THURSDAY, MAY 25, 1905.

THE ANOPHELES MOSQUITOES OF INDIA.

A Monograph of the Anopheles Mosquitoes of India. By S. P. James and Dr. W. G. Liston. Pp. 132 and plates. (Calcutta and London: Thacker and Co.) Price 24*s.* net.

THERE is one feature in which this book far surpasses any other devoted to mosquitoes, viz. the coloured plates. The authors and their artist, Dr. Turkhud, are to be congratulated on the excellence of these pictures. It will be now possible to compare an Indian Anopheline with a plate, and with practical certainty to be sure of its identity. The same could not be said of any representations of mosquitoes hitherto produced. These plates are beautifully executed, and depict faithfully the bands on the palpi, the spots on the wings, and the leg markings. It is a pity that some few Anophelines are not represented, but of these we have, of course, the systematic description.

The book is divided into two parts: (1) general, (2) systematic. The first chapter gives a general account of mosquitoes, egg, larva, nymph, and external anatomy of the imago. The description is clear and adequate for medical men, for whom the book is primarily written. We think perhaps a short account of the internal anatomy might have been added, as a knowledge of this is so important. The chapter ends with a short account of Theobald's classification of mosquitoes, which the authors are unable to accept. Instead of dividing the subfamily Anophelina into twelve genera as Theobald has done, they place them all (at least the Indian ones) in the old genus Anopheles. We cannot help thinking that this, in spite of some of the difficulties of Mr. Theobald's classification which they point out, is a retrograde step. The authors deal with a total of twenty-four Indian species; the total number of Anophelines, however, now amounts to nearly a hundred, and, to say the least, it would be very inconvenient, if not impossible, to deal with these if we placed them all in a single genus. In some of these, *e.g.* Lophoscelomyia, Christya, the difference in scale structure is so marked from, for example, a typical Myzomyia that we prefer to follow Mr. Theobald and put them in separate genera. Again, we do not know whether the authors would propose, ignoring scale structure, to arrange the rest of the Culicidæ in a single genus, Culex, and take no notice of the obvious differences in scale structure, *e.g.* between Mucidus and Culex, or between Stegomyia and Culex. We think, to be logical, they should do so, and try to classify them by palpal bands and leg markings; but this would be well-nigh impossible. We think the authors would have made their position more secure if they had been content with placing in the same genus only those in which they failed to recognise the differences in scale structure defined by Mr. Theobald. It may be granted that doubts sometimes arise, but we cannot regard this as an excuse for merging into a single genus those in which the differences are well marked and easily appreciable.

The second chapter contains a synoptic table of the Indian species of Anophelines, based upon the author's classification according to palpal bandings, wing spots, and leg markings; the chapter concludes with a description of the method of identifying Anopheline larvæ. The essential points are very clearly set forth, and there follows a classification—a modification of that originally constructed by Stephens and Christophers. One point noticeable as showing that even all the Indian Anopheline larvæ are as yet unknown is that the table only contains eighteen species, whereas the table of imagines contains twenty-four. This table should be of great assistance in helping actual workers in identifying their catch of larvæ from any source.

The third chapter is devoted to the habits of Anophelines. These most interesting questions are, as the authors admit, only beginning to be studied, and now that a book of this kind enables observers to identify their mosquitoes, we may expect much light on these questions—questions of vital importance, but to which many pay no attention. One of the most interesting problems is the distance of flight of Anophelines. Christophers and myself found in Africa instances which proved conclusively that normally the flight of Anophelines was quite a restricted one, to be counted in yards and not in miles, as was not uncommonly stated. A striking example of this we found in the central portion of Freetown, Sierra Leone. Although we lived there for several months during the dry and rainy seasons, we never discovered Anophelines in our rooms, yet a quarter of a mile away they existed in myriads in the native huts; and many other similar instances were observed by us. Yet in Mian Mir observations are quoted to show that *P. fuliginosus* will on occasions fly two and a quarter miles, and *M. rossii* three-quarters of a mile. But, of course, the conditions at Mian Mir are very different—in one case an open plain, in the other a crowded town. Closely bound up with this problem is the question of dispersal of Anophelines. Two of the most important means are (1) by flight, (2) "by a gradual spreading, by short stages, from areas in which they are abundant." This latter method is, it seems to us, one of the most important and overlooked by those who have no intimate knowledge of mosquito habits, but who readily draw up schemes for their wholesale destruction. We agree with the authors when they state, "observers who consider that Anopheles can be materially reduced in numbers by the obliteration of all breeding places in the immediate vicinity of dwellings, rely chiefly upon the suppositions that the range of flight of these insects is very limited and that they do not disperse any considerable distance from their breeding grounds. It would appear from the observations just recorded that such suppositions are incorrect, and if this is so, the task of materially reducing the number of Anopheles in any place will undoubtedly be one of great magnitude."

Again, granted that Anophelines have been diminished in numbers in a certain area, it by no means follows that the malaria will be diminished. We could furnish many instances observed by us in Africa where Anophelines were extremely scanty (but present) yet the malarial index was high. In fact, it is not *always* possible to trace any relation between the number of Anophelines and the value of the malarial index, although on the contrary it often is so. Finally, we may point out that we have at our disposal an accurate and easily applied method of determining whether anti-mosquito measures have diminished malaria. It is now universally accepted by medical men, but not generally known to the layman, that the great source of malaria in the tropics lies in the native children, who to the outward eye show no signs of ill-health, though they contain in their blood malarial parasites. The malarial index or endemicity is the percentage of children under ten years of age that harbour parasites. It is not uncommonly 100 per cent.

If, then, the anti-malarial measures have reduced malaria, this figure must decrease. If malaria has been abolished it must be zero. (It is hardly necessary to state that, in determining this index, children of the same age must be selected for comparison, and the comparison must be made at the same time of the year before and after operations; such precautions are obvious, and are, of course, always taken by those engaged in such observations.) To sum up, no facts are convincing where this proof is not adduced. If the malarial endemicity is reduced to zero, then anti-mosquito measures have been completely successful—but not until then.

Let us return, however, to the book. We think it would have been advantageous, considering the great importance of the subject, if the authors had compiled a tabular statement of those species that are known to transmit malaria *in nature*, though the data on this point can be found by search. At present, then, out of twenty-four Indian Anophelinæ it has only been shown that three convey malaria in nature, viz.:—*M. culicifacies*, by Stephens, Christophers, and James; *M. listoni*, by Stephens, Christophers, and James; *P. fuliginosus*, by Adie; and we know with practical certainty that *M. rossii* does not. The third chapter contains many interesting details of larval life, but it is to be hoped that many observers, using this book as their guide, will study the subject further and fill up the many lacunæ.

Chapter iv. is devoted again to the vexed question of classification. Then follows part ii., containing the systematic description of each species. The descriptions are excellently done, clear, and sufficient, and not overloaded with details which terrify the already overburdened medical man in the tropics. In fact, this book admirably fulfils the object of enabling "medical men engaged in tracing the connection between mosquitoes and human disease to identify and speak with precision of the species implicated." These words are attributed to Prof. Ray Lankester, and if they represent his words we cannot but think that the elaborate monograph of the Culicidæ, excellent as it is, issued by the museum authorities has not had this result. The majority of medical men in the tropics can ill afford the time or inclination to read these detailed descriptions. We think if the museum authorities would issue concise but adequate accounts of, say, the Anophelinæ only, medical men would be greatly helped. For a few shillings the United States authorities publish excellent bulletins on various subjects, *e.g.* the ticks, the flukes, and so forth, but if a medical man in British possessions wants to identify the species of tsetse-fly he is working with he must buy a monograph issued by the museum costing fifteen shillings. If he wants to know anything about ticks, the museum leaves him in the dark. Seeing what medical men have done recently in elucidating malaria, sleeping sickness, and, most recently of all, tick fever, we think they might reasonably expect some help in return. We would point out finally one small matter which might be corrected in a future edition. In the list of illustrations only i–x are mentioned, though these number xv at least. The arrangement of the plates is erratic, *e.g.* v, xi, vi, xiv, vii, &c., so that they are very difficult to find. The proofs have evidently been carefully read, and we have detected no error of any importance.

The authors have had the great advantage of describing species caught on the spot and studied under their natural surroundings. We trust somebody will be found in Africa to write an equally good text-book of African Anophelines.

We think that all medical men in India will feel grateful to the authors for this excellent work.

J. W. W. STEPHENS.

EXERCISES IN PHYSICS.

Notes and Questions in Physics. By Prof. John S. Shearer. Pp. vii+284; illustrated. (New York: The Macmillan Company; London: Macmillan and Co., Ltd., 1904.) Price 7*s.* 6*d.* net.

THE present volume has been written to take the place of a similar book prepared several years ago by Prof. C. P. Matthews and the author. Actual experience in the class-room indicated the desirability of certain extensions and changes in the text, and also of many explanatory notes and solutions.

The book is, in reality, a collection of problems—many of which have been selected from examination papers—together with occasional hints with regard to solving them, and very brief introductory paragraphs to each section which explain the principal technical terms referred to therein. It will be easily understood, therefore, that the book is not intended to take the place of regular text-books, lectures, or of laboratory practice. It is designed, indeed, to accompany these. The supply of problems in many text-books is exceedingly scanty—the present volume amplifies the supply. It will be found of great service to the teacher in suggesting problems to set as class work. As no answers are given, there will be less temptation to the teacher merely to quote the selected problems; anyone who is alive in his subject will modify them to suit his

own preferences. The absence of answers makes the book of no use to the private student who requires some check on the work he does. On the whole, we think that the utility of the book would be increased by the addition of these; or, if this is not favoured, then by their publication in a separate volume.

The whole ground of physics is covered, including mechanics. The general difficulty is only slight. By far the largest number of the problems could be tackled by a first-year university student. In mechanics very many are even of matriculation standard; thus, "The Washington Monument is 169 metres high. In what time will a stone fall from top to bottom?" Mingled with these are a few requiring the calculus. Many require only a qualitative answer; thus, 'Explain why it is difficult to walk up an icy hill." These remarks are equally true of the other sections; thus, in electricity, the following is a commonly occurring type of question :—"Two copper wires are of the same cross-section, but one is twice as long as the other. Compare their resistances." Indeed, this question illustrates the general character of the book very well. Take each clause of an ordinary text-book and express it in question form—that seems to have been the mode of formation. We miss the bright sparkle of genius which flashes out from the examination papers of many of the examiners that we know. Still, we think, and we have said, that many will find it a very useful book.

Turning next to the hints, which, we think, might be multiplied with advantage, these are not always above criticism. Take, for example, the following :—

"Prove that a gun free to move backward and the bullet fired from it have the same momentum when the bullet leaves the gun. Note: Action and reaction are equal and opposite. Force on gun = force on bullet.

$$M_g A_g = M_b A_b \text{ [A = acceleration]}$$

Multiply by t

$$M_g V_g = M_b V_b.$$"

We are of opinion that equality of the two momenta is the fundamental fact which can be proved only by experiment. The operation of changing from a variable acceleration to the change in velocity is inadequately represented by a multiplication by the time.

The arrangement of the problems seems to have been imperfectly attended to; very many questions are to be found in sections with which they have nothing to do. For example, under the head "Colour" occur a series of questions such as "Why does an object appear equally bright at all distances from the eye?"

A series of useful tables completes the volume. The numerical constants given are not always scrupulously exact. For example, log $\pi = 0.497150$ and not 0.497149 (as given) when only six figures are to be retained. Again, why should a student (or teacher) be misled into taking log π^2 as 0.994299 when the much simpler number 0.994300 is more exact? There are two other examples of this on the same page. This is the kind of number which, if quoted at all, ought to be checked and re-checked until the author is sure that he has it right.

MATHEMATICAL METAPHYSICS.

Principien der Metaphysik. By Dr. Branislav Petronievics. Vol. i., part i. Pp. xxxi+444. (Heidelberg: Carl Winter, 1904.) Price 15 marks.

THIS is the first instalment of a new work on metaphysics. It discusses only general ontology and the formal categories (in other words, the general ontological and the quantitative problem). The second part of the same volume, we are informed, will deal with the qualitative and hyper-metaphysical problems, and the second volume will then go on to cosmology and psychology.

The author's guiding principle is expressed in the motto, "Correct mathematical ideas are the key for the solution of the riddle of the universe." We doubt if this will command the acceptance of any metaphysicians whose interests are not primarily mathematical. Mr. Balfour, in a well-known passage, has pointed out how often the battles of theology are decided beyond the borders of that study; it is a little hard if the metaphysician, who contemplates all time and all existence, is to be fettered by the geometrical views of his age, and before he makes any headway in *prima philosophia* must study closely the hundred-page account of the new geometry "with 3 tables containing 56 geometrical figures."

We doubt in particular whether ordinary metaphysicians will ever accept the "discrete" or atomic view of space here given, however fashionable it may be among modern mathematicians. That view goes back to the Arabic school of the Mutakallimun. Dr. Petronievics adopts, with some slight differences, the development of the theory advocated by Giordano Bruno. He distinguishes two kinds of "point," *Mittelpunkt* (*der reale mit Inhalt erfüllte Punkt*) and *Zwischenpunkt* (*der irreale die leere nichtseiende Lücke darstellende Punkt*). The discussion of time follows the same atomic lines. The plain man wonders in what fashion precisely his old friend "Achilles and the tortoise" is to be dealt with on these principles. (That fallacy, it is true, appeals in the first instance to those who combine an atomic view of Time with a non-atomic view of Space, but it has surely its difficulties for any who regard either Time or Space as discrete.) The same guileless innocent, while understanding readily the general data which enable a Kelvin to calculate the approximate size of "atoms" of water, does not see quite so readily how we can ever hope to reach the data for determining the size of atoms of impalpable Time or Space. Nor, again, does he see the special benefit of abolishing the old Euclidean point in favour of the new one endowed with both position and magnitude, when to all intents he is compelled, a moment later, to revive in the term *Zwischenpunkt* the "point" of his earliest geometrical affections—"that which has position but *not* magnitude"; and he recalls the Horatian tag, "*Expelles furca, tamen usque recurret.*"

Still, the discussion contained in this volume is stimulating, and considerable dialectic power is displayed. One will watch with interest in the later volumes whether the author succeeds in dealing with

his various problems without always recurring to the mathematical point of view. Unfortunately, one word must be said regarding the typography. The present reviewer has seldom read a book so badly corrected for the press. There are two pages of corrigenda; but a full statement of all the small misprints would with difficulty be contained in four or five pages more. If it is not *c* for *o* or *e*, it is *u* for *n*, or *l* for *t*, or *b* for *h*, or *das* for *dass*. This is the more to be regretted because—granted the author's point of view—the *i*'s of the philosophy are quite carefully dotted.

BRITISH MINERALS.

A Handbook to a Collection of the Minerals of the British Islands in the Museum of Practical Geology. By F. W. Rudler, I.S.O. Pp. x+241. (London: H.M. Stationery Office, 1905.) Price 1*s*.

SINCE his retirement from the post he so long and efficiently held as curator of the Museum of Practical Geology, Mr Rudler has installed in that museum a collection illustrative of the modes of occurrence of British minerals. The museum has long possessed collections of British rocks, fossils, and ores, the last named arranged under the various metals which they contain. In the new collection, which is neatly arranged in twelve table-cases, the minerals found in each district are brought together; half the space is allotted to Cornwall and Devon, one-eighth to Scotland, Ireland, and the Isle of Man, and the remainder to the rest of England, the divisions being roughly according to the several mining districts, with a general group for the minerals of the Neozoic strata. The specimens, to the number of 1652, have mostly been selected from the Ludlam collection, which was bequeathed to the museum in 1880; though mostly small in size, they are of excellent quality. In addition to the name and locality attached to each specimen, there are many explanatory labels in the cases, and the present volume admirably serves the purpose of a guide to the collection.

