogue. Nine theses (three of them were sent from foreign countries) were received in competition for the 1000-dollar prize offered for this year. The theses showed wider range of endeavour than those received in the two previous contests, as they dealt with botanical, anatomical, morphological, physiological, and chemical problems. Several were of decided merit, but since, in the opinion of the examiners, no one was of adequate merit to deserve the award, the association decided to exercise its right to withhold the prize. The fourth prize is announced for 1909.

THE Herbert Spencer lecture, on "Probability, the Foundation of Eugenics," delivered at Oxford on June 5 by Mr. Francis Galton, has been published by the Clarendon Press. The author gives a short sketch of the history of eugenics, *i.e.* the "study of agencies under social control that may improve or impair the racial qualities of future generations, either physically or mentally," from his introduction of the word in 1883 to the organisation of the Eugenics Record Office in connection with the University of London. Passing to the application of probability to the theory of eugenics, Mr. Galton gives an interesting outline of a suggested short course of object-lessons in the methods of biometry, the meaning of averages, measures of variability, and so on being explained by reference to actual objects, such as hazel nuts or acorns arrayed like beads on a string. To most people variability implies something indefinite and capricious, and

they require to be taught that it can be defined and measured. Mr. Galton then proceeds to point out that human action is guided less by certainty and by probability than by custom, prejudice, or other unreasonable influences; social opinion is the tyrant by the praise or blame of which the principles of eugenics may be expected to influence individual conduct, and public opinion may easily be directed into different channels by opportune pressure. Whenever public opinion is roused it will lead to action, and it is reasonable to expect that it will be strongly exerted in favour of eugenics when a sufficiency of evidence has been collected to make the truths on which it rests plain to all.

A LARGE meeting of people interested in the work and objects of the National League for Physical Education and Improvement was held at Devonshire House on Tuesday. The Duke of Devonshire, in the course of an address to the assembly, described the investigations made by the Physical Deterioration Committee, which collected a great deal of information of the highest importance, and made a number of suggestions of practical importance, especially in the direction of suggesting the steps which should be taken for the purpose of obtaining more accurate information as to the physical condition of the large masses of the people than are at present available. These steps are the indispensable preliminary to any effective action, either by Parliament, or by local authorities, or by the public, towards finding the remedy. One or two of the committee's recommendations relating to the medical inspection of schools and other educational subjects found a place in the Education Bill of last Session, and it is hoped that they will again find a place in an uncontroversial Bill which may be introduced in the course of the present Session. One of the objects of the league is to stimulate that public interest in the matter which seems to have been lacking, and a further object is to assist in organising local effort where it already exists, and where some beginning has been made in the direction of improvement. The meeting was also addressed by Lord Balfour, Prof. Howard Marsh, Sir Gilbert Parker, M.P., and the Bishop of Ripon.

ACCORDING to the *Daily Chronicle*, Giant's Quoit, Veryan, which figures prominently in the legendary and historical records of Cornwall, was reported on June 6, at the meeting of Truro Rural District Council, to have been destroyed by blasting and used for road metalling. The Quoit was delicately poised on a cairn, or beacon of hard rock, and with Giant's Cradle close by was of great archæological interest. A few years ago an effort was made to persuade the Government to appoint an inspector with expert knowledge whose duty it would have been to compile a record of remains of archæological interest and to take steps for their preservation. The frequency of acts of vandalism, such as that in Cornwall last week, shows the need for the appointment of an inspector with archæological knowledge to supervise these national memorials and educate local authorities as to their value.

AN excellent example of the mirage was observed on May 25 seaward of Llanelly, Carmarthenshire, by Mr. John Innes about 3, 4, and 5 p.m. The tide was about full, the day hot, and an inverted image of the land hung in the clouds.

AN auroral display was seen at Pontyates, Carmarthenshire, from 10 p.m. to 11 p.m. on June 6 by the Rev. T. Thomas. He states that the effect on houses and hedges was very weird, and closely resembled the dawn of day; there were no streamers. The phenomenon was also noted at Llanishen, near Cardiff.

THE Brighton and Hove Natural History and Philosophical Society has for fifty years had Alderman C. Clark as its honorary secretary. So long a service in a position of this kind, involving much work and expenditure of time, is very remarkable. In recognition of the active part Alderman Clark has taken in bringing the society to its present prosperous condition, a massive silver salver and an illuminated album containing the names of many past and present members was presented to him at the fifty-third annual general meeting on June 6.

THE statement as to the black tern breeding in Norfolk made in our issue of May 30 is, unfortunately, based on a mistake. It is the black-headed gull—a species still breeding in many parts of the British Isles—that has returned to its old nesting-haunts at Wells.

THE *Museums Journal* for May records the foundation at the Norwich Castle Museum of a section devoted to the study of economic biology, having for its title the Norwich Museum Association. It is desired to make this excellent museum the centre of the scientific life of the county, and to utilise its collections as a basis of instruction in subjects of importance to agriculturists, horticulturists, teachers, students, &c. A few models of insects injurious to agriculturists and horticulturists have already been installed in the central hall of the castle.

AS year by year the account of the sugar-cane experiments conducted under the superintendence of Dr. F. Watts in the Leeward Islands is published, it is interesting to observe which of the seedling canes maintain their reputation, and to note the new seedlings that come into prominence. The season 1905–6 referred to in the recent publication issued by the Imperial Department of Agriculture for the West Indies was, like the previous one, characterised by drought, so that the failure in certain cases is attributed to this cause. A strong yellow cane introduced from British Guiana, known as D 625, gave the highest output, probably owing to the dry conditions surpassing such well-known varieties as B 208 and B 156.

A SERIES of analyses of the principal Indian oil seeds made by Dr. J. W. Leather form vol. i., No. 2, of the chemical series of Memoirs of the Department of Agriculture in India. The results, showing an average oil-content varying from 27 per cent. in safflower to 63 per cent. in castor seed, are of primary value to the grower and crusher. The author raises the question as to the deterioration of seed when transferred from one locality to another; thus linseed obtained from various parts of India and grown at Lyallpur in the Punjab gave a reduced proportion of oil. Other reasons may, of course, be advanced for such a reduction, but this explanation is based on the assumption that the yield becomes larger when the plants are acclimatised.

A NEW publication has been launched by the publisher of the *Rivista Geografica Italiana* as a supplement to that journal under the title of *Memorie Geografiche*. The intention is to supply a medium for the publication of monographs or original communications on the subjects of physical geography or terrestrial morphology. Italian geography will receive the preference, but contributions relative to foreign countries will be included. Each number will contain a complete memoir, and a special feature will be made of supplying illustrations and maps. The first number contains a study of the limits of altitude on the

slopes of the Comelico Range, by Prof. O. Marinelli. The limits are reckoned for the snow-line, glaciers, shrubs, trees, pastures, barns, &c.

In the report for 1905–6 of the department of botanical research connected with the desert botanical laboratory at Tucson, Arizona, the director, Dr. D. T. MacDougal, refers to a number of problems that are being investigated by the resident staff or with the cooperation of other botanists. In order to test the influence of altitude and climatic factors upon vegetation, small plantations are being laid out at different localities in Arizona and north and south California, where the same plants will be grown and the various modifications noted. Water storage in plants is being studied from several aspects, and some results are already noted. Storage organs are found most abundantly in regions where a scanty rainfall is confined to a short period and during the remainder of the year the precipitation is very slight. A curious storage organ at the base of the cucurbitaceous plant *Ibervillea sonorae* was examined by Dr. MacDougal. Changes in the shape and volume of the "saguara" *Cereus giganteus* were found by Mr. E. S. Spalding to depend mainly on water-content, but partially on temperature and illumination. The development of storage organs on the roots of seedling Opuntias was discovered by Dr. W. A. Cannon.

Two papers by Mr. R. N. Hall, on the prehistoric gold mines of Rhodesia, have been reprinted from the *African Monthly*, and issued by the African Book Company, Grahamstown. In this pamphlet, of forty-five pages, Mr. Hall collects a series of statements to prove that the main working of the Rhodesian gold mines was not due to the Portuguese during the sixteenth to eighteenth centuries, nor to the Arabs and Persians between the tenth and sixteenth centuries. He therefore holds that the mines must have been worked earlier than the tenth century. He maintains that the fragments of Nankin china found in the ruins do not prove that the Zimbabwe was erected in mediæval times, as the specimens were not found under the walls of the temple, and were buried during a subsequent occupation. He emphatically re-states the conclusion that the old mining and ruined temples of Rhodesia date from ancient times, and were due to Semitic immigrants.

The enormous rainfall of 9¼ inches in about half an hour during a thunderstorm at Guinea, Caroline County, Va., on August 24, 1906, is reported in the *Monthly Weather Review* of September last. Mr. E. A. Evans, section director of the Weather Service at Richmond, states that, being much interested in establishing the facts relating to this cloud-burst, he visited Guinea and obtained the following information. There were three "measurements" made in buckets of various dimensions, all in open positions, but the term "measurements" applies only indirectly, as there were no actual measurements taken at the time; the buckets, however, were said to have been full and overflowing. As the storm approached, the lightning became severe, and at the meeting of two clouds, one moving from west and the other from north-east, the rain "poured down in solid sheets." The storm came from the west, and moved almost due northward; the wind was light, and no rain of consequence fell 1½ miles east of Guinea.

Weather in war time was the subject selected by Mr. R. Bentley as his presidential address to Royal Meteorological Society on January 16. To find a new theme after fifty-six previous addresses is of itself not easy; Mr. Bentley's task was laborious, but he showed in a most interesting manner how the operations of war, both on land and sea, were influenced by weather in more than 360 cases, dating from the earliest times. We can only quote a few of the memorable instances. Rain appears to have been the leading factor on land; in A.D. 9 the Roman legions under Quintilius Varus perished in the swamps of Lippe, in Westphalia, owing to the impossibility of moving the wagons; 1870 years later the British experienced disaster from the same cause at Isandlwana, at the hands of the Zulus. On August 13, 1870, Marshal Bazaine excused his inactivity from his inability to cross the Moselle rapidly owing to the flooding of the river after heavy rain. Snow has also played a great part; the author refers to the passage of the Alps by Hannibal, and to the retreat of the French Army from Russia in 1812, among many other instances. Ice has been frequently of assistance; perhaps the most important occasion was the invasion of Denmark in 1658, when Charles X. marched his entire army over the frozen Baltic to besiege Copenhagen. The first exemplification of the result of fog was at the battle of Barnet, on April 14, 1471, when each side outflanked the other without being aware of it; it was owing to fog that Gustavus Adolphus lost his life at Lutzen in 1632. The effect of wind at sea may be exemplified by the buffeting of the various Spanish armadas between 1588 and 1719. In November, 1854, the allied fleets were seriously damaged by the Black Sea storm. This event was one of the principal causes that led to the establishment of storm signals in this country, as a study of the storm showed that if the present system of weather telegraphy had then existed, timely notice of its approach might have been given.

We have received copies of the *plan de voyage* and programme of scientific work of the proposed second Belgian Antarctic Expedition, drawn up by M. Henryk Arctowski. It is proposed to reach the edge of the ice-pack early in the season in about long. 100° W., and to spend some months in making hydrographic and magnetic observations. At a suitable opportunity efforts will be concentrated on making a way through the pack to the Antarctic coast, trusting to the prevailing easterly winds to bring the expedition to the neighbourhood of King Edward VII. Land, where the vessel may be able to put itself *à quai* on the edge of the ice-barrier and to go into winter quarters. Efforts will be made during the following spring to penetrate southward across the ice by means of automobiles. It is intended that the expedition shall be fitted out for three summers and two winters. The scientific programme was discussed at a meeting of men of science held at Brussels on May 4, and on May 12 an enthusiastic meeting was held at Antwerp under the presidency of M. Beernaert, Minister of State, to discuss ways and means.

The Home Office has issued the first part of the general report on mines and quarries for 1906 (Cd. 3478, price 7*d*.). The report contains statistics of the persons employed, output, and accidents at mines and quarries in the United Kingdom. The total number of persons employed was 912,576. The total output of coal was 251,067,628 tons, which is an increase of 14,938,692 tons on that of 1905. The death-rate from accidents per 1000 persons employed was 1·29 at collieries, 1·19 at metalliferous mines, and 1·06 at quarries, the corresponding rates for 1905 being 1·35, 1·45, and 1·04 respectively.

In the *Annals of Mathematics* for April Prof. G. A. Miller contributes a note on the use of group theory in elementary trigonometry. It deals with the various groups of angles the sum or difference of which is a multiple of

15°, 30°, 45°, and its interest would appear to lie, not so much in the use of groups for teaching trigonometry, but rather in the possibilities of using trigonometry for illustrating the elementary study of groups.

IN a paper on the chemical actions of light, M. P. Villard describes in the *Journal de Physique* (vi., May) certain continuation phenomena. An interesting experiment is illustrated showing the effect of green light on photographic papers containing tartaric acid. A sheet of such paper was under-exposed under a stereoscopic negative; one part was then submitted to green and another to violet light. On the green part an excellent image developed, while the violet rays completely fogged the other part. The use of green glass in intensifying prints thus finds a ready explanation.

IN the Journal of the Asiatic Society of Bengal (1907, vol. iii., No. 2) Prof. P. C. Rây describes the preparation of a silver mercuroso-mercuric nitrate by the action of a solution of mercurous nitrite on silver nitrite. The compound formed has the composition $Hg''(Hg',Ag)_2(NO_3)_2$, and is of interest as showing that univalent mercury has the power isomorphously to replace silver. In an article on the "Pursuit of Chemistry in Ancient India," published in the *Modern Review* of Allahabad, Prof. Rây shows, by reference to old Sanskrit writings, the antiquity of the knowledge of chemistry in this country, particularly as regards metallurgical processes and the preparation of medicaments. The existence of an enormous wrought-iron pillar at Katub, near Delhi, which dates back to about A.D. 400, and is larger than any forged in Europe until quite recently, is a striking illustration of the high state of development of the arts in ancient India prior to their decay caused by the introduction of a new caste system under the later religious teachers.

THE uncertainty which still exists regarding the latent heat of fusion of ice forms the subject of a paper by Mr. L. F. Guttmann in No. 4 of the *Journal of Physical Chemistry*. The values obtained by Regnault (79·2) and by Bunsen (80·0) for this fundamental constant differ by more than 1 per cent., and it is contended that Bunsen's result is vitiated by the fact that the value obtained for the density of solid ice at 0° is very variable and uncertain, depending, apparently, on the age of the ice. The value 75·59, re-calculated from Regnault's determinations by introducing certain corrections for the specific heat of ice and water, is considered to represent most accurately the true value for the latent heat of fusion of ice. It would appear, however, that Mr. Guttmann, while referring to the recent work of M. Leduc on the same subject published in the *Comptes rendus* (1906, vol. cxlii., p. 46), has overlooked the more detailed account given by the same author of his investigations in the *Journal de Physique* (see NATURE, vol. lxxiv., p. 41). The difficulties raised by Mr. Guttmann were there dealt with, and, after introducing all necessary corrections, a value of 79·2 was deduced for the latent heat as being in harmony, not only with Regnault's determinations, but also with the corrected values calculated from Bunsen's data.

MESSRS. C. E. MÜLLER, ORME AND CO. have sent us their flow extraction cup apparatus. This apparatus is an improved form of the Soxhlet extractor. Two forms of cup are used; in one case the cup has a siphon, so that the substance which is being extracted is kept covered by the solvent, and a continuous flow of the pure hot solvent is kept running directly through the substance. The other cup, which has a perforated bottom, is placed in an outer cup, which is so arranged that the inner cup stands about 1 cm. above it. By this means the cup is kept continuously surrounded by the hot solvent. We have tested this apparatus, and find the extraction to be both rapid and efficient. The cups are of glass, and are therefore very convenient for weighing the substance both before and after extraction. There is also an arrangement for distilling off the solvent after the extraction is completed.

THE 1907 issue of "The Statesman's Year-book" provides, in the convenient form one has learnt to expect in this invaluable anuual, the latest available statistics concerning the States of the world. In some cases the information comes up to within a few weeks of publication. One of the most important of the new features of the volume is the section, which has been entirely re-written, relating to the armies of the various States. Diagrams and tables are included exhibiting the comparative growth of the leading navies in the past with a forecast of the future. Maps are also given showing the Anglo-French Nigerian boundary, the Turko-Egyptian boundary (1906), the new boundary of Aden protectorate, and the increase in value of land and property in Great Britain. This is the forty-fourth publication of the annual, and Dr. J. Scott Keltie, its editor, is to be congratulated on maintaining its high standard of accuracy and usefulness.

A BIOGRAPHICAL sketch of the life and writings of Linnæus, by D. H. Harms, appeared in the *Naturwissenschaftliche Wochenschrift* of May 19.

OUR ASTRONOMICAL COLUMN.

COMET 1907*c* (GIACOBINI).—Circular No. 97 (June 6) from the Kiel Centralstelle gives a set of elements and an ephemeris for the faint comet discovered by M. Giacobini on June 1. From the ephemeris it is seen that the comet is travelling eastwards through Leo, and will pass about 1½ degrees north of δ Leonis on June 14; its brightness is decreasing slowly.

MARS.—In Bulletin No. 26 of the Lowell Observatory Prof. Lowell gives the results of the observations of the south polar cap of Mars made during the favourable presentation of 1905.

Owing to the adverse tip of the planet's axis and the distance of Mars from the earth at the suitable season of the Martian year, the mapping of the southern cap has not previously been attempted. The present communication gives the latitudes of the edge of the snow in successive longitudes as determined from some two hundred drawings. The extent of the snow cap as seen during the presentations from May 10 to August 14 is shown on three diagrams.

The observations indicate that during the beginning of the opposition cloud or mist enveloped the cap, for not until May 15 was the edge of the cap continuously recognised, although snow was seen, in latitude 31°·8 S., on January 25.