The volume is by no means a tedious catalogue or descriptive list of all the individual specimens, but is rather an extremely readable and interesting account of the mode of occurrence and history of the more common British minerals, especially those which are of economic importance. Instead of long descriptions of the characters of species, much is said of their paragenetic relations, and many valuable suggestions are made as to their possible modes of origin. The book will therefore be found interesting and instructive not only to mineralogists, but also to geologists and miners; whilst quite apart from the collection, for which it is primarily intended, it will have a permanent value as a treatise. In this connection mention may be made of the numerous and extremely valuable references to original authorities consulted in the preparation of the work.

The mode of treatment is a novel one, and necessarily involves a certain amount of repetition, especially in the case of some of the more commonly occurring minerals, such as quartz, calcite, galena, &c., which may be found in almost all the different districts; but this repetition is not tedious. As an example, the district of Cornwall and Devon may be taken, in which the main groups are as follows:—cassiterite, minerals associated with cassiterite, copper sulphides and sulpho-ferrites, copper-bearing minerals of the gozzans, arsenates and phosphates of the copper-gozzans, ores of lead, zinc, antimony, &c., sulphides and sulpho-salts, ores of iron, &c., minerals of the rarer metals, the spars of the mineral veins, miscellaneous minerals.

Apart from a few minor misprints, the only point which calls for criticism is that undue importance seems to have been attached to many quite trivial and local names. As for the printing, there is certainly much room for improvement; the lines are so badly broken that it is surprising that the whole did not fall to pieces in the course of printing.

L. J. S.

OUR BOOK SHELF.

Moths and Butterflies. By Mary C. Dickerson. Pp. xviii+344; with 200 photographs from life by the author. (Boston, U.S.A., and London: Ginn and Co., n.d.) Price 5*s*. net.

THIS is a prettily got-up book, intended for the training of classes in "nature-study," with reference to a considerable number of common and conspicuous North American butterflies and moths, the life-history of which is very fully described and illustrated. The concluding chapter, on collecting, keeping, and studying, recapitulates the points to be noted in practical observations on the insects themselves.

To English readers the book will be useful for the information it supplies about American forms, and also as indicating a similar method of study for British insects, but many of the species here noticed are much larger and more conspicuous than those likely to fall under our own observation, among them being several species of Papilio, and large Saturniidæ.

The figures, of which (including apparatus, &c.) there are 233 in all, are generally very good, though some are indistinct. The frontispiece, representing a Smerinthus at rest, and Fig. 17, on p. 147, representing a procession of the young caterpillars of Saturnia, may be specially noticed. But it looks odd to see a Smerinthus closely allied to our own *S. ocellatus* called "a most beautiful little moth" (p. 232); and, though we do not object to the use of appropriate English names, we are sorry to see on p. 231 a Sphinx allied to *S. convolvuli* called "the Humming-Bird Hawkmoth," a name by which the very different *Macroglossa stellatarum* has been known all the world over, ever since the commencement of the study of entomology.

We had expected to find some notice of the gipsy moth, the crusade against which has recently been given up in America in despair, but find only a passing reference. A few British species are noticed, such as *Vanessa antiopa*, called in America the mourning cloak, a translation of its German name; *V. atalanta*, *Pieris rapae*, &c.

A great deal of useful general information is given in the book, and it seems on the whole to be careful and accurate. One statement, however true in the abstract, ought not to have been made without qualification or explanation in a popular book. On. p. 267 we read, "We are familiar with the fact that all living

creatures develop from eggs." Further comment is needless.

Although published in 1901 and mentioned in the *Zoological Record* for that year, this book has not previously been brought under our notice.

Second Stage Magnetism and Electricity. By Dr. R. Wallace Stewart. Second edition. Re-written and enlarged. Pp. viii+416. (London: W. B. Clive.) Price 3*s.* 6*d.*

THIS book is primarily intended to serve the purposes of a candidate preparing for the second stage examination under the Board of Education (secondary branch). In reading it, we have by no means made our first acquaintance with Dr. Stewart, and the perusal has left us of our old opinion that, whether regarded as text-books intended to prepare a student for a particular examination or as a source of culture, the books prepared by the author can be very earnestly recommended. He is a lucid and accurate writer. He knows where to draw the line so that an elementary student shall not be repelled by the complication of a subject.

The present volume is brought up to date. The importance of the field—that is, the medium surrounding an electrified conductor or magnet—is insisted on; perhaps even their importance is emphasised too much. The tendency of modern thought amongst physicists is to restore to a conductor part, at any rate, of the position that it held in pre-Maxwellian days. The dielectric plays a most important part—that is a position, won for it by Maxwell, which it can never lose. At the same time, one should not lose sight of the fact that there *must* be some mechanism at the ends of a line of induction, and to-day that mechanism is being studied under the name of *electron*. The electron is an essential part of a conductor, and the complete phenomena of electricity are not fully accounted for without including it.

The volume is almost entirely re-written. It is not surprising, therefore, that there are some unfortunate slips which have escaped the vigilance of the reader. As these are misleading, we will state that on the bottom of p. 33 "positive" and "negative" should be interchanged. The following phrase (p. 42) is very misleading:—"The portions of those walls, which are, as it were, in the shadow of these objects, possess no induced charge." We think that the first thirty pages might be improved in any later edition. Considerable care has evidently been taken; yet in many cases confusion is introduced by the neglect of some tiny detail. Thus, in describing the attraction and repulsion of a pithball with subsequent re-attraction, *if in the interval it comes in contact with an earth-connected body*, the phrase that we have put in italics is omitted; and in several cases where a body is touched to earth it is not explicitly said whether the contact is to be broken before a succeeding operation is performed or not. Why is it "evident" (p. 16) that doubling a charge will double the force it exerts on another charge?

Memoria sobre el Eclipse Total de Sol del dia 30 de Agosto de 1905. By D. Antonio Tarazona. Pp. 125. (Madrid: Bailly-Bailliere E. Hijos, 1904.)

THOSE who are familiar with the Spanish language and have made up their minds to go abroad and see the approaching total eclipse of the sun will find in this book a great amount of useful information relating to this interesting event. The work is issued from the Madrid Astronomical Observatory, the director, Francisco Iñiguez, having contributed a brief preface, and contains full particulars concerning the elements of this eclipse; in fact, it might be considered a treatise on the subject, so complete is the information. In addition to a great many data which will be of special use to astronomers, there will be found a very full list of towns, in alphabetical order, at which totality occurs, with the times of the different phases of the eclipse. More generally useful perhaps will be found the maps at the end of the volume. These include a map of the world showing the position of the track from the commencement to the end of totality over the earth's surface. A second illustrates on a larger scale the Spanish portion of the track, with special lines showing the times of occurrence and duration of totality. The third, on a much larger scale (1 : 1,000,000), indicates that part of Spain alone over which the shadow sweeps, and is very complete as regards names of places, railways, &c. Lastly, two star charts are added, one showing the position of the eclipsed sun among the stars, and the second a key map to this chart giving the designations of the stars and planets in this region.

Visitors to Spain will do well to supplement their literature by securing this volume, and thanks are due to the Madrid Observatory for producing so useful a book so far in advance of the event.

Naturalistische und religiöse Weltansicht. By Rudolf Otto. Pp. 296. [Tübingen: J. C. B. Mohr (Paul Siebeck), 1904.] Price 3 marks.

No better book than this could be recommended to the young philosophical or theological student who wishes to obtain a clear and comprehensive view of the debatable ground where science, philosophy, and theology meet. The author is well read, a skilful debater, a vigorous writer; and as handbooks ought not to be unnecessarily multiplied, it is to be hoped that this one will be translated.

Like many other works in defence of religion in general, the book is not so strong on the constructive as on the critical side. The author refers with approval to the attitude of Kant when he solved certain contradictions or antimonies by a reference to the world of things in themselves. As this is precisely the point where Kant's philosophy is most seriously questioned, the argument probably suffers to that extent. But, on the other hand, the author fully realises the unity of the various phases of the one problem religion *versus* naturalism, and the harm which has been done by concentrating the attention on one phase (*e.g.* the question of miracles) as if it were the whole.

The work is valuable mainly for its survey of the most interesting biological theories of the last century, from Darwin, Häckel, Weismann, down to Wolff, Korschinsky, Driesch. The philosophical development of this last writer is sketched in an enlightening fashion. With regard to the general theory of development and "descent," the author comes to the conclusion that with the confirmation of any such theory only something relatively external is given, a clue to creation, which does not so much solve its problems as group them afresh. The index at the end of the work gives an explanation of the more difficult terms employed by modern theorists.

An Introduction to Projective Geometry and its Applications. By Dr. Arnold Emch. Pp. vii+267. (New York: Wiley and Sons; London: Chapman and Hall, Ltd., 1905.) Price 10*s.* 6*d.*

THIS text-book of modern projective geometry forms an admirable introduction to the subject, and should be known to all who are interested in this branch of mathematics. The first chapter deals with the general properties of projective ranges and pencils and their products, including harmonic and perspective projection, and the projective properties of the circle. Then

follows an investigation of collineation in a plane, comprising perspective transformations, and the linear transformations of translation, rotation, and dilatation, with combinations of these. The intimate relation that exists between projective and descriptive geometry is shown. The third chapter gives the general theory of conics, the projective properties of the circle being extended to conics by perspective transformations. The next chapter deals with pencils and ranges of conics and their products, and especially with cubics, the latter being classified under the five standard types by the help of the Steinerian transformation. Throughout the book analytical and geometrical methods are employed side by side, some portions of the subject being better suited to the former treatment; moreover, the analysis affords excellent illustrations of modern analytical geometry. The main purpose of the author has been to develop the subject in regard to its practical applications in mechanics, and the last chapter is devoted to such examples. Thus we find problems in graphic statics, plane stresses, and in the stress ellipse of an elastic material, and there is an interesting account of various linkages by means of which linear and perspective transformations can be mechanically obtained. The book is excellently got up in every way, and the diagrams are quite perfect and may well serve as models of what such figures ought to be. The author is a very clever draughtsman, and his skill as a writer is equally pronounced.

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.*]

Fictitious Problems in Mathematics.

IN my younger days it was well recognised that such statements as "perfectly smooth" and the like were mere conventional phrases for designating an ideal state of matter, which was assumed to exist for the purpose of simplifying the mathematical conditions as far as possible. Nobody can learn mathematics without working out a large number of problems and examples, and in order to make these sufficiently easy for the beginner, various fictitious hypotheses have to be introduced.

Similar objections would apply to the phrase "frictionless liquid"; but it would be impossible for anyone to learn hydrodynamics without first studying the mathematical theory of this fictitious form of matter. In fact, the introduction of viscosity leads to such formidable difficulties, that nobody has yet succeeded in solving such a simple problem as the motion due to a doublet situated at the centre of a sphere; and the solution, if it could be obtained, would throw much light on the mode of attacking more difficult problems. A. B. BASSET.

May 28.

IN NATURE of May 18 the wording of a problem set near the beginning of my "Rigid Dynamics" is rather adversely commented on. In the problem a man is described as walking along a perfectly rough board which rests on a smooth table, and the criticism is that the two suppositions are inconsistent; but this depends on what is meant by the words used, and perhaps I may be allowed to make an explanation.

When bodies are said to be perfectly rough, it is usually meant that they are so rough that the amount of friction necessary to prevent sliding in the given circumstances can certainly be called into play. In art. 156 of the treatise on dynamics, just after the laws of friction have been discussed, the words "perfectly rough" are defined to have this meaning. The board in question has therefore no special peculiarity. All that is stated is that the coefficient of friction between the man and the board exceeds a certain finite quantity.

The board rests on a smooth table, but the coefficient of friction now depends on both the board and the table, and this may be quite different from that between the man and the board. There is nothing amiss in supposing this coefficient to be zero. One way of effecting this experimentally would be to polish the table and remove all roughnesses from it. This was the plan indicated.

Where, then, is the inconsistency?

By using the ordinary abbreviations of language, the wording of the question has been made concise, and thus attention was specially directed to the dynamical principle involved in the solution.

The problem has been understood by so many students in the sense above described, and worked without a single objection having been raised, that I think the meaning must be perfectly clear. Indeed, I cannot imagine what other meaning it could have. E. J. ROUTH.

May 20.

On the Spontaneous Action of Radio-active Bodies on Gelatin Media.

IN the course of some experiments on the formation of unstable molecular aggregates, notably in phosphorescent bodies, I was led to try whether such dynamically unstable groupings could be produced by the action of radium upon certain organic substances. It will scarcely be necessary to enter here into an account of the many speculative experiments which I have at one time or another tried, but it will suffice if I describe, as briefly as possible, the experiment which, amongst others, has led to a very curious result, and that is the effect of radium chloride and radium bromide upon gelatin media, such as those generally used for bacterial cultures.

An extract of meat of 1 lb. of beef to 1 litre of water, together with 1 per cent. of Witter peptone, 1 per cent. of sodium chloride, and 10 per cent. of gold labelled gelatin, was slowly heated in the usual way, sterilised, and then cooled. The gelatin culture medium thus prepared, and commonly known as bouillon, is acted upon by radium salts and some other slightly radio-active bodies in a most remarkable manner.

In one experiment the salt was placed in a small hermetically sealed tube, one end of which was drawn out to a fine point, so that it could be easily broken. This was inserted in a test-tube containing the gelatin medium. The latter was stopped up with cotton wool in the usual way with such experiments, and then sterilised at a temperature of about 130° C. under pressure for about thirty minutes. Controls without radium were also at various times thus similarly sterilised.

When the gelatin had stood for some time and become settled, the fine end of the tube containing the radium salt was broken, from outside, without opening the test-tube, by means of a wire hook in a side tube.

The salt, which in this particular experiment consisted of $2\frac{1}{2}$ milligrams of radium bromide, was thus allowed to drop upon the surface of the gelatin.

After twenty-four hours or so in the case of the bromide, and about three or four days in that of the chloride, a peculiar culture-like growth appeared on the surface, and gradually made its way downwards, until after a fortnight, in some cases, it had grown fully a centimetre beneath the surface.

If the medium was sterilised several times before the radium was dropped on it, so that its colour was altered, probably by the inversion of the sugar, the growth was greatly retarded, and was confined chiefly to the surface.

It was found that plane polarised light, when transmitted through the tube at right angles to its axis, was rotated left-handedly in that part of the gelatin containing the growth, and in that part alone.

The controls showed no contamination whatever, and no rotation. The test-tubes were opened and microscopic slides examined under a twelfth power. They presented the appearance shown in Fig. 1. At first sight these seemed to be microbes, but as they did not give sub-cultures when inoculated in fresh media they could scarcely be bacteria. The progress of any of the sub-cultures after a month was extremely small, and certainly

too small for a bacterial growth. It was not at all obvious how bacteria could have remained in one set of tubes and not in the other, unless the radium salt itself acted as a shield, so to speak, for any spores which may originally have become mixed with the salt, perhaps during its manufacture, and when embedded in it could resist even the severe process of sterilisation to which it was submitted.

On heating the culture and re-sterilising the medium, the bacterial-like forms completely disappeared; but only temporarily, for after some days they were again visible when examined in a microscopic slide. Nay, more, they disappeared in the slides when these were exposed to diffused daylight for some hours, but reappeared again after a few days when kept in the dark. Thus it seems quite conclusive that whatever they may be, their presence is at any rate due to the spontaneous action of the radium salt upon the culture medium, and not alone to the influence of anything which previously existed therein.