In a telegram, published in Circular No. 97 from the Kiel Centralstelle, Prof. Lowell announces that Mr. Lampland has photographed the Martian canals Thoth and Astaboras.

A THIRD ASTEROID NEAR JUPITER'S ORBIT.—From a determination of the orbital elements of the minor planet 1906 VY, Herrn Vladimír Heinrich finds that in this object we have a third member of the Jupiter group of asteroids. According to the elements yet determined, the length of the semi-major axis of the orbit is about 5·19 astronomical units (*Astronomische Nachrichten*, No. 4181, p. 88, June 1).

RADIAL VELOCITIES OF ε AND ζ CYGNI.—Observations made at Bonn during 1904–5–6 indicate that the period of the radial velocity of ε Cygni is possibly shorter than that exhibited by the Lick observations of this star. Prof. Küstner finds a variation, of the radial velocity in regard

to the sun, ranging from −6·1 km. (September 23, 1906) to −15·3 km. (October 29, 1904).

The velocities determined for ζ Cygni vary only from +14·3 km. to 15·7 km. (*Astronomische Nachrichten*, No. 4181, p. 87).

MINOR PLANETS DISCOVERED DURING 1906.—In No. 21 (p. 261, May 23) of the *Naturwissenschaftliche Rundschau* Prof. Berberich discusses the minor planets discovered during 1906. In all, the discovery of 126 of these objects was announced, but of these thirteen were undoubtedly objects which had been seen before, whilst sixty-nine await further observation. The orbits of twenty are now known to be elliptical, whilst twenty-one others are probably so; in three cases a circular orbit fits the observational results better. Prof. Berberich gives a comparison between the orbital elements now determined and those previously calculated for the asteroids shown to be identical with bodies discovered earlier. The magnitudes, designations, and details of discovery are also given for those probably having elliptical paths.

THE SPECTRUM OF SATURN.—The results of a photographic study of the spectrum of Saturn, made by Mr. V. M. Slipher during the autumn of 1905, appear in Bulletin No. 27 of the Lowell Observatory. The spectra were taken on plates especially sensitised to the orange-red, and extend to λ 6563. The comparison spectrum, photographed on either side of the planet's spectrum, was that of the moon at about the same altitude, so that differential effects of the earth's atmospheric absorption were eliminated. The following absorption bands appear in the Saturnian spectrum, their relative strengths being in the order given:—λλ 6193, 5430, 6145, 645, 577.

The first named is a very strong band, broad and symmetrical, and traceable down to the band at λ 6145. None of these bands is to be found in the spectra of the rings, although a much weaker absorption than that producing λ 6193 should be indicated if it existed. This points to the conclusion that if the rings possess any atmosphere at all it is much rarer than that surrounding the ball of the planet. No trace of absorption due to the presence of aqueous vapour is shown on the spectrograms.

Mr. Slipher also gives an interesting comparative table of the spectra of the four outer planets, Saturn, Jupiter, Uranus, and Neptune, which indicates that the planets which are similar telescopically have similar spectra. The excellent plate accompanying the paper shows reproductions of the spectra of these four planets taken with various comparisons.

OXFORD UNIVERSITY OBSERVATORY.—The thirty-second annual report of the Savilian professor of astronomy, dealing with the period May 1, 1906, to April 30, 1907, contains but little which is of general interest.

The proof-reading and printing of the astrographic results for the Oxford zone have occupied the time of the staff fully during the past year, and will, with the necessary re-measurement and checking, continue to do so for some few years; consequently, no other serious piece of work can be undertaken. Vols. i. (zone +31°) and ii. (zone +30°), and the greater part of vol. iii. (zone +29°), are now printed, the two former being also bound.

CELEBRATION OF THE BICENTENARY OF LINNÆUS.

THE Linné Fest[1] which has just come to an end was a complete success in every way. The meeting was admirably managed, and the delegates were treated with the most generous hospitality. At Upsala[2] they were especially indebted to the Rector of the University (Dr. Schück) and to Mr. Aksel Andersson, of the University library. The last-named gentleman was tireless in his efforts to rule his troublesome pack, and, indeed, lost his voice in that service, and became as hoarse as a huntsman after a long day. Many of the delegates arrived on May 22; the remainder reached Upsala by special train on the morning of May 23—the first day of the Fest. At the station they were met by the students of the University, looking uncommonly smart in dress coats and white caps, their fuglemen decorated with huge blue and yellow scarves. They struck us as a very fine set of young men as they marched past with their banners and saluted us. The guests were also honoured by the presence of the women students, who wore white caps like those of the men, which they removed in a masculine manner by way of salute to the assembled delegates. At mid-day was held the great meeting in the Aula of the University, when the delegates presented their addresses, heard the oration of the Rector, and listened to Holmgren's hymn in honour of Linnæus and Liljefoss's music to Snoilsky's poem "The Prince of Flowers."

The delegates of each nation formed a group, and the groups went up in alphabetical order, beginning with America and ending with Österrike (Austria), the modified *o* being the last letter in the Swedish alphabet. Each group had a leader, who made a short speech as he passed the Rector's throne, this office being performed for England by Sir Archibald Geikie with conspicuous success. It was a relief to those delegates who are not quite clear about Latin quantities to find that addresses were merely handed in. After their leader's speech the delegates descended into the body of the hall, filed passed the Crown Prince and other Royal personages with bows of varying degrees of elegance, and so got safely back to their seats.

Among the delegates were the following well-known men of science:—Profs. Farlow, Harvard; Warming, Copenhagen; Elfving, Helsingfors; Prince Roland Bonaparte, Académie des Sciences, Paris; France being also represented by MM. Flahault, Giard, and Mangin; Profs. Moll, Holland; Wille, Christiania; Borodin and Palladin, St. Petersburg; Casimir de Candolle, Geneva; Engler, Berlin; Goebel, Munich; Haeckel, Jena; Pax, Breslau; Peter, Göttingen; Pfeffer, Leipzig; Wiesner, Vienna. Halle had the distinction of being represented by a mathematician, Prof. Wangerin, who came as the president of the Leopold. Car. Academy. The delegates from "Storbritanien och Irland" were:—Sir A. Geikie, Royal Society; Dr. Bather, British Museum and Zoological Society; Mr. Carruthers, Linnean Society; Mr. F. Darwin, Cambridge and the Royal Society; Mr. Daydon Jackson, who was personally invited; Mr. Morice, Entomological Society; Prof. Poulton, Oxford; Lieut.-Colonel Prain, Kew Gardens; Dr. Rainy, College of Physicians, Edinburgh, and the University; Dr. Church, Edinburgh. The Society of Arts of London was represented by the Swedish professor Sjögren. Great Britain was in the proud position of having more delegates than any other nation. Prof. Bailey Balfour, whose name occurs on the official list, was unfortunately absent.

At the conclusion of the meeting the delegates were presented to the Crown Prince, who afterwards conferred the Order of the Polar Star on some of them, among whom were Mr. Daydon Jackson and Prof. Poulton.

The festivities were not nearly concluded. There was a concert at 4.30 p.m. given in the Botanic Garden by the students, whose remarkably finished singing was much admired.

In the evening the guests were divided between the hospitable tables of the Rector and the Archbishop. At the Rector's party, the toast of the Linnean Society was given by our host, whose generous reference to the Linnean treasures in London was warmly appreciated by the Englishmen present. The evening concluded with a grand reception in the University buildings.

On the following day (May 24) was held a great "promotion" of doctors, which by a revival of ancient custom took place in the cathedral. The building was filled with a great crowd, and the students again gave a picturesque touch by their massed white caps. The proceedings began with the creation of thirty Swedish D.D.'s named by the King and "promoted" by the Archbishop.

Then came Doctors of Law and Medicine, among the latter being Dr. Rainy, of Edinburgh. Prof. Haeckel was in a class by himself as a Jubilee Doctor. Each M.D. was presented with a remarkable headdress, being, in fact, a tall hat covered with pleated black material, and with these they were respectfully crowned by the promoter. A re-

[1] An interesting gathering took place on May 21 at Råshult, the birthplace of Linnæus, where a ceremony was arranged, including a visit to the church in which he was christened. Many delegates attended at the invitation of the Rector of the University of Lund.

[2] Modern spelling reform has converted the name to Uppsa'a.

markable feature in the ceremony was the firing of a cannon as each candidate was promoted. The delegates were reminded of another Scandinavian land the King of which gave command to "let the kettle to the trumpet speak, the trumpet to the cannoneer without." In Upsala the trumpet and kettle-drum seemed to be replaced by the electric button.

The Doctors in Philosophy were promoted by Dr. Tycho Tullberg, a collateral descendant of Linnæus. The ceremony consisted in placing a gold ring on the finger and a "laurel crown" on the head of each candidate; in the case of the honorary doctors the crown was made of leaves from a bay tree planted by Linnæus. The British doctors were Mr. Carruthers, Mr. F. Darwin, Sir A. Geikie, and Mr. Daydon Jackson. Among the Swedish doctors was the deservedly popular Prince Eugen, who has made for himself a reputation as an admirable landscape painter.

In the evening there was a great banquet in the Aula of the University, and an evening entertainment given by the students.

On Saturday, May 25, the delegates departed for Stockholm, where the Linné Fest was continued by the Royal Swedish Academy under the auspices of Count Mörner, the president. Here again the delegates were met with excellent arrangements and a warm welcome. A solemn meeting of the academy was held at which the delegates presented addresses, speeches were made, and a cantata was sung, of which the words were by G. Retzius, the music by Valentin. To the general satisfaction of all the delegates, and to the especial delight of those from Britain, the Linnean gold medal of the academy was awarded to Sir Joseph Hooker, and handed to Sir Rennell Rodd, the British Ambassador, for transmission to England. A beautiful bronze medal given to each delegate forms a particularly attractive memento of a memorable occasion.

In the evening a great banquet was given, at which the speeches were made by the president of the academy (Count Mörner), the Crown Prince, Prince Roland Bonaparte, and the Prime Minister. Later in the evening the students gave an entertainment at Skansen, the beautiful zoological and ethnological garden of Stockholm.

One of the most striking features of the Fest was the interest shown in it by the Royal House. The Crown Prince and Princess and other members of the Royal Family were present at the meetings and banquets both at Upsala and Stockholm. The Crown Prince mingled with the guests with a kindness that was much appreciated by the delegates, and the same may be recorded of the other members of the Royal House. A garden-party given by the Crown Prince on Sunday was somewhat marred by the break-up of the fine weather which had added so much to the effect of the Upsala gathering.

Finally must be mentioned the generosity of the authorities of Upsala and Stockholm in presenting the delegates with a valuable reproduction of the portraits of Linnæus and a reprint of his works, including a facsimile of the first edition of the "Systema Naturæ."

Celebration at the Linnean Society.

The reception held by the Linnean Society of London on Friday, June 7, as part of its celebration of the bicentenary of Linnæus, was attended by nearly three hundred guests, many of whom were ladies. The Swedish Minister, some of the Swedish Legation, and several other Swedes were amongst those present. The president of the society, Prof. Herdman, F.R.S., and Mrs. Herdman, received the guests in the library, and prominent among the exhibits were many interesting personal relics of the great naturalist—selections from his herbarium, cases of Lepidoptera, Coleoptera, fishes, and shells, including the celebrated artificial pearls produced by the native fresh-water mussel.

The beautiful medallion by Inlander, which was copied by Josiah Wedgwood, occupied a conspicuous position, and was surrounded by a laurel wreath from the recent festival held at Upsala on May 23 and 24, which was lent by one of the British representatives who received an honorary degree there. A large series of medals which had been struck at various times in honour of Linnæus also were set out in the same case; they included Count Tessin's medals of 1746 and 1758, Ljungberger's large medal, struck by command of Gustaf III. in 1778 on the death of Linnæus, and many of a later date. Recent medals were also shown, such as the Linnean medal of the society, a special copy of which had been presented to the Royal University of Upsala last month, and, latest of all, a bronze copy of the bicentenary medal, struck for the Royal Swedish Academy of Sciences, and awarded on May 25 to Sir Joseph Hooker, G.C.S.I., F.R.S. Two cases contained the correspondence between Linnæus and our own countryman, John Ellis, F.R.S., the letters on both sides being shown; manuscripts of great interest, copies of books interleaved and copiously annotated by Linnæus, his Lapland diary, and his note-book for the eventful year which witnessed his departure from Sweden to take his medical degree at Harderwijk, and the issue of his "Systema Naturæ" in 1735. The foregoing were shown by the Linnean Society, in whose possession they have been since the death of Sir J. E. Smith, the first president, in 1828.

Dr. Tempest Anderson displayed photographs showing the growth of vegetation in St. Vincent since the volcanic eruption in 1902; Prof. Dendy, preparations from his New Zealand specimens; Mr. A. D. Darbishire, Mendelian phenomena; Miss Benson and Prof. F. W. Oliver, the spermatozoid bodies in the fossil seeds of Lagenostoma and Physostoma; Prof. Farmer, apogamic growths from fern-prothallia; and the president, specimens of pearl oysters and plankton gatherings taken during the present spring. Animated photographs of plant-life were shown by Mrs. D. H. Scott, and many other objects of great interest were on view in the library and the galleries.

During the evening a series of short lectures was given in the meeting room by the following:—Prof. Poulton, Prof. Herdman (who prefaced his remarks by a short discourse on the present Linnean celebration), Lieut-Colonel Prain, and Mr. F. J. Lewis. The rooms were not deserted until nearly midnight.

THE ROYAL OBSERVATORY, GREENWICH.

THE report of the Astronomer Royal to the Board of Visitors, on the work done at the Royal Observatory during the period May 11, 1906, to May 10, 1907, was presented on Saturday, June 8, when the annual visitation took place. A brief summary of this report is given below.

In addition to the routine observations, the transit-circle was employed on a number of stars, of the ninth magnitude and brighter, which may be used as reference stars for the Oxford astrographic zones; 7704 transits were taken during the year.

The second nine-year catalogue (epoch 1900) will probably be ready for press before the end of the current year, and will be divided into two parts, (1) fundamental and zodiacal stars, (2) astrographic reference stars.

The reflecting prism for illuminating the field of the altazimuth has been replaced by a smoothly ground reflector of opal glass, cemented on to the object-glass, and this gives a much more uniform illumination. The observations of the moon and of the lunar crater Mösting A were continued, and, discussed with the similar observations carried out at the Cape Observatory, should give an improved value for the lunar parallax.

The new working list for the 28-inch refractor primarily includes double stars discovered by Hough, and during the year 400 pairs were observed, fifty-eight of them having a separation of less than 0″·5. The equatorial and polar diameters of Jupiter were measured by the methods described in the previous report, these measures being intended to supplement those made during the opposition of 1895–6. The diameters of the satellites were also measured on two nights with the filar micrometer.

When the 30-inch mirror on the Thompson equatorial was taken out for re-silvering, in November, 1906, it was found to be slightly loose in its cell, so, before re-mounting,

twelve wedges of *lignum vitae* were inserted symmetrically round the mirror, and appear to have eliminated the slight movement.

Fifty-five photographs of the sixth, and eleven photographs of the seventh, satellite of Jupiter were secured with the 30-inch reflector, together with 170 photographs of minor planets and comets and twelve of various nebulæ. Of the latter, that of M 31 (Andromeda) and one of the Ring Nebula in Lyra are especially good.

The discussion of the photographs of Eros taken during the opposition of 1900–1 was completed, and a value for the solar parallax, in close agreement with the previously accepted value, was deduced.

With the astrographic telescope 188 supplementary photographs were taken, and 133 of them were passed as satisfactory. Positive copies of the plates covering zones 71°–74° are now completed, and of the 461 chart plates necessary to cover the remaining zones, 75° to the pole, seventy-five have to be repeated for the purpose of reproduction. Vol. ii. of the Greenwich Astrographic Catalogue is now complete, except for the introduction, which will contain the constants for the plates, and these have now been computed. For the area included in zone 81° (from 6h. to 24h.) and the zones 82° to the pole, viz. 254·7 square degrees, the 40m. exposure plates show 75,683 star images, or 297·2 per square degree; in the B.D. the corresponding area (1°) includes 15·7 stars. About 13,000 enlarged prints of the chart plates were made during the year.

During the period covered by the report, the sun was photographed on 210 days, and for 1906, including the Indian and Mauritian negatives, the daily photographic record of the sun's surface was complete except for one day. Twenty-three photographs of portions of the solar disc were secured with the 26-inch photographic refractor, fitted with a negative enlarger, the scale being such as to give a solar diameter of 30 inches.

The magnetic observations were carried on as usual, the principal results for the magnetic elements for 1906 being

Mean declination	16° 3′·6 W.
Mean horizontal force	4·0174 (in British units)
	1·8524 (in metric ,,)
Mean dip (with 3-inch needles)	66° 55′ 17″

There were no days of "great" magnetic disturbance and eight of lesser disturbance.

The mean temperature for the year ending April 30, 1907, was 50°·5, or 0°·9 above the average for 1841–1905, the highest and lowest shade temperatures recorded being 94°·3 (August 31) and 19°·8 (December 30) respectively. Of the 4457 hours that the sun was above the horizon at Greenwich, the Campbell-Stokes instrument recorded 1687 hours of bright sunshine.

The total rainfall was 0·26 inch below the average for the sixty-five years 1841–1905, being 23·86 inches, whilst the number of "rainy days" was 148.

The performance of the chronometers sent in for the annual trial was hardly up to the high standard of recent years, and of the fourteen pocket-chronometers submitted none came up to the standard of purchase. The next trial for chronometers will commence on June 15, and for chronometer watches on August 3.