When washed they are found to be soluble in warm water, and however much they may resemble microbes,

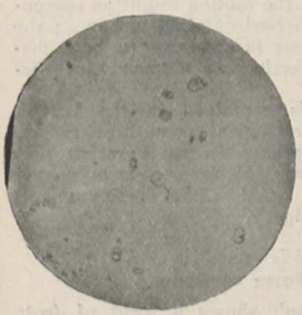

FIG. 1.

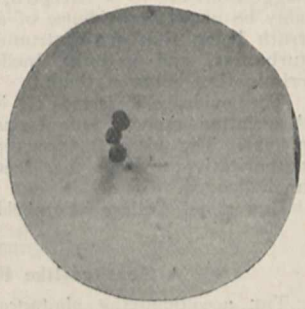

FIG. 2.

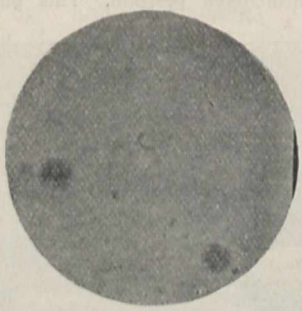

FIG. 3.

they cannot for this reason be identified with them, as also for the fact that they do not give subcultures as bacteria should.

Prof. Sims Woodhead has very kindly opened some of the test-tubes and examined them from the bacteriological point of view. His observations fully confirm my own. He assures me that they are not bacteria, and suggests that they might possibly be crystals. They are, at any rate, not contaminations.

I have tried to identify them with many crystalline bodies, and the nearest approximation to this form appears to be that of the crystals of calcium carbonate, but these are many times larger, and, in fact, of a different order of magnitude altogether, being visible under comparatively low powers; and are, moreover, insoluble in water.

A careful and prolonged examination of their structure, behaviour, and development leaves little doubt in my mind that they are highly organised bodies, although not bacteria.

Unfortunately the quantity is so very minute that a chemical analysis of their composition is extremely difficult. The amount of salt in the first instance is so small, and the number of aggregates, or whatever they may be, thus produced perhaps still smaller.

The most effective method of studying their properties, from the physicist's point of view, is that of long and, so far as possible, continual observation, a method similar to that which the astronomer is bound to adopt in his study of bodies over which he has not the control to deal with as he pleases.

From the accompanying photographs it will be observed that they are not all of the same size; they range from about 0·3 μ to the minutest specks; they are mostly, if not altogether, all of the same shape, and show distinct signs of growth; the larger ones appear to have sprung from smaller forms, and these in turn from still smaller ones, and they have all probably arisen in some way from the invisible particles of radium.

Fig. 2 distinctly shows the existence of nuclei in the larger and more highly developed forms, whilst Fig. 3 reveals, though indistinctly, what is their most remarkable property of all, and that is their subdivision when a certain size is reached. They do not grow beyond this size, but subdivide.

These photographs, together with the numerous results of eye observations, which indicate that a continuous growth and development take place, followed by segregation, leave little doubt that whilst on the one hand they cannot be said to be bacteria, they cannot be regarded as crystals either in the sense of being merely aggregates of symmetrically arranged groups of molecules, which crystals are supposed to be. The stoppage of growth at a particular stage of development is a clear indication of a continuous adjustment of internal to external relations, and thus suggests vitality.

They are clearly something more than mere aggregates in so far as they are not merely capable of growth, but also of subdivision, possibly of reproduction, and certainly of decay.

The subcultures do show, however slightly, some indication of growth after four or five weeks, although that growth is, I understand, too small for a bacterial subculture. Moreover, when examined in the polariscope they have not been found to yield the characteristic figures and changes of colour which crystals generally give.

Thus for these reasons I have been led to regard them as colloidal rather than as crystalline bodies, and probably more of the nature of "dynamical aggregates" than of "static aggregates," of which crystals are composed.

There appears to be a tendency amongst text-book writers to classify minute bodies which are not bacteria as crystals, but really without sufficient reason, and as these bodies cannot be identified with microbes, on the one hand, nor with crystals on the other, I have ventured, for convenience, in order to distinguish them from either of these, to give them a new name, *Radiobes*, which might, on the whole, be more appropriate as indicating their resemblance to microbes, as well as their distinct nature and origin.

Some slightly radio-active bodies appear also to produce these effects after many weeks.

A more detailed account of these experiments will be published shortly. This note merely contains some of the principal points so far observed.

I have to thank Mr. W. Mitchell, who sterilised the tubes, for the assistance he has rendered in these experiments.

JOHN BUTLER BURKE.

Cavendish Laboratory, Cambridge, May 10.

The Consolidation of the Earth.

THERE are several points in Dr. See's last letter (NATURE, May 11) calling for remark from the geological point of view.

(1) The effect of (hydrostatic) pressure at depths tends not to liquefaction (as in the case of the ice of a glacier) but to promote crystallisation, the condition of the greatest density of mineral matter, as I showed years ago in my little work on metamorphism in discussing the relation of the crystalline to the vitreous states. It is here that the importance of "solid-liquid critical state" comes in.

(2) We have no right to assume the existence at any stage of the history of our planet of a mere molten ball radiating heat directly into cold space, since in that "pre-oceanic stage" it was surrounded by a non-conduct-

ing mantle or "jacket" of such enormous density and altitude as to contain (as its main constituents) (*a*) the greater part of the water of the present hydrosphere in the vapour state; (*b*) the CO_2 locked up in the limestones and other carbonates of the lithosphere, as well as that represented by the coal and the living vegetation of the globe; (*c*) the hydrocarbons possibly represented by Archæan graphite, together with (*d*) the halogens (if atomic evolution had reached that stage), including the Cl_2 of the 73 per cent. of the NaCl of the salts of the present ocean. It is conceivable that a vast convection system existed, as the outer zones of the primordial atmosphere underwent cooling with consequent condensation, and descended towards the molten globe; but there could scarcely be contact generally between such cooler portions and the heated molten mass. The conditions would be rather such as are partly illustrated by what a student of physics is familiar with as the "spheroidal state" of a liquid floating on a cushion of steam above a hot plate of metal. Under the enormous pressure prevailing at the surface of the globe in that pre-oceanic stage of its history great quantities of superheated steam and other gases must have been mechanically included, and in some cases, perhaps, occluded, in the hot *crust* in the inceptive stages of its development by congelation; and in such circumstances, as I suggested seventeen years ago, superheated water in traces would probably enter into the composition of such silicates as *hornblende* and *mica*, the two most characteristic of the minerals of the heavier metals of the Archæan gneisses and schists. A year or two later that hypothesis received demonstration from the splendid work of de Kroustchoff (see NATURE, vol. xliii. p. 545, also *Bulletin de l'Académie des Sciences de St. Petersbourg*, tome xiii., "Über künstliche Hornblende," by K. von Chrustschoff). So, I take it, we can understand how such a crust could float on a magma of molten rock material, just as air-charged fragments of pumice or of charcoal float on water, yet sink quickly to the bottom under the exhausted receiver of an air-pump; or as even a coil of platinum foil (sp. gr. 21·5) can be made to float in water inside a good air pump, as it is pontooned by innumerable bubbles of distended atmospheric gases previously condensed upon its surface; or, again, as masses of lava slag of large dimensions are seen to float for a time upon the vast lake of liquid rock material in the crater of Kilauea. With tidal action in the magma greater when the moon was nearer the earth than at present, such a thin crust would easily undergo disruption, while portions of it would float off and be engulfed in the magma. This view, which I propounded some seventeen years ago, had been anticipated partly by Zöllner, and was adopted by the distinguished American geologist, Dr. A. C. Lawson, to explain the phenomena presented by the enormous inclusions of more basic rock masses in the gneiss of the Rainy Lake region, which excited great interest among our leading British geologists at the International Geological Congress in London in 1888, though it seems at the time to have been very imperfectly perceived by most of them. So far the evidence we have goes to support Dr. See's contention that the descent of such masses into the magma would be arrested long before they even approached the centre of the sphere; but one feels great difficulty in following his argument based on "Laplace's law," for reasons given in my former letter (NATURE, May 4).

By a slip I wrote, it appears, "impossibility" for possibility in the top line of p. 8 in my last letter.

Bishop's Stortford, May 17. A. IRVING.

The Spirit-level as a Seismoscope.

A MISCONCEPTION seems to prevail among seismologists as to the behaviour of a spirit-level. A displacement of the bubble is regarded as conclusive evidence of the tilting of the instrument. It should be pointed out, however, that this is far from being the case. For a second cause, equally effective in producing displacement of the bubble, is a horizontal acceleration of the instrument in the direction of the tube. The position of the bubble should be taken as indicating, not the normal statical vertical, but the dynamical residual vertical obtained by subtracting the acceleration of the instrument (as a vector) from that of gravity. (I disregard, in this statement, the slight lag due to viscosity.)

A couple of simple experiments, serving to emphasise this, may be suggested. A spirit-level is suspended in a horizontal position by two equal strings attached one to each end. In one case the strings hang vertically from two hooks; in the other case they are attached both to one hook. If the level is set swinging in the plane of the strings, then in the *first* case the bubble will be found to have an oscillatory movement relatively to the tube, the tube having linear acceleration but no tilting movement. In the second case the tube has both movements, but their effects exactly neutralise each other, and the bubble remains stationary in the tube. The expert waiter (may it be added?) who hurries about with plates of soup has a very effective empirical knowledge of this last case of compensation.

The motion of the bubble of a level has been brought forward as evidence in favour of the undulatory character of the disturbance producing the motion; but if the above suggestions are to be accepted, the motion might as reasonably be urged as evidence of a horizontal disturbance; the truth being that the instrument is sensitive to both disturbances, and is quite ineffective as a means of discriminating between them.

The evidence referred to is contained in the British Association report, 1902 (seismological committee report, p. 72). The view finds acceptance in some recent and authoritative works,[1] and seems, so far, to have passed unchallenged. G. T. BENNETT.

Emmanuel College, Cambridge.

A Feather-like Form of Frost.

THE accompanying photograph shows a form of frost not, I believe, usually seen except at a comparatively high altitude and unsheltered position. This photograph was

FIG. 1.—Frost "feathers" on windward side of rock.

taken on April 22 near the summit of Carnedd Llewelyn, N. Wales (3484 feet above sea-level). These delicate frost "feathers" appear gradually to grow outwards from the rock face on the windward side, and the delicacy of their form is, no doubt, modified in some degree with the varying rate of the wind and the temperature. I have found, in the same district, these "feathers" 9 inches from root to tip; those shown are about 6 inches long. They form a comparatively solid mass where they touch, but the tips keep distinct, and the whole mass is in reality very brittle, and easily breaks up into small pieces.

H. M. WARNER.

44 Highbury Park, N., May 16.

[1] Dutton, "Earthquakes in the Light of the New Seismology," p. 137; Davison, "A Study of Recent Earthquakes," p. 280.

THE EVOLUTION OF ENGRAVING IN THE STONE AGE.

WE have at various times directed the attention of our readers to this interesting subject, but new discoveries are continually being made. M. Ed. Piette, whose name is so well known in connection with his investigation of the famous cave of Mas-d'Azil, has given in *l'Anthropologie* (xv., 1904, p. 129) a classification of the deposits formed in caves during the age of the reindeer; starting as a geologist, he was firmly impressed with the fact that stratigraphy is at the root of fruitful advance in prehistory, and this end he has kept steadily in view. He gives the following table of relative chronology of the epochs which form part of the age of the reindeer :—

Epochs of Lartet and Christy	Epochs of G. de Mortillet	Epochs of E. Piette
Madelaine and Laugerie-haute	Magdalénienne / Solutréenne	Gourdanienne / Papalienne
Moustier	Moustérienne	Mostérienne

The following is his cultural sequence, in which the epoch of Moustier does not take part, "as at that time the fine arts were not yet born" :—

Age or series	Epoch or stage	Layer
Glyptic	Of engraving (Gourdanienne)	Of engravings and harpoons of reindeer antler
		Of engravings without harpoons or with very few harpoons
		Of engravings with cut-out contours
	Of sculpture (Papalienne)	Of sculptures in low relief
		Of sculptures in the round

The sculptors in the round used their flint tools for many purposes, including carving, chiselling, scraping, engraving, and burnishing; they certainly sketched their statuettes before modelling them, and they polished them. The sculptors in low relief scraped and burnished. Their works were not child's play, but the product of a real artistic sense. They studied and drew heads, limbs, and feet (Fig. 1). The sculptors in the round figured the flayed animal and even the skeleton. When mammoth ivory became rare reindeer antlers were employed for carving, and this appears to have led the way to the next artistic developments.

Many of the figures in this copiously illustrated paper are from the layer of sculptures in low relief; it was in this layer that several pieces were found decorated with circles and bold spirals (Fig. 2). At first these designs were carved deeply, they gradually became less deep, until in the Gourdanienne epoch they were merely lines. M. Piette believes the spirals were symbolic, and suggests that they had reference to snakes. Plant forms were rarely drawn, and of the very numerous animals engraved by far the most frequent were those upon the flesh of which the men fed.

As the relief in the designs became less and less, the artist had to employ the graver. At the end of the Papalienne epoch the artists undertook to execute very low reliefs on plates of bone not more than two millimetres in thickness. They made silhouettes, modelling the contours on both sides; but the great difficulty of carving such thin objects soon led to its abandonment. They replaced this style by cutting out contours and engraving the surface. This technique was common in the region of the Pyrenees, but rare to the north of the Garonne; being a transitional form it did not last long, whereas sculptures in low relief persisted into later layers.

At first, following the traditions of the sculptor, the engraver represented isolated animals, but the artists of Laugerie-basse appear to have been the earliest to design groups (Fig. 3). In the upper layers signs are engraved which M. Piette considers to be of the nature of inscriptions.

Thanks to the rigid stratigraphical method employed by M. Piette, he has been enabled to upset the

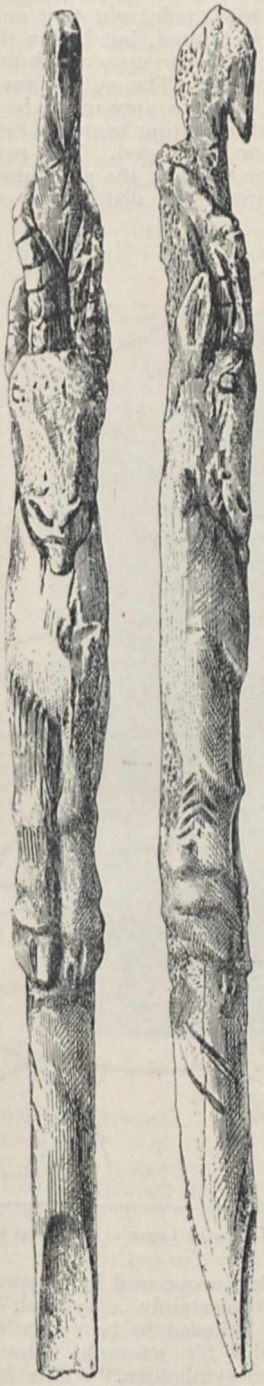

FIG. 1.—Bone Throwing-stick (Mas-d'Azil). Layer of sculptures in the round. Less than natural size.

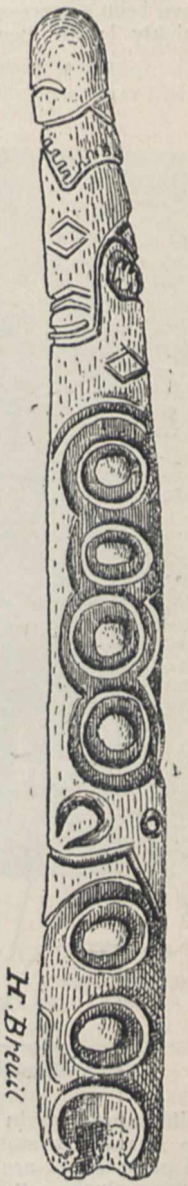

FIG. 2.—Portion of reindeer antler decorated with circles and other signs (Lourdes). Layer of sculptures in low relief.

a priori argument that sculpture was a later form of pictorial art than engraving, and has established that the reverse is the case.

In a subsequent paper, entitled "Les Écritures de

l'Age glyptique" (tome xvi., 1905, p. 1), M. Piette claims to have discovered "inscriptions composed of characters forming a primitive writing," all of which are from the layer of sculptures in low relief, and consequently from the earlier glyptic epoch. The first specimen figured by the author is that reproduced here as Fig. 2. First of all one must point out that only one side of this rod of bone is figured, but before the design can be understood it will be necessary to know what the whole design looks like. The author says, "The circle with central prominence appears to be a simplification of the circle with radiating centre which evidently signifies the sun or solar god. The rays have been suppressed in order to write the sign more quickly"; he then briefly gives the distribution of similar markings in prehistoric Europe and in Egypt. The lozenge is stated to be "certainly a symbol," and other signs are similarly believed to be symbols or hieroglyphs. "The spiral," for example, "has held a large place in primitive symbolism." This is possibly true, but spirals may mean many things in the art of existing backward peoples, and may be conventional symbols or more or less realistic representations; but it is extremely hazardous to make guesses as to what any given spiral may be intended to represent; the probability is that all such guesses will be incorrect, and the same remark applies to other elementary designs. Several spirals and concentric circles are figured by the author in juxtaposition, and the evidence seems to point to the conclusion that here, as in so many other instances from various parts of the world, the concentric circle or oval is a simplification of the spiral; if this be so, the theory that the concentric circles are degenerate rayed circles, *i.e.* suns, falls to the ground. The bold decoration on these bone objects in all probability had a meaning. Some of the designs may have been symbols; but, surely, it is somewhat far-fetched to describe them as hieroglyphs, and we cannot follow the author when he states (as he does in a letter to the editor), "According to me this inscription (Fig. 2) is the glorification of light."

FIG. 3.—Engraving on bone (Lorthet). Layer of engravings without harpoons.

M. Piette also directs attention to certain linear markings on bones from various sites of the reindeer age. These he boldly claims to be true linear scripts, and suggests that the writings of la Madeleine and Rochebertier were continued into the linear script of Abydos without undergoing much change.

Archæologists are deeply indebted to M. Piette for the thoroughness with which he has carried out his investigations, and we must not unfairly criticise him if that enthusiasm which has carried him through his labours sometimes runs away with his more dispassionate judgment. He is probably quite correct in believing that the decoration on the bone objects he has discovered has a meaning, but judging from our experience of the decorative art of existing primitive peoples it is extremely improbable that we shall ever be able to decipher its meaning or unravel its symbolism. More evidence is needed before we can pass judgment upon the supposed linear script. A. C. H.

THE NEW DIPLODOCUS SKELETON.

ON Friday, May 12, in the presence of a large and representative company, Lord Avebury, on behalf of his fellow trustees, received from Mr. Andrew Carnegie the gift of the full-sized model of the skeleton of the gigantic American dinosaur known as *Diplodocus carnegii*, which has been mounted in the reptile gallery of the Natural History Branch of the British Museum under the superintendence of Dr. Holland, of Pittsburg, who has charge of the original specimens on which the complete restoration is based. Although the gigantic four-footed dinosaurs constituting the group Sauropoda were first made known to the world on the evidence of detached bones and teeth described by Mantell (Pelorosaurus) and Owen (Cardiodon and Ceteosaurus), it has been reserved for American palæontologists, working in the rich Upper Jurassic beds of Wyoming and Colorado, to give to the world an adequate conception of the huge proportions and extraordinary form of these strange reptiles. Strangest of all is perhaps Diplodocus (so named on account of

the double chevron-bones, which were at first thought to be peculiar to this form, although now known to be common to the entire group), which appears to be distinguished from all its relatives by the weakness of its dentition, the teeth being reduced to a small number, of the size and form of lead pencils, confined to the front of the jaws. Another remarkable feature, which may, however, have been common to other members of the group, is the position of the nasal aperture at the top of the skull, this being not improbably indicative of partially aquatic habits, an inference confirmed by the nature of the dentition of Diplodocus, which can scarcely have been adapted for anything else than a diet of soft and luscious water-plants.

Diplodocus was apparently one of the largest representatives of the group, the length of the skeleton, as mounted, being about 75 feet, while if the vertebral column were placed in a straight line the length would be some 10 feet more. The height at the shoulder is about 14 feet. The only rival to such bulk at the present day is presented by the skeleton of Sibbald's rorqual. That such a monster should have a skull considerably smaller than that of a large crocodile is one of the most remarkable facts made apparent by this restoration; while scarcely less noteworthy are the extreme elongation of the neck and tail (the latter for several feet of its length being comparable to a huge whip-lash), and the shortness of the trunk. With the exception of the bones regarded as the clavicles, of which only one original specimen was found, and the position of which in the skeleton may be doubtful, there is full authority for every bone in the model; so that we are now practically as well acquainted with the osteology of these monsters as we are with that of crocodiles.

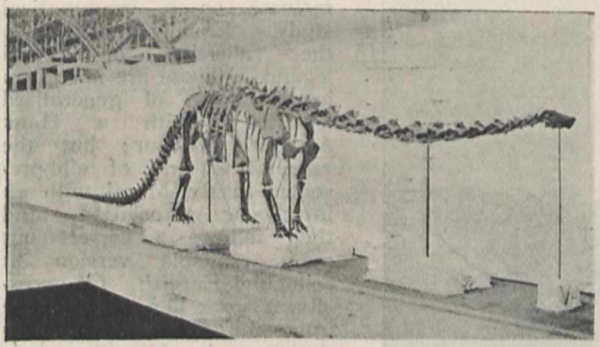

FIG. 1.—Restored Model of the Skeleton of *Diplodocus carnegii* as originally set up in the Museum at Pittsburg. From a photograph presented by Dr. Holland to the British Museum.

Mr. Carnegie's gift, which is due to the initiation of the King, is not only of immense value and interest to the man of science, but will likewise prove a great attraction to the ordinary visitor to the Museum. It is almost an appalling thought that the skeleton of a creature which lived at least several million years ago should have come down in such marvellous preservation to our own day.

THE MASAI OF EAST AFRICA.[1]

THE Masai (the word should be pronounced with a stress on the first syllable—Másai) were first distinguished and described as an East African people by the missionary Krapf, who, with Rebmann, was the discoverer of Mounts Kenia and Kilimanjaro. Krapf, who commenced the exploration of equatorial East Africa in 1848, had begun dimly to perceive the remarkable oneness in language of the Bantu tribes in the southern half of Africa from the Equator to Natal and Cape Colony, and he was therefore puzzled to find in the Masai a race intruding into Bantu East Africa which spoke a language absolutely different from the Bantu type.

At this period—let us say about 1850—the Masai had forced themselves on the attention of the Arab rulers of East Africa by their raids on the cattle of the Bantu tribes, raids which brought them occasionally to within sight of the island-town of Mombasa. In the 'fifties of the last century, nevertheless, the Masai had not established that reign of terror which during the 'sixties, 'seventies, and 'eighties did so much to obstruct the exploration of eastern equatorial Africa, and so long prevented the white man from travelling direct from the Mombasa coast to the eastern shores of the Victoria Nyanza. Therefore, in the 'fifties of the nineteenth century, Swahili, Arab or Baluch traders managed to reach the east and north-east coasts of the Victoria Nyanza from Mombasa or Lamu. The stories they told to Krapf and other missionaries gave to Europeans the first hint of the existence beyond the Masai of tribes allied in speech and physical characteristics and habits. During the 'seventies the Masai pushed their raids further and further south, until they were almost heard of—so to speak—in the regions immediately to the north of Lake Nyasa. In this direction they were ultimately checked by the sturdy resistance of the Bantu Hehe people, a vigorous race that long resisted German dominion in the same territory, a race made more warlike and coherent by a slight infusion of Zulu immigrants from the south. To the south-west the Masai were checked by the warlike Wagogo, to the west by the distantly allied tribes of Lumbwa and Ja-luo, and to the north by the Galas and Somalis. It is possible, however, that but for the eventual interposition of the European they might have

FIG. 1.—Masai girls, showing ornaments. From Hollis's "The Masai."

[1] "The Masai, their Language and Folklore." By A. C. Hollis. With an introduction by Sir Charles Elliot. Pp. xxviii+356. (Oxford: Clarendon Press, 1905.) Price 14s. net.

subdued the Bantu coast people and the Arab half-breeds to the shores of the Indian Ocean.

All observers of the Masai have noted their superiority in physical appearance to the pure-blooded negro. There has evidently been a good deal of intermixture, especially during the last three decades, with women of Bantu race, and the original Masai stock itself is only one of the many hybrids between the Caucasian and the negro; but still the average man or woman of Masai race is a negroid rather than a negro, with a skin of coppery-brown, not black,[1] with a more defined bridge to the nose and a better developed chin than the ordinary negro possesses. They are, however, far more negro in appearance than, for example, the Hamitic (Hima) aristocracy of the lands lying to the north, west and south of the Victoria Nyanza; yet they retain a larger infusion of Caucasian blood (due, of course, to Hamitic intermixture) than the pure type of Nilotic negro, to which in other respects they are nearest allied in origin, language, and, above all, in habits and customs.

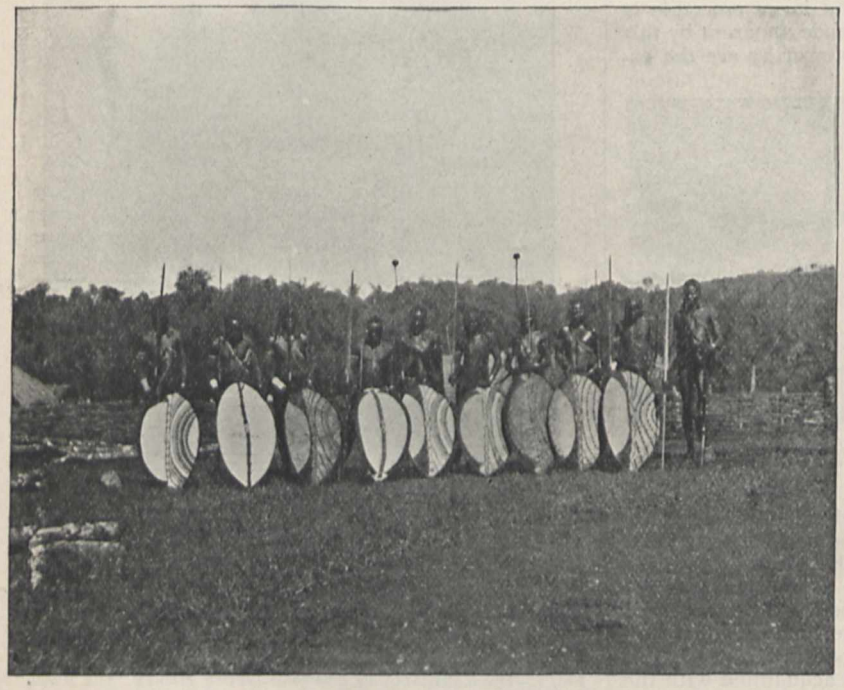

FIG. 2.—Masai warriors of various "ages" and "districts," each with the shield of his "age" and "district." From Hollis's "The Masai."

Now that our knowledge of eastern equatorial Africa is so extensive, we realise that the Masai are no isolated phenomenon in racial distribution, but are simply a southward extension of the Nilotic peoples. They probably originated several hundred years ago in the northern part of the present Uganda Protectorate, in the mountainous country between the present abode of the Lotuka tribe (the nearest allies of the Masai in language) and the Turkana peoples to the east. In this region they were simply one of the many blends between the Hamitic (Gala) invaders of equatorial Africa and the Nile negroes. The writer of this review, in his work on the Uganda Protectorate (p. 841), has computed that the proportion of Caucasian intermixture in the case of the Masai is from one-quarter to one-eighth. Their language, which for classification may be grouped with the Lotuka, Elgumi or Wamia, Bari (on the White Nile), Karamojo, and Turkana, is, together with the nearly allied group of the Nandi-Dorobo, distinctly, though distantly, related to the well marked Nilotic family of negro languages which includes the Dinka, Shiluk, Dyur, Acholi, &c., and links on to the negro languages stretching away to Wadai and Lake Chad. In the Masai language, as in the kindred tongues of the Masai group, there is distinct evidence of Somali or Gala influence. This may be due to the ancient intermixture of blood between the Gala and the Nilotic negro which formed the Masai, and also to the contiguity of the Masai in some of their wanderings with outlying groups of Hamitic people.

For the first time the civilised world has been presented with an authoritative work on the Masai language, customs, and folklore, by Mr. A. C. Hollis, of the British East Africa Protectorate. Nothing of the kind worth serious notice has appeared since the works of Krapf and Erhardt. Though a Masai dictionary remains to be composed which shall give a full vocabulary of this interesting language, the book under review can scarcely be bettered in fulness or correctness as a grammatical study. Equally admirable is the collection of Masai legends. These are not given in the form of generalised "stories" with a Hans Andersen flavour; but the original is first of all presented in the Masai with an interlinear translation, and then follows a correct but more readable version in colloquial English. Of necessity, a work like this is more interesting to students than to the general public (though it is admirably illustrated with appropriate photographs). But for the students of African ethnology and languages it is a work of permanent value; it is *the* authoritative study of the Masai people; and it is satisfactory to record that the author confines himself mainly to facts and not to theories, and that Sir Charles Eliot in his introduction does not trace the origin of the Masai to the ten lost tribes of Israel. A recrudescence of this irritating mania having recently appeared amongst German writers on Africa who ought to have known better, it is a relief to find that English authorities on African questions can still retain their sanity on the subject of the proper place in history and ethnology of that mixed Armenian, Dravidian, and Semitic people which we call by the racial name of Jew.

H. H. JOHNSTON.

[1] Owing to their habit of smearing their bodies with a red clay, they strike the casual observer as being a red-skinned rather than a brown race.

NOTES.

THE anniversary dinner of the Royal Geographical Society on Monday was really a complimentary banquet to Sir Clements Markham, the popular and active president of the society, who has just retired from office after twelve years of zealous service. During this period Sir Clements Markham has watched over the affairs of the society, and has guarded the interests of geography, with a devotion

and untiring energy which it is easier to admire than to emulate. But his influence has not only been exerted while directing the affairs of the society as president, for he was honorary secretary of the society from 1863 to 1888, and the Founder's medal awarded to him upon his retirement was a mark of appreciation of his work for the promotion of geography, both in connection with the society and otherwise. It is, indeed, difficult to think of the Royal Geographical Society apart from the personality of Sir Clements Markham, for in all the affairs of the society he has long been ubiquitous. Wherever and whenever geographical interests could be advanced, he has championed them with a strength of view and courage of conviction which have commanded the admiration even of those who have differed from him. He has always been jealous of the honour of his charge; and only those who have been closely associated with him can appreciate adequately how carefully he has cherished the society's welfare. At the banquet on Monday, the chairman, Sir George D. T. Goldie, who has succeeded Sir Clements Markham in the presidential chair, referred in eloquent terms to Sir Clements' work as explorer and author, and his great achievement in the introduction of the cultivation of the Cinchona plant from South America into India. Messages of regret upon the retirement of Sir Clements Markham were read from the King and the Prince of Wales. After Sir Clements had replied to the toast of his health, a testimonial was presented to him from the relatives of the officers and members of the scientific staff of the *Discovery* in recognition of his courtesy in keeping up communication with them. This souvenir consisted of a reproduction of the Cashel cup, and bore a suitable inscription. There was also a gold pin studded with jewels for Lady Markham.