In concluding his report, the Astronomer Royal refers to the threatened danger to the astronomical efficiency of the observatory occasioned by the L.C.C. generating station near by, the principal point being the recommendation of the committee appointed to consider the matter, that the conditions be reviewed after the lapse of two years. Experiments made last summer showed that the vibrations from the present installation can be effectually damped out by keeping the film of mercury in the amalgamated trough as thin as possible, but there still remains the danger that these vibrations may so cause the large telescopes to oscillate that delicate observations, such as close double-star work, may suffer materially.

A more insidious danger is that the heated gases from the chimneys may affect the accuracy of star observations on the northern meridian, and in that case the errors would not be discovered until the observations were reduced, when, possibly, it would be impracticable to repeat the observations.

TWO HEAVY SEISMOGRAPHS.

TWO new seismographs devised by Dr. Wiechert are now on sale by Spindler and Hoyer, of Göttingen. The fact which will strike most seismologists is the magnitude of the "stationary" mass employed. The horizontal pendulum uses a "stationary" mass of 17,000 kilo., nearly 17 tons. The mass is composed of barytes contained in a cylindrical sheet-iron vessel with a flat bottom. Its dimensions are 2 metres in diameter by nearly 2 metres in height, and, being intended to have freedom of movement horizontally, the vessel is suspended by three iron rods of 3 cm. diameter, the elasticity of which allows the necessary freedom. The next striking feature is the multiplication with which the thrust arm moves the indicator point, and this is 2200! It is brought about by means of four levers, multiplying $5\times5\times5\times17\frac{1}{2}$. The loss owing to the inertia and elasticity of the connecting system amounts to 5 per cent. only. "The instrument renders specially important service in the small European earthquakes where the rapid oscillations are more prominent." It is clear that this statement is justified. For local disturbances and extremely rapid elastic vibrations the instrument should be of great service, but, with such a multiplication, one is compelled to wonder how much the machine requires to be isolated in order to avoid the disturbance due to traffic. It is not surprising to find in a specimen seismogram tremors due to a gas engine $2\frac{1}{2}$ kilometres distant. Other drawbacks to the use of the pendulum are the price, 5000 marks, and the number of times the paper must require to be changed. These purely practical considerations must have weight with anyone who has real work in view.

The vertical seismograph has a "stationary" mass of 1300 kilograms, about one and a third tons. Even this is great as compared with the usual one to two hundred pounds. The multiplication, 160, is also large when one thinks of the usual 12 to 20. "The vertical apparatus often indicates the first movements of very distant earthquakes better than even the 17,000 kilo. pendulum, which multiplies 2000 times; so the Schlüter result is confirmed, from which follows that in the case of first indications we have to do with longitudinal movements." Thus runs the prospectus. The price of this pendulum, too, 2800 marks, is rather prohibitive, although the workmanship in both leaves little to be desired.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—Dr. Graham-Smith, Prof. Nuttall, and Prof. Woodhead have been nominated to represent the University at the International Congress of Hygiene and Demography to be held in Berlin in September.

The general board of studies has approved Alexander Scott for the degree of Doctor in Science.

Profs. E. H. Liveing and H. Louis have been nominated examiners in the application of science to the art of mining, and Mr. C. T. Heycock an examiner in metallurgy for the diploma in mining engineering for the examination to be held in the Michaelmas term, 1907.

The Balfour studentship will be vacant at Michaelmas next. The names of applicants, together with such information as they may think desirable, should be sent on or before October 1 to the secretary, J. W. Clark, Registry of the University, Cambridge. The studentship is of the net annual value of 200*l.*, or such larger sum as the University may from time to time determine. The student need not be a member of the University, and during his tenure of the studentship is required to devote himself to original biological inquiry.

The Vice-Chancellor announces that the advisory committee of the Colonial Office for the tropical diseases research fund recommends that a grant of 100*l.* for two years should be made from the fund to assist in establishing a research studentship in medical entomology in Cambridge, and that Lord Elgin is prepared to approve of the proposal. Candidates for the studentship are requested to send in their applications to Prof. Nuttall, 3 Cranmer Road, Cambridge, on or before Monday, June 17.

LIVERPOOL.—Mr. J. K. Catterson-Smith has been appointed demonstrator in electrotechnology, and Dr. G. D. Hope demonstrator and assistant lecturer in organic chemistry.

From the interest of funds bequeathed to the University by the late J. L. Bowes, the council has decided to allot 100*l.* per annum towards the permanent endowment of the lectureship on organic chemistry.

Grants have been made out of funds provided by H.M. Treasury for the following researches at present being carried out in science laboratories:—for investigation of absorptive properties of vegetable fibres; for plates to illustrate a monograph on the edible crab; for materials used in the investigation of Röntgen radiation; for apparatus for research on brass annealing; for apparatus for investigating high-temperature combustion; for research on three-membered heterocyclic derivatives; for research on continuous and momentary arcs; for suction of gases in pipes; and for research on blood pressure.

The University has decided to confer the degree of D.Sc., *honoris causa*, at the forthcoming graduation in July, on the following men of science:—Prof. A. R. Forsyth, F.R.S.; Prof. F. Gotch, F.R.S.; Dr. C. L. A. Laveran, Chef de Service Honoraire of the Institut Pasteur, Paris; Sir Oliver J. Lodge, F.R.S.; Sir John Murray, K.C.B., F.R.S.; Prof. W. Osler, F.R.S.; Prof. W. Ostwald; Sir William Ramsay, K.C.B., F.R.S.; and Sir Henry E. Roscoe, F.R.S. The degree will be conferred on Dr. Laveran *in absentia*.

MANCHESTER.—His Grace the Duke of Devonshire, who for many years has held the office of president of the Owens College, and more recently of the University, has been elected Chancellor of the University upon the resignation of Earl Spencer. The installation ceremony has been fixed for July 10, and on this occasion a number of honorary degrees will be conferred. Prof. E. Rutherford, F.R.S., whose appointment as Langworthy professor of physics and director of the physical laboratories has already been noted, is now in Manchester making arrangements for taking over the duties of his office in October.

Prof. Arthur Schuster, F.R.S., has been offered, and has accepted, an appointment as honorary professor of physics; his continued cooperation in the work of the department is thus assured.

Mr. W. H. Jackson, who has for the past five years held the position of assistant lecturer in mathematics, has been appointed assistant professor of mathematics at Haverford College, Pa., U.S.A.

OXFORD.—Mr. D. L. Chapman has been selected for the official fellowship in natural science at Jesus College. Mr. Chapman was an exhibitioner of Christ Church, and since 1897 has been a demonstrator in Prof. Dixon's laboratory at the Victoria University of Manchester.

ON Thursday, June 6, the Buckinghamshire Education Committee closed all their schools so that the teachers could attend a conference, organised by Mr. C. G. Watkins, at Aylesbury, at which a number of the delegates of the Federal Conference on Education were present. Among the subjects discussed was the question as to how the rural schools might be kept in touch with the progress and development of educational life. An important difference between rural schools in the colonies and in the mother country was brought out. In the former the teachers are the best teachers, and quickly move as they are promoted according to the work that they can do. Here the best teachers go at once to the better-paid posts in towns; those in the rural districts stay where they are, as there is no system of promotion. Among those from the colonies who spoke on this and other topics were the Hon. Colin Campbell (Minister of Education, Manitoba), Mr. Frank Tate, I.S.O. (Victoria), Mr. A. Williams (South Australia), Mr. J. A. Douglas (Southern Nigeria). Mr. W. M. Webb pointed to the use that could be made of museums fixed and circulating in the training of teachers, particularly in rural districts, and he mentioned the resolutions passed at the Federal Conference with regard to a collection that should bring before teachers fresh methods and new appliances.

THE board of trustees of the University of Illinois has voted that the Engineering Experiment Station be authorised to offer ten research fellowships in the college of engineering each of an annual value of 100*l.* A pamphlet received from the University gives information concerning these fellowships, and describes the facilities for experimental work now available in the college of engineering.

WE have received a copy of a brochure, presented to the British editors on the occasion of their visit to Berlin last month, which provides an instructive account of the Handelshochschule founded by the Berlin Merchants' Corporation. It is the only institution of its kind in Germany which owes its existence to the efforts of a body of business men, and is maintained solely at their expense. The school is particularly meant for commercial students who have gone through a regular apprenticeship, and, besides, have attained that degree of general training which entitles to the privilege of serving the shorter term of one year in the German Army or Navy. Exceptions are made in the case of students otherwise suitably prepared. The object constantly held in view is "to provide instruction and opportunities for research in the sciences necessary and most useful for a commercial career." The approved course of work extends over two years. The school was opened in October, 1906, and during the first session 1371 persons were in attendance on lectures. The inauguration of the scheme serves to show that German merchants possess initiative enough themselves to supply any deficiency which may exist in the State system of education.