MM. METSCHNIKOFF and ROUX, who have recently shown that syphilis is inoculable on the higher apes, at a meeting of the French Academy of Medicine on May 16 announced that they have at last detected the microorganism of this disease. The microbe appears to be a long, delicate, spirillar form, difficult to observe, and readily destroyed by any manipulations. It seems to have been seen first by MM. Bordet and Gengou, of the Pasteur Institute, three years ago, and subsequently by Herren Schaudinn and Hoffmann, by whom it was named *Spirochaete pallida*. It measures 4–14 μ in length by 1 μ in breadth, and though resembling similar organisms in mucus, &c., is readily distinguished from these. The spirochæte has been found in four out of six human cases of the disease, and also in the inoculated monkeys, and Dr. Levaditi also exhibited preparations of it obtained from a child suffering from hereditary syphilis.

THE Royal Medical and Chirurgical Society celebrated the centenary of its foundation by a dinner on May 22, which was attended by the Prince of Wales and a large and distinguished company, the president, Sir Douglas Powell, Bart., presiding. In responding to the loyal toasts, the Prince of Wales (who is an honorary Fellow of the Society) expressed his pleasure at being present. He regarded his position as president of King Edward's Hospital Fund as a precious trust, and he watched with keen interest and satisfaction the gradual but steady development of medical science. He congratulated the Society on celebrating the 100th anniversary of its foundation, a period which had been prolific in advances in medicine and surgery. Physiology had become established as a precise branch of learning; bacteriology had laid bare the foundations of disease; antiseptics and the clinical thermometer had been invented; our hospitals had become institutions in which the most beneficent treatment is carried out with scientific thoroughness; and in the sphere of public hygiene nothing short of a revolution had been effected. Among the guests were the Duke of Northumberland, Lord Strathcona, Lord Alverstone, Sir W. Huggins, P.R.S., Mr. John Tweedy, P.R.C.S., Surgeon-General Keogh, Prof. Ray Lankester, Sir W. Ramsay, Sir F. Treves, Sir P. Manson, Prof. Christian Bohr, Prof. Pierre Marie, and many others. Last night the Fellows and their friends and other guests were entertained at a soirée at the Natural History Museum. As a fitting supplement to the centenary festivities, it may be mentioned that the society recently invited delegates from the other medical societies to confer on the practicability of an amalgamation between the various societies and the foundation of an "Academy of Medicine," such as exists in Paris and other cities.

IN connection with the fiftieth anniversary of the Société des Sciences naturelles de Lucerne, which takes place this year, the Société helvétique des Sciences naturelles will hold its eighty-eighth annual meeting at Lucerne on September 10 to 13 inclusive. The business of the meeting will be carried on in seven sections, dealing respectively with mineralogy and geology, botany, zoology, chemistry, physics and mathematics, medicine, and civil engineering. Lectures to the general assemblies have been promised by Profs. F. Zschokke, A. Heim, and H. Bachmann. Five scientific societies will hold their annual meetings at Lucerne on the same occasion, namely, the Swiss societies of geology, botany, zoology, and chemistry, and the Zurich Physical Society. Full particulars can be obtained by writing to the president of the meeting, Dr. E. Schumacher-Kopp, Adligenschwylerstr., 24, Lucerne.

IN commemoration of the first admission of women to the full fellowship of the Linnean Society, a dinner was given to the lady fellows of the society on May 18, at the invitation of the treasurer, Mr. F. Crisp.

MR. A. HOWARD has been appointed by the Secretary of State for India economic botanist to the Imperial Department of Agriculture of India. He will be stationed at the experiment station at Pusa, Behar, Bengal.

A COURSE of instruction in oceanic research will be held at Bergen, during the university vacation, from August 8 to October 14. The course, as in previous years, will consist of lectures, practical instruction and assistance in laboratory work; excursions will also be made, during which the use of various appliances and instruments will be practically demonstrated. The work will be in charge of Dr. A. Appellöf, Dr. D. Damas, Dr. H. H. Gran, Mr. B. Helland-Hansen, Dr. Johan Hjort, and Mr. C. F. Kolderup. Further particulars can be obtained from the Oceanographical Institute of Bergen Museum, Bergen, Norway.

THE association which maintains an American woman's table in Dr. Dohrn's marine laboratory at Naples also offers at stated times a cash prize of 200*l*. for the best thesis presented by a woman of any nationality embodying original laboratory research. This prize was awarded at the annual meeting in Boston, on April 29, to Miss N. M. Stevens for a paper on the germ cells of *Aphis rosea* and *Aphis oenothera*. The theses offered in competition for the next prize should be presented to the executive committee of the association, and must be in the hands of the chairman of the committee on the prize, Mrs. Ellen H. Richards, Massachusetts Institute of

Technology, Boston, Mass., before December 31, 1906. The prize will be awarded at the annual meeting in April, 1907.

AT the meeting of the Pathological Society of London on May 16, Mr. C. Walker gave a demonstration which seems to solve the nature of the so-called "cancer bodies" (Ruffer's bodies) of malignant tumours, which have been believed by many to be parasitic protozoa. He showed specimens of the normal reproductive cells of the testis containing bodies which are apparently identical with the "cancer bodies," but are really the archoplastic vesicles of those cells.

IN the *Bulletin of the Johns Hopkins Hospital* for April (xvi., No. 169) the most interesting and important communication is by Dr. Clowes on the immunisation of mice against cancer. In certain mice which had been inoculated with mouse cancer, the disease underwent an unexpected and spontaneous retrogression, and it was found that the serum of these animals produced a marked curative effect on the cancerous tumours in other mice suffering from the disease.

DR. W. B. WHERRY records some interesting observations on the biology of the cholera spirillum (*Bull. Bureau of Gov. Laboratories, Manila*, No. 19), in which he shows that the slight variations in cultural and other characters so often met with in different strains of this micro-organism are largely due to slight differences in the culture media employed, particularly in their reaction, and suggestions are given for the more accurate preparation of standard media.

THE *Journal of the Royal Sanitary Institute* (xxvi., No. 4) contains a report of a discussion on the aërial dissemination of small-pox round small-pox hospitals, in the course of which Dr. H. E. Armstrong, Dr. T. M. Clayton, and others adduce a good deal of evidence against the commonly accepted view of the danger of aërial infection in the neighbourhood of such hospitals. Municipal milk depôts and milk sterilisation is the subject of another paper by Dr. G. F. McCleary.

DR. CHARLES CREIGHTON, who recently paid a special visit to India for the purpose of inquiring on the spot into some of the circumstances connected with the prevalence of plague, read a paper on this disease before the Society of Arts on May 18. Dr. Creighton first criticised the composition of the British Plague Commission of 1898, complaining that there was no epidemiologist upon it. He next gave a somewhat detailed account of the geographical distribution of plague, and directed attention to the difference of incidence of the disease in the villages of the district of Ratnagiri and those of the adjoining district of Satara. In the former all the buildings, roadways, &c., are of stone, and plague occurs little or not at all; in the latter the villages are plague-stricken, and the crowded dwellings are of mud, the floors, &c., being saturated with offal. Dr. Creighton believes that crowded sites too long inhabited and without drainage are the cause of the trouble, which is explicable on the laws of soil-infection enunciated by Pettenkofer and his school.

A PRICED catalogue of pinned specimens of Lepidoptera, issued by Mr. H. Fruhstorfer, of Turmstrasse, Berlin, from whom we have received a copy, should prove useful to collectors.

AMONG our weekly budget are included three papers on North American zoology. In the first, from the *Bulletin of the Brockly Institute* (vol. i., No. 5), published by the Macmillan Company, Dr. J. A. Allan gives a list of mammals from Beaver county, Utah, several of which are described as new. The mammals of this elevated region are stated to differ considerably from their representatives in the adjacent foot-hills. In No. 6 of the same serial Mr. C. Schæfer describes new American beetles, and in the third paper (from the *Proceedings of the U.S. Museum*) Mr. W. D. Kearfoot diagnoses new tortricine moths from Carolina.

IN the April issue (vol. i., part iv.) of the *Records of the Albany Museum* Dr. R. Broom discusses the proper signification of the Owenian term "Anomodontia," and comes to the conclusion that it is applicable only to the dicynodonts. He also describes certain new fossil reptiles from Aliwal North, and contributes some important notes on the localities of type specimens of other South African reptiles, especially those in the British Museum. In the course of these remarks, it is pointed out that Anthodon is of Wealden age, and probably, therefore, a dinosaur instead of a pariasaurian, and that the limb-bones described by Owen as Platypodosaurus are almost certainly referable to Udenodon.

IN the issue of *Biologisches Centralblatt* of May 1 the Rev. Father Wasmann brings to a close his important series of articles as to the origin of slavery among ants, and formulates the conclusions at which he has arrived, which are too long to be recapitulated in our columns at length. It may be mentioned, however, that, in the author's opinion, this system of slavery had independent origins at different dates respectively in the formicine and the myrmecine sections of the ant family, and that it has also been independently acquired in different genera and species of these two subfamilies at different times. In general, it seems to have been of later origin in the Formicinæ than in the Myrmecinæ. Moreover, the phenomenon affords confirmation of the biological doctrine that the ontogeny of a group constitutes a brief recapitulation of its phylogeny. In another article in the same issue Dr. O. Zacharias emphasises the importance of modern methods of studying "hydrobiology" in relation to fish-culture and fisheries.

PART iii. of vol. xlvii. of the quarterly issue of *Smithsonian Miscellaneous Contributions* contains an article by Mr. C. D. Sherborn on the species of birds described as new in Vroeg's catalogue, published in 1764. P. S. Pallas is believed to be the real author of the names. The only copy of this work that has come under the author's notice is in the library of the Linnean Society, where it might have been left in well merited obscurity. Social spiders (*Stegodyphus sarasinorum*) form the subject of another article, by Mr. N. S. Jambunathan, in the same serial. The spiders of this species, which was discovered by the author at Saidapet, Madras, in 1898, live in a sponge-like nest formed of branching net-work with communicating canals and a number of external openings. These nests, which may be attached either to the tips of branches of trees or to leaves of the prickly pear, are ashy-grey in colour, and constructed of leaves and refuse from the spiders' food. Externally is a coat of stout sticky threads of the same colour as the spiders themselves, and sheet-like webs spread in all directions from the nests. Five or six nests are often found together, each of which may be the home of from 40 to 100 spiders, usually in the proportion of seven males to one female. A number of spiders will cooperate to overpower a single large insect.

DURING the last few days paragraphs have appeared in the newspapers stating that a plague of flies has invaded Cardiff Docks, causing much inconvenience. The flies are said to have made their appearance with a southerly wind on Sunday, May 14. Mr. Ernest E. Austen, of the British Museum (Natural History), informs us that specimens forwarded to the museum show that the trouble has been caused by the fly known as *Dilophus febrilis*, Linn., a very common British species of the family Bibionidæ, met with from April to September, but especially abundant in May. In colour the flies are black, with a shining thorax, and measure about 5½ millimetres, or rather less than a quarter of an inch, in length. As in all Bibionidæ, the males are distinguished from the females by the large size of the head, which in the former sex appears from above to be entirely composed of the eyes. Of five specimens sent to the British Museum, all were males. *Dilophus febrilis* breeds in horse and cattle droppings, in which the larvæ—white footless grubs measuring half an inch in length, with a dark brown head capsule at the anterior extremity—are found in small masses. This fly is quite incapable of biting, as are also all the other species of the same family, so far as at present known, though the possession of an elongated proboscis by two Mexican representatives of the genus Plecia suggests that there may be forms that suck blood. The occasional occurrence of Bibionidæ and other Diptera in immense numbers is well known, and notes on the subject have already appeared in these columns (*cf.* NATURE, vol. xlviii., 1893, pp. 103, 127, 176). With regard to *Dilophus febrilis*, Mr. J. W. Douglas, writing in the *Entomologist's Monthly Magazine* for 1880 (p. 142), describes a swarm of this species at sea off the Norfolk coast on September 2 of that year. It is stated that the air was obscured by the flies as by a cloud, and that a schooner sailing at about a cable's length from the shore was so covered with them that for five hours persons were unable to remain on deck; the air cleared at about 4 p.m. The cause of these phenomenal swarms is still uncertain, but it is probably to be found in exceptionally favourable climatic conditions, which, by accelerating the growth of the larvæ and shortening the pupal stage, cause myriads of flies to appear at practically the same time.

IN the *Biological Bulletin* (February) Mr. R. S. Lillie discusses the conditions determining the disposition of the chromatic filaments and chromosomes in mitosis, and advances a physicochemical theory, based upon mutual repulsions of the particles of a colloid solution, to explain the sequence of the stages in nuclear division.

A REVISION by Mr. B. Hayata of the Euphorbiaceæ and Buxaceæ of Japan, as represented in the herbarium of the University of Tokio, forms article iii. in vol. xx. of the Journal of the College of Science in that university. The number of genera is limited to twenty-four under Euphorbiaceæ and two under Buxaceæ, and seven new species are recorded. The author has provided figures of the flowers for most of the species.

A BRIEF survey of the progress of the Nilambur Teak Plantations, Madras, from its inception by Mr. Conolly in 1840 to its present condition, when the receipts more than balance the cost, is contributed by Mr. R. McIntosh to the *Indian Forester* (March). The harvest time is still thirty-five years ahead, when the fellings are expected to produce a revenue of 40,000*l.* a year. The difficulty experienced at first in getting the seed to germinate was overcome by soaking the seeds before planting, and by keeping the soil thoroughly moist after planting. The teak forests of Burma form the subject of another article, in which Mr. R. S. Troup comes to the conclusion that useful as fire protection may be in most forests, annual burning in moist mixed forests of teak and bamboos is decidedly efficacious.

THE appearance of a *Nature-study Review*, edited and published by Mr. M. A. Bigelow in Lancaster, Pennsylvania, indicates that the subject is making progress in the United States. A discussion in the first number as to the scope of nature-study has led to a general expression of opinion that it differs from natural science in so far as it lacks the characteristic organisation of science, and that it should be confined to elementary schools; further articles on the subject appear in the March number, which is the second of a bi-monthly issue. Amongst the articles giving the experiences of teachers one by Dr. E. A. Bigelow directs attention to the convenience of putting up the salts required for plant food solutions in tabloid form.

IN *Spelunca* (*Bull. de la Soc. de Spéléologie*, tome v., Nos. 39 and 40) there are interesting articles on the caverns and subterranean water-courses of the Mendip Hills, by Mr. H. E. Balch, and on those of the Jura Mountains by M. E. Fournier.

MR. E. C. DAVEY, who in 1874 contributed to the *Transactions of the Newbury District Field Club* an essay on the sponge-gravel beds near Faringdon, with photographs of some of the fossil sponges, has revised and amplified his article under the title "The Neocomian Sponges, Bryozoa, Foraminifera, and other Fossils of the Sponge-gravel Beds at Little Coxwell, near Faringdon." This is now published by Messrs. Dulau and Co., price 5*s.* net, and it contains five photographic plates of sponges, Echini, and Foraminifera. The nomenclature of the sponges is revised in accordance with the researches of Dr. G. J. Hinde, but the author does not wholly agree with the determinations made by that palæontologist, and adds other species, one new species being figured and briefly described. Under the heading "Bivalves," the author includes brachiopods and lamellibranchs; he makes no reference to the occurrence of Belemnites, to which Mr. G. W. Lamplugh directed special attention in 1903 (*Geol. Mag.*, p. 32).