A DEPUTATION from the British Medical Association, the Board of Hygiene and Temperance, and the 1904 Committee of the Medical Profession, waited upon the President of the Board of Education on June 6 to urge the teaching of hygiene and temperance in all schools and training colleges under the Board, and the establishment of a medical bureau in the Education Department. Mr. McKenna, M.P., in reply, said that the chief difficulty is to obtain competent teachers, and the next is to get the teachers to teach the children. To come into immediate contact with the schools, it is necessary to have teachers to teach children in 21,000 schools, and these are not available. As to medical inspection, the Bill dealing with this subject has not yet passed through the House of Commons, but it is to be pressed, and Mr. McKenna believes it will obtain the support of the House and become law. Until the Bill is passed it would be undesirable to declare in advance what the settled policy of the Board is as to the details of carrying out the proposals of the Bill. Naturally the desire of the Board will be to have expert medical advice, if the Bill passes, upon the various topics with which it is concerned, but no definite lines could be laid down now on the proposal for the establishment of a medical bureau. On the general question, Mr. McKenna expressed himself as heartily in sympathy, as the whole of the Government are, with the objects laid before him. It is most desirable for children in elementary schools to be taught hygiene and temperance.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, April 18.—"On Reciprocal Innervation of Antagonistic Muscles." Tenth note. By Prof. C. S. **Sherrington**, F.R.S.

This communication furnishes fresh examples of reciprocal innervation of antagonistic muscles. These examples are taken from the great flexion-reflex of the leg. The paper shows that in that reflex the extensors of the ankle are inhibited concurrently with excitation of flexors of the ankle. It also shows that the adductors of the hip are relaxed by inhibition concurrently with reflex contraction of the abductors, and that the external rotators of the hip similarly are relaxed by inhibition concurrently with contraction of the internal rotators. These new instances of reciprocal innervation of antagonistic muscles are important, because of the desirability of seeing how far reciprocal innervation may be considered a general or

widespread principle in the coordination of muscular actions.

The communication next proceeds to show that the muscles of the limbs are divisible into two groups; in one group the reflex action provocable excites the muscle itself and relaxes by inhibition its antagonist muscles. To this group belong, among others, the following muscles:—*biceps cruris, biceps brachii, gracilis, tensor fasciae femoris, semi-tendinosus, tibialis anticus*, and *gluteus minimus*. In the other group the reflex action provocable from the nerve of the muscle inhibits that muscle itself while exciting reflex contraction in the muscles antagonistic to it. In this group come the following muscles:—*vastocrureus, gastrocnemius, soleus, triceps brachii, supraspinatus scapulae* and *anconeus, adductor magnus*, and *quadratus femoris*.

The communication finally reverts to the after rebound of contraction which, as pointed out in a previous communication on this subject, very usually follows reflex inhibition of the limb muscles. It is shown that this after-rebound to contraction is of central origin, and can be produced by direct electrical excitation of the cross-section of the spinal cord itself. The rebound contraction is illustrated by a graphic record of the rebound contraction following reflex inhibition of the gastrocnemius muscle in the cat.

Geological Society, May 15.—Sir Archibald Geikie, Sec.R.S., president, in the chair.—The origin of certain cañon-like valleys associated with lake-like areas of depression: F. W. **Harmer**. In glaciated regions, as shown by Prof. P. F. Kendall, the invasion of a district by an ice-sheet would tend to obstruct the natural drainage, producing lakes, of which the outflow might take place over the advancing ice, between the ice and the hillsides, or it might escape laterally, in a direction at right angles to the longest diameter of the lake and to the course of the pre-existing stream. Overflow channels would assume a gorge-like character, and would present a comparatively recent appearance. During the Glacial epoch the North Sea ice appears to have invaded the plain of the Witham and the valleys of the Welland, Nene, and Ouse, overriding also the higher land separating them; the Tees ice-stream moved up the Trent basin to the vicinity of Derby, and thence, inosculating with the Derwent glacier, up the Soar valley towards Leicester and Rugby; the Irish Sea ice passed into the northern part of the basin of the Lower Severn; ice from the Brecknock Beacons passed towards the Bristol Channel, and, combined with Irish Sea ice crossing Pembrokeshire from St. David's Head towards Cardiff, may have caused the accumulation of sedentary ice in the Severn valley. After considering the case of Lake Pickering and the Malton Gorge as a typical example, the author passes on to Lake Shrewsbury and the gorge at Ironbridge. Pre-glacial drainage of the upper Severn and Vyrnwy was probably northwards; when a glacial lake was first formed over the Cheshire plain it may have drained towards the Trent, possibly by Rudyard and Madeley; when these gaps were closed, the lowest outlet seems to have been towards the south, and the Severn Gorge at Ironbridge was cut. Lake Trowbridge and the gorges of Clifton and Bradford-on-Avon are next dealt with, the latter being attributed to the overflow of a glacial lake occupying the Trowbridge plain, and the former to the blocking of the Flax-Bourton valley by ice. The gaps in the Jurassic escarpment at Lincoln and Ancaster are explained as overflows from a lake caused by the damming of the Trent outlet towards the Humber. This gave rise at first to the more northern, and later to the southern gorge. Finally, Lake Oxford and the Goring Gap are dealt with in considerable detail.

Royal Microscopical Society, May 15.—Lord Avebury, F.R.S., president, in the chair.—Diffraction rings due to a circular aperture: Prof. A. W. **Porter** and P. F. **Everitt**. The differences between the theoretical and the observed radius of the first dark diffraction ring mentioned in Mr. Nelson's paper, read March 21, 1906, were considered to be due to the method of observation, because the values obtained from observations made by Mr. Everitt, under the best conditions, were in very close agreement with theory.

Zoological Society, May 28.—Dr. J. Rose Bradford, F.R.S., vice-president, in the chair.—The form of the brain in the extinct lemurs of Madagascar, with some remarks on the affinities of the Indrisinæ: Dr. G. Elliot **Smith**. This formed a supplement to the paper on recently discovered subfossil Prosimiæ from Madagascar, read before the society by Mr. H. F. Standing on March 19. From an examination of cranial casts of an extinct species of lemur and of Mesopropithecus and Palæopropithecus, and of brain casts of Nesopithecus and Megaladapis, in conjunction with information derived from the study of recent lemurs, the author had arrived at the conclusion that Propithecus, Avahis, Indris, Mesopropithecus, Nesopithecus, Palæopropithecus, Chiromys, and Megaladapis must be regarded as the diversely specialised members of one family, all of which exhibited in greater or less degree distinct evidence of retrogressive changes from a more primitive and also more pithecoid type.—Some notes on the abdominal viscera of Chlamydoselachus: Mrs. O. A. Merritt **Hawkes**. Observations on the alimentary canal, including the associated glands, the dentition, and the spiral valve of this fish. The results were compared with the accounts of these organs previously given by Garman and Günther, and attention was directed to any discrepancies which had been noted. The female reproductive organs were also examined, and evidence was cited supporting the conclusion that Chlamydoselachus was viviparous. The interesting discovery was recorded that a vestigial seventh branchial arch was present.—Second report on the batrachians and reptiles collected in South Africa by Mr. C. H. B. Grant: G. A. **Boulenger**. The report dealt with fifty-eight species—nineteen Batrachia and thirty-nine Reptilia—of which two were described as new.—Hydroids of the Cape Verde Island marine fauna collected by Mr. Cyril Crossland: J. **Ritchie**. The collection contained twenty-seven species, and added considerably to our rather meagre knowledge of the hydroid fauna of the northerly portions of the west coast of Africa. The majority of the specimens hitherto described from Cape Verde Island had been obtained in comparatively deep water, but the present collection was a littoral one, and contained examples of only one species before recorded from the locality, viz. *Sertularia versluysi*, Nutting. Of the twenty-seven species represented in the collection eighteen were already known, while the remaining nine were described as new to science. Of the new forms, the most interesting was a gymnoblast, the peculiar branching and simple gonophore of which separated it so widely from known genera that a new genus had been established for it.

CAMBRIDGE.

Philosophical Society, May 6.—Dr. Hobson, president, in the chair.—The influence of a strong magnetic field on the spark-spectra of lead, tin, antimony, bismuth, and gold: J. E. **Purvis**. The strength of the field was 40,000 units. The more important results were:—(1) Comparing the metals *separately*, there were lines belonging to the same type in having the same number of constituents, the same ratio of intensities of these constituents, the same polarisations, and the same distances apart when represented on the same scale of vibration numbers. (2) Comparing the metals *with one another*, there were lines which were comparable similarly, and this was particularly well marked amongst lines which were divided into four. (3) There were lines of Au, Sb, and Pb yielding four constituents which were essentially identical in every way with lines of the principal series in the spectra of Cu and Ag. (4) The constituents of some of the triplets of lines in the spectra of the different metals were also comparable with the constituents of some of the quadruplets in that the constituents vibrating perpendicular to the lines of force were polarised in the same direction and had the same distances apart when represented on the same scale of $d\lambda/\lambda^2$.—The β rays from potassium: N. R. **Campbell**. An account is given of an investigation into the nature of the rays from potassium which were described in a recent paper by the author and Mr. Wood. The experiments were directed mainly to showing that the rays carry a charge, and must therefore be β rays, since their penetration indicates that they cannot be α rays. For