BASING his conclusions largely on the capacity of the cranium, but also taking into account other characters, Mr. A. da Costa Ferreira has attempted to dissect out, as it were, the probable racial constituents of the Portuguese, and has set forth his results in the *Bulletin de la Société d'Anthropologie de Paris* (5e. sér., tome v., p. 473). He finds a short, mesorhine dolichocephalic type with a small head which he thinks belongs to the Cro-Magnon race, and a tall, leptorhine dolichocephalic type with a large head. The mesaticephals are partly attributed to a brachycephalic mixture; those of short stature, leptorhine, and with a large head, are thought to belong to the race of Grenelle or to a Celtic invasion. The small headed, leptorhine mesaticephals are probably of Semitic origin, while the mesorhines may be of Berber extraction.

IN order to make more widely known and more easily accessible to American students the results of important researches on the Maya hieroglyphs, printed in the German language, the Peabody Museum Committee on Central American Research has begun a series of translations of which the first, on the representation of deities of the Maya manuscripts, by Dr. P. Schellhas, has been published as vol. iv., No. 1, of the *Papers of the Peabody*

Museum, Harvard University. In this valuable enumeration Dr. Schellhas is very careful not to theorise or to go beyond the warrant of the manuscripts themselves. In several cases he refers to diverse views concerning the names of the gods in question; but, as he truly observes, "these different opinions show on what uncertain grounds such attempts at interpretation stand, and that it is best to be satisfied with designating the deities by letters and collecting material for their purely descriptive designation. In vol. iii. of the same *Papers* are illustrated accounts of the Cahokia and surrounding mound groups, by Mr. D. I. Bushnell, and of the exploration of mounds in Coahoma, co. Mississippi, by C. Peabody. In vol. i. Mrs. Zelia Nuttall gives a very interesting account of a penitential rite of the ancient Mexicans mainly derived from Spanish sources. Blood was drawn from cuts in various parts of the body, including the tongue and ears; the rite of voluntarily drawing blood, principally from the ear, was a feature of every-day life in ancient Mexico, and was performed by young and old. It constituted an act of humility, thanksgiving, penitence, or propitiation.

THE Survey Department of Egypt has published an important paper on the rainfall of the Nile basin in 1904, by Captain H. G. Lyons, director-general of the service. Five years ago there were only six or eight places where the rainfall was being measured regularly; now, thanks chiefly to the efforts of Captain Lyons, there are more than forty, of which thirty-two lie to the south of Berber (lat. 18° N.). He points out that to understand the seasonal variation of the rainfall the relative positions of the equatorial low-pressure belt, and the high-pressure areas to the north and south of it at different seasons, must be taken into consideration. In the low-pressure area there is an ascensional movement of the air, so that its moisture is condensed to form clouds and rain. This ascensional movement depends upon the heating effect of the sun, and it is shown month by month how the low-pressure area varies with respect to the sun's position from south to north, and back to south again. The carefully prepared tables and diagrams show, as a general result, that the rainfall of 1904 in the Nile basin was below the average; in the equatorial regions it was somewhat deficient in the earlier part of the year, and above the average in the autumn.

A SOMEWHAT striking paper has been published by Prof. Ronald Ross, F.R.S., of Liverpool University, on verb functions, with notes on the solution of equations by operative division (*Proceedings of the Royal Irish Academy*, xxv., A, 3). The writer points out that whereas symbols such as f and ϕ are used to denote functions in general, no notation exists which can explicitly represent the operation of forming any *particular* function of any argument, apart from the argument itself, except in certain simple cases as exemplified by the prefixes log, sin, &c. The notation proposed by Prof. Ross meets this want. It depends on the use of a purely symbolical letter β to denote the *base* of a given operation, this symbol occurring in the "verb function" or operator. When this verb function operates on a subject x, it produces the result obtained by writing x for β in the operator. For example,

$$[\beta^{m/n}](ab)=(ab)^{m/n}, [\beta \log \beta - 1]x = x \log x - 1, [e^{\beta} \cos \beta]x = e^{x} \cos x,$$

and so on. Another peculiarity is the use of square brackets to enclose each separate operation, the necessity of which may be illustrated by the following example:—$[(a+\beta)^2]x$ represents $(a+x)^2$, whereas

$$[a+\beta]^2 x = [a+\beta][a+\beta]x = [a+\beta](a+x) = a+(a+x) = 2a+x.$$

In connection with inverse operations, Prof. Ross introduces the notation of a double fraction or solidus line as a distinction from the ordinary division symbol; thus, according to his notation, we should have

$$\frac{1}{[a\beta^2+b\beta+c]}0 = -\frac{b \pm \sqrt{(b^2-4ac)}}{2a}$$

as the symbolical enunciation of the expressions for the roots of a quadratic equation.

THE peculiar magnetic properties of the so-called Heusler's bronzes, consisting of copper, manganese, and aluminium, are the subject of a paper by E. Take in the *Verhandlungen* of the German Physical Society (vol. vii., 133). The "transformation points" of a number of samples of the bronze were determined, as well as the effect of heating and re-heating upon them. The results are shown in a series of striking curves.

REFERENCE has already been made in these notes (NATURE, vol. lxx. p. 583) to the simple form of telescope pyrometer invented by M. Féry for measuring high temperatures. This instrument is now being sold by the Cambridge Scientific Instrument Co., Ltd., who have been appointed sole agents for its sale in the United Kingdom, the British colonies, and in the United States; it is made in two forms, a mirror pyrometer, recording temperatures between 500° C. and 1100° C., and a lens pyrometer, reading between 900° C. and 3500° C.

PROF. MOISSAN has published, in the form of a pamphlet having the title "La Chimie minérale, ses Relations avec les autres Sciences," an address delivered last September at the Congress of Arts and Sciences at St. Louis. Prof. Moissan, who by his own researches and those of his colleagues has so widely enlarged the domains of inorganic chemistry, whilst regretting that this branch of science is still systematically imperfect as compared with organic chemistry, emphasises the fact that during the past few years its study has again resumed a place of honour. This has been due largely to the discovery of the gases of the atmosphere, to research at high and low temperatures, the investigation of the rare earths, and to the increasing tendency to the fusion of chemical and physical methods. "Many important investigations still remain to be made in inorganic chemistry, but for success very refined methods and a high degree of accuracy will be required. Chemical research must acquire the precision of physics." Finally, it must be recognised that experiment is the sole guide to truth, and that Faraday's saying still holds true that chemistry is essentially an experimental science.

THE recent researches of M. Berthelot on the permeability of fused quartz vessels to gases at high temperatures have led him to study glass from the same point of view, with very interesting results. In many analytical processes, and more especially in the analysis of organic compounds, it is tacitly assumed that at temperatures below its melting point glass is impermeable to oxygen, nitrogen, and carbon monoxide and dioxide. In the current number of the *Comptes rendus*, M. Berthelot gives an account of some experiments on glass, the mode of working being the same as that used for the quartz tubes (see NATURE, April 13, p. 568) with the exception that the tubes were necessarily slowly cooled, and finds that at temperatures between 550° C. and 800° C. glass tubes are permeable to gases. He compares the passage of gases through slightly softened glass to the gaseous exchanges taking place at the ordinary temperature through the walls of indiarubber tubing, and emphasises the importance of this property of glass, hitherto unsuspected, in many chemical and physical investigations at high temperatures.

MESSRS. CROSBY LOCKWOOD AND SON will publish shortly a work on "Modern Lightning Conductors," by Mr. Killingworth Hedges, honorary secretary of the Lightning Research Committee.

AN appendix to Mr. R. L. Taylor's "Student's Chemistry" has been published by Mr. John Heywood. It consists of two sections; the first part deals with the radio-active elements, and the second is an introduction to the study of organic chemistry.

WE have received from the Art. Institut Orell Füssli, of Zurich, Nos. 177, 178, and 179 of their "Illustrated Europe" series of handbooks. The three parts are bound together in a convenient little volume with the title "Grisons Oberland." The guide book is by Dr. Chr. Tarnuzzer, and a historical sketch has been contributed by Prof. J. C. Muoth. The translation into English was done by Dr. and Mrs. Spöndly-Blakiston. Visitors to this interesting part of Switzerland will find interesting scientific, historical, and topographical information in this guide book. The book may be obtained in this country from Messrs. Hachette and Co.

MESSRS. OLIVER AND BOYD have published the ninth volume of the "Reports from the Laboratory of the Royal College of Physicians, Edinburgh." The volume is edited by Sir J. B. Tuke and Dr. Noël Paton. The papers included fall under two categories; the first comprises fourteen papers describing researches on the ductless glands under the Mason fund, and the second consists of general researches in physiology, pathology, and pharmacology.

WE have received from Mr. John Grant, of Edinburgh, a catalogue of scientific books, chiefly on botany, zoology, and geology, and a catalogue of recent purchases—including some well known works of science—all of which are offered at greatly reduced prices.

MR. W. BUTLER, Southport, has devised a new type of camera stand—called the Swingcam—to facilitate the photography of natural history subjects. The stand enables a photographer to point the lens of a camera at any angle and fix it in that position, without the use of a swinging back or front or any other independent attachment. The Swingcam tripod head can be fixed in a horizontal or vertical position, or at any angle, and is also capable of being inverted if desired. Naturalists and others who occasionally have to use cameras in awkward positions will no doubt find these devices a convenience.

NEW editions of two standard works already reviewed in these columns have just been received from Mr. Gustav Fischer, Jena. One is the seventh edition of the "Lehrbuch der Botanik" by Profs. Strasburger, Noll, Schenck and Karsten, and the other is the seventh edition of Dr. R. Hertwig's "Lehrbuch der Zoologie." Both works have been revised, so that they will maintain their high position among text-books of science.

WE have received from Messrs. Henry Sotheran and Co., 140 Strand, W.C., a copy of their latest catalogue of second-hand books, including numerous scientific works; and from Messrs. John Wheldon and Co., 30 Great Queen Street, W.C., a catalogue of a miscellaneous collection of books, comprising many dealing with biology, geology, and mathematics.

MESSRS. DAWBARN AND WARD, LTD., have published a second revised edition of "Photographic Failures: Prevention and Cure," by "Scrutator" of the *Photogram*.

OUR ASTRONOMICAL COLUMN.

NEWLY DISCOVERED NEBULÆ.—In No. 4013 of the *Astronomische Nachrichten* Prof. Max Wolf announces the discovery of a small, but beautiful, nebula the position of which, referred to the equator of 1900·0, is as follows:—$\alpha = 13h.\ 58m.\ 33{\cdot}44s.$, $\delta = -9^\circ\ 39'\ 36''$. This object was discovered on a plate exposed during a search for minor planet (126), Velleda, and is of a spiral form, of the unusual S-shaped variety, the nucleus being of the fourteenth magnitude. Its diameter in R.A. is about $0'{\cdot}75$, and in dec. about $1'{\cdot}0$.

A second nebula of especial interest was found in the position (1900·0) R.A. $= 13h.\ 58m.\ 15{\cdot}17s.$, $\delta = -9^\circ\ 40'\ 10''$. This object is $1'$ in length along its major axis, which has a position angle of about 120°, and is of the Andromeda nebula form.

THE BRUCE TELESCOPE REFERENCE PHOTOGRAPHS.—When the 24-inch Bruce telescope of the Harvard College Observatory was being planned it was expected that the instrument might be useful in assisting in the discoveries of new satellites, and this expectation was realised in the discovery of Phœbe. A number of plates of each planet have been taken since 1893, and of these Prof. Pickering now gives the details as to object photographed, exposure, date and region, in Circular No. 97 of the Harvard College Observatory, hoping that the knowledge of their existence may assist other observers of possible satellites. The list includes 12 plates exposed for Mercury, 2 for Mars, 6 for Vesta, 21 for Jupiter, 12 for Uranus, and 3 for Neptune. The Saturn plates were fully described when the manner of the discovery of Phœbe was related in a former publication. The limiting magnitude of the objects shown on these plates may be taken as 17·0 or 17·5, and therefore the photographs may prove useful in the correction of the elements of Jupiter's newly discovered satellites when more is known of the positions of these two objects.

COMET 1904 II. (1904 *d*).—A continuation of the ephemeris for comet 1904 *d* is given in No. 4012 of the *Astronomische Nachrichten* by Herr M. Ebell.

This comet is now only about one-sixth as bright as when discovered, and is gradually becoming fainter. Its position on May 26, according to the ephemeris, will be α (true) $= 2h.\ 23m.\ 48s.$, δ (true) $= +64^\circ\ 50'$, which is about 2° south of ι Cassiopeiæ, and the object is travelling slowly towards the constellation Camelus with a very slightly increasing declination.

TWELVE STARS WITH VARIABLE RADIAL VELOCITIES.—Further results of the spectrographic work performed by the D. O. Mills expedition from Lick Observatory to the southern hemisphere are published in Bulletin No. 75 of that observatory.

Twelve stars have been found by Prof. Wright and Dr. Palmer to be spectroscopic binaries, some of them, mentioned below, having features of especial interest. α Phœnicis has a period of about 190 days. The system of θ Eridani has been found to be very similar to that of Mizar, the brightest component, θ_1, having a composite spectrum similar to that of the star named. α Puppis, α Volantis, α Carinæ, and κ and p Velorum are amongst the other stars of which the radial velocities have been found to be variable.

DOUBLE "CANALS" ON MARS IN 1903.—In Bulletin No. 15 of the Lowell Observatory Mr. Lowell gives, and discusses in detail, the results of his observations of the Martian "canals" during 1903. Before proceeding to the account of the actual observations, he comments on the various theories which have been advanced in argument against the reality of the "doubling" phenomenon. The "diplopic" or out-of-focus theory is refuted for five reasons, the chief of which is that for any special epoch the width of each individual double canal remains constant.

The "interference" theory is met by the statements that in the case of these features there is no bright streak such as would be necessary to produce the two dark streaks to give the idea of a double canal, and that the width of each double canal does not vary with the aperture employed. Lastly, the "illusion," or, as Mr. Lowell refers to it, the "Small Boy," theory is considered,

the chief argument against it being that the ambiguity of real and false effects only exists at the limit of vision, whereas most of the canals considered are, *when well seen*, far within this limit.

A number of interesting points concerning the canal systems are deduced from the 1903 observations, but only one or two of the more striking may be mentioned here. (1) The majority of the double canals do not exceed 3°·2 (degrees on the planet's surface) in width; (2) at the time of maximum visibility the two members of each double are generally of equal strength, but as they wane one of them usually becomes apparently stronger than the other; (3) the double canals appear to congregate in special longitudes and latitudes, in the latter case especially favouring the equatorial regions, a fact which Mr. Lowell urges as an argument against the "diplopic" theory; (4) the double canals are peculiar to the lighter regions of the planet's surface, although single canals are, apparently, just as numerous in the darker as in the lighter regions; the double canals, however, are always connected, directly, or through the medium of similar objects, with the darker areas.

CATALOGUE OF NEW DOUBLE STARS.—Prof. Hussey's ninth catalogue of double stars, discovered with the 12-inch and 36-inch refractors of the Lick Observatory, and mostly measured with the latter instrument, is contained in Bulletin No. 74 of that observatory. The preceding catalogues have severally appeared in Nos. 480, 485, and 494 of the *Astronomical Journal*, and Nos. 12, 21, 27, 57, and 65 of the Lick Observatory Bulletins.

The present publication gives the catalogue and D.M. numbers, the position and the distance and position-angle determined at each observation for each of the double stars recorded. The catalogue numbers extend from 801 to 1000 inclusive, and run consecutively.

THE ROYAL SOCIETY CONVERSAZIONE.

MANY instruments and devices of scientific interest were shown at the Royal Society's conversazione on Wednesday, May 17. As usual, the exhibits illustrated methods and results of recent work in various branches of science, and the subjoined summary of the official catalogue contains a few particulars relating to them.