this purpose the deviation of the rays in an electrostatic field was observed and compared with that of the β rays from uranium. The conclusion reached in the earlier paper is confirmed, that the potassium rays are β rays the average velocity of which is less than that of the β rays of uranium. Incidentally, convincing proof was obtained of the photographic action of the rays. It seems beyond doubt that potassium must be classed among the radio-active elements.—The number of electrons in an atom: N. R. **Campbell.** A somewhat speculative calculation of the number of electrons in a radio-active atom based on the energy liberated in radio-active processes. The estimation of the average energy of an intra-atomic electron is based on observations of the velocity of the slow δ rays from radium. The conclusion is reached that the number of electrons is probably of the same order of magnitude as that deduced on the assumption that the whole mass of an atom is the sum of the masses of the contained electrons. General arguments are offered for the view that the number of electrons in a radium atom cannot be less than 1300, and is probably very much greater.—The longitudinal impact of metal rods with rounded ends: J. E. **Sears.** The paper deals with the determination of the velocity of propagation of elastic waves in metal rods by means of observations on the duration of their longitudinal impact. The experiments were carried out with rods of steel, copper, and aluminium, and in every case the observed value of the wave-velocity was within $\frac{1}{2}$ per cent. of that calculated from static tests by the formula $v=\sqrt{Eg/\rho}$, with the proper correction for adiabatic propagation. It was also observed that, for the exceedingly short times involved in these experiments, stresses far exceeding the elastic limit of the material can be applied without producing any permanent effects.—Selective absorption of Röntgen rays: G. W. C. **Kaye.** A Röntgen-ray bulb was constructed so that a pencil of kathode rays fell on an antikathode which was one of a batch of metals mounted on a small carriage which could be moved along inside the tube by a magnet from outside. The quantity of Röntgen rays passing through a thin aluminium window in the tube was measured by their ionising effect. Absorbing screens of different metals were placed in turn between the ionisation chamber and the aluminium window. Using a plate of aluminium as the absorber, the relation between the amount of transmitted radiation and the atomic weight of the metal used as antikathode was found to be approximately a linear one over a wide range of atomic weights. Screens of a few other metals were employed, and the results indicate that a metal is specially transparent to the Röntgen radiation from an antikathode of that metal, and that this abnormal transparency is shared in less degree by metals of atomic weight differing little from that of the antikathode. The effect seems to indicate that the Röntgen rays emerging from the interior of the antikathode to the surface undergo selective absorption, leaving the remainder specially penetrating to further layers of the same substance.—The transmission of earthquakes through the earth (second paper): Rev. O. **Fisher.**—Note on the influence of extraneous forces upon the proportion of the sexes produced by canaries: W. **Heape.** The breeding results in two aviaries are examined. In the one (N), the young produced were in the proportion of 76·99 cocks per 100 hens; in the other (G), 353·3 cocks per 100 hens were bred. This remarkable difference in the proportion of the sexes produced in these two aviaries is shown to be consistent both in detail and in the total results. Moreover, it is shown that a pair of N's birds transferred to G's aviary produced a large excess of cocks, and a pair of G's birds bred in N's aviary produced young of which the sexes were closely in accord with the average proportion obtained in the aviary that year. Examination of details regarding the food supplied and the temperature and surroundings to which the birds were subjected in these two aviaries indicates the probability that these factors exerted selective action on the generative elements dehisced by the parent birds, and may be interpreted as evidence of the exercise of extraneous forces on the proportion of the sexes produced.

PARIS.

Academy of Sciences, June 3.—M. Henri Becquerel in the chair.—The origin of the irregularities of the lunar surface: MM. **Loewy** and **Puiseux.** A critical discussion of the theories of Laplace and G. H. Darwin concerning the moon's origin, and the present condition of its surface.—Selenium hexafluoride: Sir W. **Ramsay.** A reply to the criticisms of M. Lebeau on the selenium hexafluoride discovered by Prideaux.—Magnetic observations at Tananarivo: Ed. Él. **Colin.** The results are summarised in three tables showing the absolute measurements of declination, inclination, and the horizontal component from May, 1906, to April, 1907.—Tetramethyl-dioxyacetone: Louis **Henry.** An account of the study of the reaction between mesoxalic ester and magnesium methyl bromide by M. Joseph Lemaire. The magnesium compound being used in excess, the pentamethyl derivative $(CH_3)_2.C(OH).C(CH_3)(OH).C(OH)(CH_3)_2$ was looked for. The actual product, however, proved to be

$$(CH_3)_2.C(OH).CO.C(OH)(CH_3)_2,$$

the physical properties of which are given.—Some applications of the theorem of Landau-Picard: C. **Carathéodory.**—Integral invariants: E. **Goursat.**—An apparatus for the study of telephonic currents: Henri **Abraham** and M. **Devaux-Charbonnel.** The essential part of the apparatus is the moving coil galvanometer for alternating currents described by H. Abraham in an earlier paper. This can be arranged so as to measure, not only the amplitudes, but also the phases and strength of telephone currents.—The speaking condenser: Pierre **Sève.**—A self-recording pyrometer with fixed photographic plate: M. **Wologdine.** The time ordinate is obtained by a mirror rotating round a horizontal axis at a uniform rate.—An apparatus for the preparation of a constant stream of pure oxygen: Gustave D. **Hinrichs.** The centre bulb of a Kipp is filled with well-washed granular pyrolusite, the liquid consisting of hydrogen peroxide acidified with one-twelfth of its volume of concentrated sulphuric acid.—The action of silicon tetrachloride on silver and copper: Em. **Vigouroux.** With silver, the tetrachloride is partially reduced to the sesquichloride; the silver not converted into chloride is free from silicon. With copper, the metallic ingot remaining contains about 2·4 per cent. of silicon.—The transformation of the esters of the α-bromo-fatty acids into the corresponding α-iodo-compounds: F. **Bodroux** and F. **Taboury.** The α-bromo-ester is treated with anhydrous magnesium iodide in presence of ether. The reaction is energetic and practically quantitative.—A new method of synthesis of biprimary compounds containing an odd number of atoms of carbon: dimethoxy-heptane, 1.7 $CH_3O(CH_2)_7O.CH_3$: J. **Hamonet.**—The synthesis of the auramines by means of the oxalic esters: A. **Guyot.**—The action of organo-magnesium compounds on the cyclic alkylidene ketones: Henri **de Béville.**—A new type of bisazoic compound: H. **Duval.**—An alkaline microgranite collected at Graham's Land by Dr. Charcot's Antarctic Expedition: E. **Gourdon.**—The dehiscence of some stamens: M. **Pauchet.**—The *rôle* of comparative anatomy in the distinction between the species of the genus Cistus: M. **Gard.**—A new method of separating and estimating the organic acids in fruits and vegetables: J. M. **Albahary.**—The cultural mutation of *Solanum tuberosum*: Edouard **Heckel.**—The xylophage parasites of *Manihot Glaziovi*: P. **Lesne.**—The structure of the spinal medulla: N. A. **Barbieri.**—Fluorine in the shells of non-marine molluscs: P. **Carles.** Fluorine was found in all the non-marine molluscs examined, but in quantities much smaller than in the shells of marine molluscs.—The influence of the rapid displacements of air caused by the motor-car on the general nutrition: A. **Mouneyrat.** Both in normal and anæmic persons the number of red corpuscles in the blood is increased by moderate use of the motor-car. In neurasthenia accompanied by insomnia there is also a marked improvement.—A new method for the experimental diagnosis of tuberculosis: H. **Vallée.** Von Pirket has recently proposed the lesions arising from the application of a dilute solution of tuberculin to the skin of tuberculous subjects as a means for diagnosing tubercu-

losis in man. The author has studied this skin reaction with animals with results generally confirming those of Von Pirket. In healthy animals (cattle, horses, guinea-pigs) no appreciable skin reaction is produced; with tuberculous animals, on the other hand, the skin reaction is well marked.

DIARY OF SOCIETIES.

THURSDAY, JUNE 13.

ROYAL SOCIETY, at 4.30.—Some Points in the Development of *Ophiothrix fragilis*: Prof. E. W. MacBride, F.R.S.—On Certain Phenomena of Inactivation and of Inhibition exhibited by Precipitin Antisera: D. A. Welsh and H. G. Chapman.—The Inhibitory Action upon Subsequent Phagocytosis exerted on Active Normal Serum by Inactive Normal Serum through which Bacilli have been passed: J. C. G. Ledingham.—*Miadesmia membranacea*, Bertrand; a New Palæozoic Lycopod with a Seed-like Structure: Miss M. Benson.—On the Identification of Chitin by its Physical Constants: Miss I. Sollas.

CHEMICAL SOCIETY (Extra Meeting), at 8.30.—Discourse entitled Some Borderline Problems in Botany: Prof. J. B. Farmer, F.R.S.

MATHEMATICAL SOCIETY, at 5.30.—On Partial Differential Equations of the Second Order: Prof. A. R. Forsyth.

INSTITUTION OF MINING ENGINEERS, at 11 a.m.—Improvements required in Inland Navigation: H. R. de Salis.—Bye-product Coking Plant at Clay Cross: W. B. M. Jackson.—Notes on Bye product Coke-ovens, with Special Reference to the Koppers Oven: A. V. Kochs.—Bye-product Coke-ovens: P. Schwarz.—Water Supplies by Means of Artesian-bored Tube-wells: H. F. Broadhurst.—Gypsum in Sussex: W. J. Kemp and G. A. Lewis.—The Use of Duplicate Capell Fans: G. M. Capell.

MATHEMATICAL SOCIETY, at 5.30.—Note on a Special Set of Classes of Partial Differential Equations of the Second Order: Prof. A. R. Forsyth.—Various Extensions of Abel's Lemma: Prof. T. J. I'A. Bromwich.—On the Number of Representations of a Number as a Sum of $2r$ Squares, where $2r$ does not exceed 18: Dr. J. W. L. Glaisher.—An Extension of Eisenstein's Law of Reciprocity: Mr. A. E. Western.—On Certain Singular Points of Surfaces: Mr. A. B. Basset.—The Minimum Necessary Postulates as to a Function to be Defined as Analytic over a Region: Prof. E. B. Elliott.

FRIDAY, JUNE 14.

ROYAL INSTITUTION, at 9.

ROYAL ASTRONOMICAL SOCIETY, at 5.—(1) Note on the Colours of α and o Ceti; (2) The Relation between Star Colours and Spectra: W. S. Franks.—On the "Owl Nebula," M 97, N.G.C. 3587: E. E. Barnard.—Ancient Eclipses: P. H. Cowell.—Note on the Visual Spectrum of Mira Ceti in December, 1906: Rev. A. L. Cortie.—The Spectrum of Mira Ceti in December, 1906, as Photographed at Stonyhurst College Observatory: Rev. W. Sidgreaves.—Observations of Comets *d*, *e*, *g*, 1906, from Photographs taken with the 30-inch Reflector of the Thompson Equatorial: Royal Observatory, Greenwich.—*Probable Papers*: Observations of Jupiter: Rev. T. E. R. Phillips.—Description of an Equatorial Reflecting Telescope driven by a Hydraulic Ram: T. E. Heath.—The Work of the Mount Wilson Observatory: Prof. G. E. Hale.

PHYSICAL SOCIETY, at 8.—Observations on the Electric Arc: W. L. Upson.—The Poulsen Arc as a Means of Producing Electrical Oscillations (with Experiments): Dr. J. A. Fleming.—Exhibition of a Direct Reading Conductivity Bridge for Rods: R. Appleyard.

INSTITUTION OF MINING ENGINEERS, at 10.30 a.m.—The Reform of British Weights and Measures: A. Hopkinson.—The Thick Coal of Warwickshire: J. T. Browne.—Description of the Ozokerite (Mineral Wax) Mine at Boryslaw, Galicia, Austria: D. M. Chambers.—Notes on the Structural Geology of South Africa: Dr. C. Sandberg.—The New Rand Gold-field, Orange River Colony: A. R. Sawyer.—Cast-iron Tubbing: What is the Rational Formula? H. W. G. Halbaum.

MONDAY, JUNE 17.

ROYAL GEOGRAPHICAL SOCIETY, at 8.30.—In the Equatorial Forests of Africa: Major P. H. G. Powell-Cotton.

TUESDAY, JUNE 18.

ROYAL STATISTICAL SOCIETY, at 5.

ZOOLOGICAL SOCIETY, at 8.30.—On Growth-forms and supposed Species in Corals (illustrated by Lantern Slides): Dr. F. W. Jones.—Notes on Limnocnida from Lakes Tanganyika and Victoria Nyanza: R. T. Günther.—On *Lacerta ionica*, Lehrs, a Variety of *Lacerta taurica*, Pallas: G. A. Boulenger, F.R.S.—On Neotropical Lycænidæ, with Descriptions of New Species: Hamilton H. Druce.—Descriptions of *Velifer hrpselopterus* and a New Fish of the Genus Velifer: C. Tate Regan.—On the Anatomy, Classification, and Systematic Position of the Teleostean Fishes of the Sub-order Halotriognathi: C. Tate Regan.—A Monographic Revision of the Monkeys of the Genus Cercopithecus: R. I. Pocock.—Notes upon some African Species of the Genus Felis recently exhibited in the Zoological Gardens: R. I. Pocock.

WEDNESDAY, JUNE 19.

GEOLOGICAL SOCIETY, at 8.—The Constitution of the Interior of the Earth as revealed by Earthquakes (Second Communication): Some New Light on the Origin of the Oceans: R. D. Oldham.—(1) The Swansea Earthquake of June 27, 1906; (2) The Ochil Earthquakes of September, 1900, to April, 1907: Dr. C. Davison.—(1) The Inferior Oolite and Contiguous Deposits of the Bath-Doulting District; (2) The Inferior Oolite and Contiguous Deposits of the District between the Rissingtons and Burford: L. Richardson.—The Flora of the Inferior Oolite of Brora (Sutherland): Dr. M. C. Stopes.

ROYAL METEOROLOGICAL SOCIETY, at 4.30.—Weather and Crops, 1891–1906: F. C. Bayard.—The Relation of the Rainfall to the Depth of Water in a Well at Cirencester, 1903–1906: C. P. Hooker.—*Exhibit*: The "Step" Anemometer, an Instrument designed to obviate the "Sheltering" Error: W. Child.

ROYAL MICROSCOPICAL SOCIETY, at 8.—Eye-pieces for the Microscope: E. M. Nelson.—Lecture, illustrated by Lantern-slides, on the Life-history of the Tiger Beetle, *Cicindela campestris*: F. Enoch.

THURSDAY, JUNE 20.

ROYAL SOCIETY, at 4.30.—*Probable Papers*: Bakerian Lecture, On the Atomic Weight of Radium: Dr. T. E. Thorpe, C.B., F.R.S.—On the Origin of the Gases Evolved by Mineral Springs: Hon. R. J. Strutt, F.R.S.—On the Presence of Sulphur in Some of the Hotter Stars: Sir J. Norman Lockyer, K.C.B., F.R.S.—The Fluted Spectrum of Titanium Oxide: A. Fowler.—Preliminary Note on a New Method of Measuring Directly Double Refraction in Strained Glass: L. N. G. Filon.—Studies of the Processes Operative in Solutions, II., The Displacement of Chlorides from Solution by Alcohol and by Hydrogen Chloride: Prof. H. E. Armstrong, F.R.S., E. V. Eyre, and A. V. Hussey; III. The Sucroclastic Action of Nitric Acid as Influenced by Nitrates: R. Whymper; IV. The Hydrolysis of Methylic Acetate in Presence of Salts: Prof. H. E. Armstrong and J. A. Watson; V. The Discrimination of Hydrates in Solution: Prof. H. E. Armstrong, F.R.S., and R. J. Caldwell.

CHEMICAL SOCIETY, at 8.30.—Some Properties of Radium Emanation: A. T. Cameron and Sir W. Ramsay.—The Affinity Constants of Aminosulphonic Acids as Determined by the Aid of Methyl Orange: V. H. Veley.—Azo-derivatives of 1:3-Diphenylbarbituric Acid. Dynamic Isomerism among the Coloured Hydrazones of 1:3-Diphenylalloxan: M. A. Whiteley.—A Series of Coloured Diazo-salts Derived from p-Aminoaceto-α-naphthalide: G. T. Morgan and W. O. Wootton.—(1) Colour and Constitution of Azo-compounds, Part I.; (2) Colour and Constitution of Azo-compounds, Part II.: J. T. Hewitt and H. V. Mitchell.—The Oxidation of Hydrazines by Free Oxygen: F. D. Chattaway.—Calmatambin, a new Glucoside: F. L. Pyman.—The Decomposition of Hyponitrous Acid in Presence of Mineral Acids: P. C. Rây and A. C. Ganguli.—The Chemical Composition of Petroleum from Borneo: H. O. Jones and H. A. Wootton.—(1) The Synthesis of Phenonaphthacridines. Trimethylphenonaphthacridines; (2) The Condensation of Aldehydes with Mixtures of α-Naphthol and α-Naphthylamine; Synthesis of 7-Aryl $\begin{matrix}\alpha\text{—N—}\alpha\\ |\\ \beta\text{—CH—}\beta\end{matrix}$ Dinaphthacridines: A. Senier and P. C. Austin.—(1) An Improved Form of Apparatus for the Rapid Estimation of Sulphates and Salts of Barium; (2) The Determination of Sugar by Fehling's Solution: W. R. Lang and T. B. Allen.

LINNEAN SOCIETY, at 8.—Distribution of Conifers of China: Dr. Maxwell T. Masters, F.R.S.—Pre-glacial Flora of Great Britain: Clement Reid, F.R.S., and Mrs. Reid.—Cruise of H.M.S. *Sealark*, Part ii.: Dr. J. Stanley Gardiner.—On Tubucellaria: A. W. Waters.—Cruise of the *Silver Belle*: Dr. N. Wolfenden.—Triassic Species of Zamiko and Pterophyllum: E. A. N. Arber.

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