In the course of the evening lantern demonstrations were given in the meeting-room by Dr. E. A. Wilson, Sir Oliver Lodge, and Mr. Perceval Landon. Sir Oliver Lodge demonstrated the use of electric valves for the production of high-tension continuous current. Electric vacuum valves, which it is now found were suggested in a letter by Sir George Stokes twenty years ago, have as their function the *entrapping* of a portion of electricity by permitting its passage in one direction and stopping its return. They therefore can be employed to accumulate electricity supplied from an intermittent or jerky source and to store it at a steady high potential; so that it may thereafter maintain a current through a very high resistance, as in electrostatics, and may produce X-rays, or point-discharge, or other continuous high-tension effects, and enable a small portable coil to imitate some of the effects of a much larger one by storage and accumulation of impulses. Among the applications contemplated are the separation of metallic fume and the dissipation of fog.—Dr. Edward A. Wilson showed a number of Antarctic views illustrating the life and work done on board the *Discovery* during the years 1902 to 1904, and views of the seals, penguins, and other birds met with in the Antarctic circle; and Mr. Perceval Landon exhibited pictures of the road to Lhasa.

The other exhibits are here grouped together according to subjects more or less closely related to one another.

Specimens illustrating the action of light and of radium upon glass: Sir William Crookes, F.R.S. (1) It is well known that many samples of colourless glass containing manganese slowly assume a violet tint when exposed to sunlight. In some specimens of glass exhibited the pieces were of all depths of tint, from deep violet, almost black in thick pieces, to pale amethyst. Analysis shows the glass to contain manganese. Heating the glass in a covered crucible to its softening point discharges the colour, leaving the glass white and transparent. The coloration is not superficial. On immersing a piece of the coloured glass in a liquid of about the same refractive index as itself, the colour is seen to have penetrated throughout the mass. Radium, acting for a few days, even through quartz, will produce as intense a coloration in a piece of this glass as exposure to the sun on the Pampa has taken years to effect. Six pieces of glass from the greenhouses at Kew Gardens illustrated changes which took probably about fifty years to complete in our climate. Purple spots were produced on two of these specimens by Sir William Crookes by the action of 15 milligrams of radium bromide in a quartz tube in the course of ten days, the beginning of change being well marked at the end of two days. In a specimen of manganese glass exposed to light for forty years as a pane of a greenhouse, the ends of the glass which had been protected from light by the window frame were colourless. In the expectation that radium might have a reducing effect on the manganese compound, Mr. F. Soddy submitted a portion of the pane to the action of 30 milligrams of radium bromide for three days in May, 1904. The colour, however, instead of being diminished, was intensified. Specimens were also shown illustrating the coloration of glass, quartz, and fluorspar by the β rays of radium.

Action of actinium or emanium emanation on a sensitive screen: Sir William Ramsay, K.C.B., F.R.S. Actinium or emanium are different names, adopted by Debierne and Giesel respectively, for the same substance, separable from pitchblende, and accompanying lanthanum. It gives off an emanation, of which the period of activity is very short—a few seconds. When this emanation impinges on a sensitive zinc sulphide screen, the screen becomes luminous. The luminous patch can be blown away, and in a second or two reappears.—Phosphorescence caused by the β rays of radium: Mr. G. T. Beilby. Phosphorescence of calcspar and other substances—(1) during exposure to the rays; (2) after removal from the rays; and (3) revived by heat after secondary phosphorescence has died down. The storage of phosphorescence and the coloration effects are due to partial electrolysis of the calcium carbonate or other substance by the stream of negative electrons. A proportion of the ions re-combine at once, others continue to re-combine after the rays have ceased to act, and the remainder only re-combine when the mobility of the crystal molecules is increased by heat.—Skiagrams of the hands of Machnow, the Russian giant, and of O'Brien, the Irish giant: Mr. S. G. Shattock.

Large echelon spectroscope: Prof. A. Schuster, F.R.S. This echelon spectroscope, constructed by Messrs. Adam Hilger, Ltd., consists of 33 plates, and has a resolving power equal to that of an ordinary grating of 329,000 lines in the first order.—A hand refractometer: Mr. G. F. Herbert Smith. By means of this form of refractometer the refractive indices of any translucent substance, the refractive power of which lies within the effective range of the instrument, 1·400 to 1·760 approximately, may be determined with ease and celerity, to units in the second place of decimals if ordinary light, and to two or three units in the third place of decimals if the monochromatic light emitted by a volatilising sodium salt be the source of illumination.—The Ashe-Finlayson comparascope: Mr. D. Finlayson. This accessory to the microscope has been designed to enable the images of two different objects, separately mounted, to be projected side by side into the field of view, thereby enabling a thorough comparison to be made of their respective points of difference and resemblance. The apparatus consists of a prism placed above the primary objective which reflects to the ocular the rays from a secondary objective placed at right angles to the optic axis of the microscope.—(1) Torsion balance, used in radiation pressure measurements, by Nichols and Hull; (2) vacuum tube, of Nichols and Hull, to illustrate the repulsion of comet tails by the sun: Prof. E. F. Nichols.—An optical appliance to facilitate visual perception of ultra-microscopic particles: Mr. Carl Zeiss. The apparatus consists of a projection table provided with an arc lamp, optical bench, two projection aplanats, and a precision slit. (The use of sunlight instead of the arc lamp is preferable.) Particles of far less than half a wave-length can be made visible with this apparatus.—

Mechanical lantern slide illustrative of the phenomenon of a total solar eclipse: Mr. W. Shackleton. A white disc representing the sun is projected on a screen; by moving an opaque disc representing the moon, this is gradually obscured, and the preliminary partial phases of a total solar eclipse are shown. A moment before complete obscuration a twin shutter is opened, which allows the corona and chromosphere to be projected, thus reproducing totality, which may last as long as desired.—Stereoscopic views of the sun and stars of estimated parallax: Mr. T. E. Heath. The perspective drawings were made from a plan and elevations in which the scale of stellar distances was ten light-years to 1 inch, and of stellar discs such that the sun (or a star which gives equal light) was 1/50th of an inch in diameter. The magnitudes were made to vary with the varying distance of the spectator.—(1) Microscope and goniometer stage for examining the optical qualities of minute grains of sand; (2) set of petrological quartz wedges; (3) photomicrographic camera, designed by Mr. J. W. Gordon for taking small direct photomicrographs while the instrument is in use after observation without attention to the adjustments: Messrs. R. and J. Beck, Ltd.

(1) Photomicrographs of section of gun tube showing change in structure of steel after 2000 rounds; (2) photomicrographs of alloys of aluminium with nickel; (3) photomicrographs of alloy of copper with cobalt and nickel: Dr. Hodgkinson, Captain Playfair, R.A., and Mr. Coote. —(1) Apparatus for polishing and preparing metals for microscopic examination; (2) specimens of steels in the cast and forged condition containing phosphorus: Mr. J. E. Stead, F.R.S.—Transverse sections of slip-bands and other microscopic features of metallic surfaces: Mr. W. Rosenhain.—A series of alloys of iron and steel tested at liquid air temperature: Mr. R. A. Hadfield. The specimens showed the effect of liquid air (temperature −182° C.) upon almost pure iron (Swedish charcoal iron "S.C.I.," 0·04 carbon, 99·82 iron) and a large number of alloys of iron with other elements. The well known ductility of iron disappears, while its tenacity is more than doubled. Similar effects occur with nearly all the alloys of iron with carbon and other elements, except those containing nickel, which metal appears to modify considerably the embrittling effect of low temperatures upon iron.

Clock and chronometer by Thomas Mudge: Mr. A. Mallock, F.R.S. The clock was made about 1776, and contains Mudge's moon motion. Mudge's object in making this motion was to show that any desired velocity ratio could be approximated to very closely with comparatively few wheels. The train of wheel-work he employed makes the mean lunation 0·03 second less than the actual mean lunation, that is, the error is less than 1 in 2½ millions. There are other remarkable features in this clock connected with the balance wheel, escapement, and temperature correction.—(1) Tangent-micrometer for theodolites, &c.; (2) endless-tangent screw for sextants: Mr. E. A. Reeves. By the addition of a micrometer "drum," and a simple arrangement for clamping the outer rim or dial carrying the numbers, combined with a special indicator, a carefully constructed tangent-screw serves also as a micrometer, and renders it possible to read the arc with the same accuracy as with the usual form of micrometer, while the instrument need not be larger than the ordinary vernier theodolite. The sextant device consists of a tangent-screw constructed with an endless thread, by means of which the vernier arm can be made to pass from any one part of the arc to another. For making rough contacts the tangent-screw is raised from the arc by means of a lever pressed by the finger. When the pressure on the lever is released the tangent-screw, actuated by a spring, again comes in contact with the arc, and serves as a clamp.

A direct reading cymometer for measuring the length of the waves used in wireless telegraphy: Prof. J. A. Fleming, F.R.S. The instrument consists of a sliding tubular condenser and an inductance coil, the capacity and inductance being varied together in the same proportion by one movement of a handle. The circuit is closed by a copper bar, which is placed alongside the aërial wire indicating the electric waves. The handle of the cymometer is then moved until a neon vacuum tube used as an indicator shines most brightly, and thus determines when the cymometer circuit is tuned to the frequency of the aërial. A pointer moving over a scale then indicates the wave-length of the radiated wave in feet or metres.—An oscillation valve for rectifying electrical oscillations and rendering them measurable on an ordinary galvanometer: Prof. J. A. Fleming, F.R.S. The valve consists of a bulb enclosing a carbon filament made like an incandescence lamp. The filament is surrounded by a metal cylinder. The bulb is highly exhausted. When the filament is incandescent, negative electricity can move through the vacuum from the hot filament to the cylinder, but not in the reverse direction. Hence the arrangement can separate out the two opposite currents in an electric oscillation. It can be used in combination with a dead beat galvanometer as a receiver in wireless telegraphy. The valve replaces the coherer and other appliances, and the signals are given by long and short deflections of the galvanometer.—(1) Resonance induction coil and high potential apparatus; (2) resonance electromagnet: Messrs. Isenthal and Co. Electrolytic condensers of very large capacity are charged from the mains through the primary of a suitably wound induction coil, and the circuit broken and reversed at zero potential by means of a motor-driven commutator of special construction. The advantages are:—no motor transformer is required in primary circuit, no rectifying device in secondary circuit, and there are no interruptors to be cleaned. The apparatus enables a current to be converted sparklessly into pure sine current suitable for space telegraphy. An electromagnet excited from a source of this kind exhibits peculiar physical and physiological phenomena.—(1) High-tension resonance transformer; (2) X-ray stereoscope: Mr. Russell Wright. The special form of "step-up" transformer exhibited works direct from the alternating current mains, and produces an alternating discharge of sufficient tension for X-ray work or high-frequency effluve. By means of a small revolving shutter, driven by a synchronous motor, between the observer's eye and two X-ray tubes, stereoscopic images could be clearly seen on an X-ray screen.

High temperature electric furnaces: Director of the National Physical Laboratory. These furnaces are constructed of rare earths such as are used in Nernst lamps. They are available for temperatures between 800° C. and 2000° C. The apparatus used in a recent determination of the melting point of platinum was shown at work, in addition to that for other experiments of a similar character.—New models of laboratory electric furnaces: Mr. R. S. Hutton. The furnaces consist of a carbon tube, rod, or plate heated by an electric current. In the tube furnaces the carbon is surrounded by some material of low thermal conductivity, which also serves to protect the hot tube from oxidation. The substance to be heated is placed in a carbon boat or crucible inside the tube, and can thus be brought to a very high temperature. The method employed for conveying the current to the carbon by soldering water-jacketed sleeves to the electro-coppered ends of the carbon forms a novel feature of the construction.

Photographs taken in China by the Carnegie expedition under Mr. Baily Willis in 1904, illustrating a presumably Glacial deposit underlying the base of the Cambrian rocks of the region: Sir Archibald Geikie, Sec.R.S.—Photographs, cast, and model of skull of Diplodocus, a Jurassic dinosaur from Wyoming, and other fossils from the middle west of North America: Dr. W. J. Holland.—Remains of fossil mammals from Crete: Miss D. M. A. Bate. Numerous mammalian remains were found in 1904 in the Pleistocene cave and fresh-water deposits of Crete. These include remains of the following animals:—antelope, deer, elephant, pigmy hippopotamus, shrew, and two species of rodents.—The great Indian earthquake, April 4: Prof. J. Milne, F.R.S. Five seismograms of this disturbance were shown from Shide, Isle of Wight. (1–2) Open diagrams on smoked paper showing north-south and east-west motion. (3) Open diagrams of east-west motion on photographic paper. The instrument was a Milne horizontal pendulum. (4–5) Photographic records from a pair of Milne horizontal pendulums vibrated north-south and east-west. The exhibit also included seismograms of east-west

motion from Edinburgh, Paisley, Beirut, and Toronto.—Charts of the Gulf of St. Lawrence, showing the co-tidal lines at mean time of Quebec: Captain Tizard, C.B., F.R.S.—Photographs of the "Cullinan" diamond: Sir William Crookes, F.R.S.

Microscopic preparations illustrating the development of calcareous spicules in various invertebrate animals: Prof. E. A. Minchin and Mr. W. Woodland. Calcareous spicules are small skeletal elements to be found in most of the lower animals. These spicules assume varied and often beautiful forms, those of sponges and "sea cucumbers" (Cucumariidæ and Synaptidæ) being especially striking in this latter respect, and are built up in all instances by the agency of scleroblasts—small nucleated protoplasmic masses which deposit the lime. The causes underlying the production of the curious forms which these spicules assume (triradiates, perforated plates, wheels and anchors, &c.) are not by any means yet understood, but are probably several in number, some being purely mechanical in nature, others, perhaps, being those which give rise to crystals.—Cellular constituents peculiar to cancerous and reproductive tissues: Prof. J. B. Farmer, F.R.S., Mr. J. E. S. Moore, and Mr. C. E. Walker. In the cells of malignant tumours, structures known as "Plimmer's bodies" are present in most cases. These structures have been regarded as parasitic organisms or as specific cellular peculiarities confined to such malignant tissues. They have recently been identified as also being present in normal reproductive tissues. They form a definite organ of the cell during its conversion to a spermatozoon, and they also can be identified in the two preceding divisions. They are absent from other cells of the body.—The simplest kind of protoplasm: Dr. Charlton Bastian, F.R.S. One drop of a fluid swarming with common bacteria had been introduced into one ounce of distilled water containing ten grains of neutral ammonic tartrate in solution. The bacteria grow freely in this fluid, and as the constitution of the ammonia salt is $2NH_4O, C_8H_4O_{10}+2HO$, they must fashion their protoplasm in some way from C, H, O, and N only, though sulphur and phosphorus, one or both, are commonly regarded as necessary constituents of living matter.

The parasite of "kala azar": Brevet Lieut.-Colonel W. B. Leishman. This protozoal organism is found in the spleen and other organs in cases of "kala azar," an extremely fatal disease occurring in epidemic form in Assam, and also, in endemic form, in other parts of India and the tropics. Nothing is yet known as to the mode of infection or as to the life of the parasite outside its human host. In artificial cultures it develops into a flagellated organism closely resembling a trypanosome. Specimens and sketches were shown of the parasites as they occur in the tissues, and of the flagellated forms into which they develop in artificial cultures.—The isolation of *B. typhosus* from water by means of alum precipitation: Mr. H. S. Willson. Alum is added to the infected water in the proportion of 0·5 gram to the litre. When the precipitate of aluminium hydrate has fully formed, the water is centrifugalised and the sediment containing most of the bacteria present in the water is spread on plates of suitable media, and incubated at 42° C. The precipitate, which is known to be destructive to many water and sewage organisms, has no germicidal action on *B. typhosus*.

(1) Stone adze heads in various stages of manufacture, and chips from the neighbourhood of Suloga, Woodlark Island, British New Guinea; (2) photographs of straight-haired individuals from Nara district central division, British New Guinea; (3) wood carvings and drawings, principally from Massim district, British New Guinea: Mr. C. G. Seligmann. Specimens of cross-bred maize illustrating inheritance in accordance with Mendel's law: Mr. R. H. Lock.—Living representatives of the Plymouth marine fauna: Marine Biological Association. Material obtained with the dredge from certain typical grounds in the neighbourhood of Plymouth was shown, together with representatives of the animals living on each ground.—Photographs illustrating young cuckoo in the act of ejecting egg and young bird from nest of foster-parent: Mr. W. Percival Westell.

A new problem on superposition: Mr. H. E. Dudeney. This was a demonstration that an equilateral triangle can be cut into four pieces that may be re-assembled to form a square, with some examples of a general method for transforming all rectilinear triangles into squares by dissection.

Oil painting, a Friday evening lecture at the Royal Institution: Mr. H. J. Brooks.

ATMOSPHERIC ELECTRICITY OBSERVED FROM BALLOONS.

IT is now some years since attempts were first made to investigate the electrical conditions of the upper atmosphere by aid of manned balloons; but it is only within the last three years that the difficulties of the observations and the proper methods to be used have been anything like understood.

Measurements of the normal potential gradient were first attempted. The early observers worked very much in the dark, Linke being the first, in 1901, to investigate the errors due to the mere presence of the balloon itself. He found that for the influence of an uncharged balloon to be small enough to be neglected, the upper of the two collectors used must be at least 10 metres below the basket.

Linke also investigated the efficiency of different forms of collectors. The original form of collector used in balloon work was a modification of Kelvin's drop collector. A wire was lowered from an insulated vessel out of which water flowed and ran down the wire; the drops forming on the end of the wire and then falling off brought the whole wire to the potential of the air at its end. There are many objections to this form of collector; it is very slow in action, uses a large quantity of water, and will not work when the temperature falls below freezing. Flame collectors are obviously out of the question for balloon work on account of their danger, and, much to the regret of the experimenters, radium did not come up to expectation. The difficulty with radium collectors is that the radium ionises a large volume of air, which, on account of the absence of relative motion between the balloon and the surrounding air, travels along with the balloon and completely alters the electrical conditions of the atmosphere in its neighbourhood. By a simple device Linke has finally overcome all difficulties connected with the collectors. A vessel containing spirits is insulated on a shelf fastened to the outside of the basket. From this vessel hangs a long thin lead or other flexible pipe. At the lower end of the pipe is a nozzle which forms the collector proper. As stated above, the collector must be 10 metres below the balloon; thus there is at least a 10-metre head of liquid acting at the nozzle. The pressure due to this causes a very fine jet to escape from a pinhole in the nozzle. As the jet breaks up into exceedingly fine drops, a very rapid collector action takes place. Collectors of this form have acted splendidly, and their use makes it possible to measure the potential gradient with accuracy and ease.

The rate of dissipation of electricity from a charged body, and the degree of ionisation of the air, have also been made subjects for investigation in the upper atmosphere. Ebert and Linke have devoted several ascents to measurements of the dissipation, and Ebert designed the first instrument to measure the natural ionisation of the air; but the ionisation has been most carefully investigated by Gerdien, who improved Ebert's instrument so that it measures not only the ionisation, but the conductivity of the air also.

It was when making these latter investigations that a number of difficulties connected with the casting of ballast were first observed. Ebert found that the pouring of sand from the ballast bags so highly charged the balloon with friction electricity that electrical observations became impossible. Gerdien found that after sand had been cast the balloon remained for some minutes in an atmosphere filled with fine sand dust, which greatly affected the measurements of the ionisation. Linke also found that on account of the sudden upward acceleration given to the balloon after sand had been cast the position of the electroscope leaves changed without any change of voltage. Gerdien was the first to overcome these difficulties. Besides sand, he took two large watertight sacks filled

with water. By having pipes and taps fitted to the sacks water could be discharged as desired. Sand still remained the ordinary ballast; but when electrical measurements were being made water only was used. In order to prevent the water freezing in the cold upper atmosphere, Gerdien filled the sacks with boiling water, which, experience proved, kept sufficiently warm to prevent freezing before it was all used. This method was found to be entirely satisfactory, for it not only got over all difficulties connected with the sand, but by regulating the flow of the water much greater control could be exercised over the balloon than had before been possible with sand.

These and other difficulties have been so recently recognised and overcome that trustworthy results have as yet hardly been obtained, but the observations appear to justify the following conclusions:—

The normal potential gradient remains positive to the highest point yet investigated (5900 metres by Gerdien), but decreases in magnitude as the height increases. This points to the lower regions of the atmosphere containing a positive charge equal to the negative charge on the earth's surface, so that the globe as a whole is not charged.

The number of ions in a cubic metre of air is the same at all heights.

Electricity is dissipated more rapidly from a charged body the higher it is in the atmosphere, this being, no doubt, due to the greater ease with which ions move in rarified air.

These results require further verification before they can be accepted as final, and it is to be hoped that facilities will be forthcoming for the investigations to be followed up in this country. It is a strange fact that no Englishman has yet devoted himself to a study which combines science and sport in such an attractive manner.

GEORGE C. SIMPSON.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—The syndicate the proposals of which with regard to the previous examinations were thrown out by the Senate last term, was elected to consider the studies and examinations of the University, and, although it has so far considered but one examination, a determined attempt is being made to bring its deliberations to a close. The period for which the syndicate was appointed lapses at the end of this term, and the grace which authorises its re-appointment will to-day be "non-placetted" in the Senate. A short time ago four members were added to the syndicate. Their nomination was not objected to, though the action of the council in appointing them was termed inexpedient. It seems a strange piece of courtesy to acquiesce in the appointment of men like the master of Gonville and Caius, Mr. S. H. Butcher, late professor of Greek in Edinburgh, Dr. Adam, and Mr. Hardy to a syndicate which the opponents of change intended, so far as lay within their power, to render moribund.

The natural sciences tripos continues to increase. There are 149 candidates entered for part i. and 30 candidates for part ii., both of which began this week. In the first part of the mathematical tripos there are 57, and in the first part of the classical tripos there are 102 candidates, in the second part 12. The entrances for the mechanical sciences tripos, part i., are 45.

The Board of Agricultural Studies reports a continuous increase both in the number of students attending the agricultural courses and in the number presenting themselves for the examinations. The number of students is now close upon fifty, and shows an increase of seven within the last twelvemonth.

The honorary degree of M.A. will to-day be conferred on Mr. Robert Stephenson, late chairman of the Cambridgeshire County Council, in recognition of his services to education, and especially to the promotion of agricultural education in the university.

The Rede lecture will be delivered on Saturday, June 10, at 11.30 a.m., by Sir Francis Younghusband, K.C.I.E. His subject is "Our True Relationship with India."

The council of the Senate has promulgated a grace proposing that a syndicate be appointed to consider the desirability of establishing in the university a diploma in forestry, and to draw up, if it thinks fit, a scheme of instruction and examination in forestry; that it be empowered to consult with any persons or bodies; and that it report to the Senate before the end of the Lent term, 1906.

The next combined examination for sixty-two entrance scholarships and various exhibitions at Pembroke, Gonville and Caius, King's, Jesus, Christ's, St. John's and Emmanuel Colleges will be held on Tuesday, December 5, 1905, and following days, commencing at 9 a.m. on Tuesday, December 5. Mathematics, classics, and natural sciences will be the subjects of examination at all the above-mentioned colleges, and certain colleges examine in history, modern languages, and Hebrew.

OXFORD.—Dr. Henry Wilde, F.R.S., has presented 100*l.* to the Hope Department of Zoology for the purchase and preparation of specimens illustrating mimicry and protective resemblance.

The Romanes lecture for 1905 will be delivered by Prof. Ray Lankester, F.R.S., in the Sheldonian Theatre on Wednesday, June 14, at 2.30. The subject of the lecture will be "Man and Nature."

Mr. R. de J. Fleming Struthers has been elected to a senior scholarship in chemistry at Exeter College.

The Junior Scientific Club will hold a conversazione at the Museum on Tuesday, May 30.

MR. E. P. CULVERWELL has been elected to the professorship of education founded by the Board of Trinity College, Dublin, for a period of five years.

A REUTER telegram from Toronto reports that the Ontario Government has announced a provisional grant of 100,000*l.* to the University of Toronto toward the proposed new buildings which, it is estimated, will cost 320,000*l.*

IT has been announced, *Science* states, that the trustees of Columbia University have received 100,000*l.* from an anonymous donor for the construction of a new college hall; and that the Legislature of Minnesota has made direct appropriations for the University of Minnesota for the next two years amounting to 142,000*l.*, besides 12,000*l.* derived from the insurance on the old main building, destroyed by fire last September.

AN International Exhibition of Pedagogy, under the patronage of H.M. the King of Spain and of H.M. Queen Maria Christina, will be held in Barcelona from May to October. Particulars as to the scope of the exhibition and the conditions attaching to exhibits are given in the official programme, a limited number of copies of which can be obtained on application to the Director of Special Inquiries and Reports, Board of Education Library, St. Stephen's House, Cannon Row, Whitehall, London, S.W.

PRESIDING at the annual meeting of the British and Foreign School Society, Mr. A. H. D. Acland moved the adoption of the report on the year's work of the association. During the course of his speech, he remarked that in many schools too much is done for the brain and too little for the body. If hygiene, instead of being merely a special subject, were made part of the teacher's general outfit, much would be done for the health of the nation. Mr. Acland said he hopes also that by degrees the pest of examinations will be modified and got rid of—a matter in which the old universities are among the greatest sinners. Whoever could wipe out two-thirds of the examinations would be one of the greatest benefactors of the human species.

THE question of the concentration of the teaching of the preliminary and intermediate subjects of the medical curriculum in London at a few centres has long occupied the attention of those interested in medical education, as it has been felt that this step must result in greater efficiency in teaching, as well as economy in expenditure. The Westminster Hospital Medical School has been the first to take definite action in the matter, and has just completed negotiations with King's College by which arrangements have been made for the teaching of physics, chemistry, biology, anatomy, physiology, and materia medica (that is to say, the subjects of the preliminary and intermediate examinations) to Westminster students

of King's College. Students will enter Westminster Hospital Medical School as in the past, and will remain Westminster men; they will not become matriculated students of King's College, but they will be taught the earlier subjects of study at that institution. The scheme will come into effect at the commencement of next winter session in October. At the same time, the teaching of the subjects of the final examination is being completely re-organised. It is believed that this commencement of a probably more general concentration of the teaching of the preliminary and intermediate subjects of the curriculum cannot but promote the best interests of medical education in London.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, March 9.—"On some Continuous Observations of the Rate of Dissipation of Electric Charges in the Open Air." By Dr. C. Coleridge **Farr**. Communicated by Dr. C. Chree, F.R.S.

During part of 1902 and 1903 the author resolved to take as many observations of the rates of dissipation of electric charges as possible, and to continue them over the whole day, and, when opportunity offered, over longer periods.

The observations were made on the Canterbury Plains of New Zealand, about 20 feet above sea-level, and five miles due west from the sea coast. The apparatus used was Elster and Geitel's[1] *Zerstreuungsapparat*. Corresponding observations were made of the direction and intensity of the wind (Beaufort), the humidity, and the potential difference between a point about 10 feet above the ground and the earth. This was determined by a Kelvin portable electrometer and a water-dropper.

The dissipation apparatus was read by a telescope, and at night it was illuminated by a bull's-eye lantern, but only during the actual time of reading.

The conductivity of the air is very irregular, but on an average negative electricity is dispersed more rapidly than positive.

$$\text{Taking } q = \frac{\text{conductivity of air for } -\text{ve electricity}}{\text{conductivity of air for } +\text{ve electricity}},$$

six ordinary days, embracing several hundreds of observations, gave an average of $q = 1{\cdot}16$.

Yet on several occasions for some hours together during these six days, positive electricity was dissipated the more rapidly. The examples considered apparently indicate that a low value for q is, as might be expected, accompanied with a reversal of sign of the atmospheric charge. On one occasion, however, the potential became -185 volts with q about unity.

Again, considering the six days only, as more typical of ordinary conditions than two others to be referred to, there is distinct evidence of a double maximum and minimum value for the conductivity throughout the day for charges of both signs.

Of two other days, viz. February 1 and 2 and December 15 and 16, the former exhibits no distinct maxima and minima, but a strong south-west gale was blowing; the latter day is incomplete.

Observations on February 1 and 2, and on March 1 and 2, during south-west gales gave a much higher value for the conductivity for both positive and negative charges than usual. Since the wind on these two days was in the same direction, there is only a slight amount of evidence that the excessive conductivity is due to the strength rather than to the direction of the wind.

Two days not yet mentioned, viz. February 18 and March 16, may now be referred to. On the first of these a strong gale from the north-west was blowing when the observations were begun. On the latter, at 6.30 a.m., it was calm; at 8 a.m. there was a light south-west wind, and at 9.30 it was blowing strongly from the north-west with a characteristic falling barometer. These "nor'westers" blow over a range of mountains reaching 7000 feet, and deposit their moisture on the western slopes, though the rain often extends to the eastern side. In Christchurch they are invariably dry and hot, being of the nature of "Foehn" winds, and have a depressing effect upon most people.

Though the above days are the only two of the class upon which, so far, the author has taken dissipation observations, yet potential observations indicate that the winds are negatively charged relatively to the earth, which is contrary to the usual condition. On both days the dissipation curves show marked peculiarities. The earliest observation, at 11.15 a.m. on February 18, gave $q = 0{\cdot}4$, with a negative potential difference between water-dropper and earth of -300 volts at 10.20 a.m., -150 volts at 11.40 a.m., and -50 volts at 12.45 p.m. Corresponding with this rise of potential there is also a marked rise in the value of q.

On March 16 the whole history is apparent. At 7.30 a.m. the wind was light south-west, $q = 1{\cdot}3$, potential $+90$ volts. At 9.45 a.m., wind north-west, strong, $q = 0{\cdot}7$, potential -250 volts. At 10.30 a.m., wind north-west, strong, $q = 1{\cdot}1$, potential -100 volts approximately. The north-west wind seemed then to have thoroughly established itself. The values of q became less and less, the curves indicating the conductivity of the air for positive and negative charges diverging rapidly, that for positive reaching a high value, whilst the negative curve reached remarkably low values. Corresponding with the extremely low value for q the potential reached its greatest negative value, -1885 volts. After this q increased and the negative potential decreased, until at 4.30 p.m. $q = 0{\cdot}94$, potential -30 volts.

March 30.—"On a New Type of Electric Furnace with a Re-determination of the Melting Point of Platinum." By Dr. J. A. **Harker**. Communicated by Dr. R. T. Glazebrook, F.R.S.

The first part of the paper deals with a description of a new type of electric furnace for the attainment in absence of noxious gases of temperatures between 800° C. and 2200° C. The conductor conveying the electric current is a tube of solid electrolytes similar in composition to the filament of a Nernst lamp. An essential feature is that, for many purposes, the usefulness and life of a furnace constructed in this way may be much increased by adopting a "cascade" system of heating. That is, the energy supplied may be divided, so that only sufficient is put through the tubular conductor itself to raise its temperature, say 1000° C. above its surrounding, the surrounding itself being maintained at 1000° C., thus enabling a temperature of 2000° C. to be attained in the tube without straining it unduly.

The regulation of temperature in small furnaces of this type is so perfectly under control that very well defined melting points may be taken with very small quantities of substance.

The second half of the paper deals with a re-determination of the melting point of platinum by the thermo-electric method in these furnaces, the highest value found being 1713° C., the lowest 1702° C., and the mean result of the experiments 1710° C. ± 5° C.

May 11.—"The Effect of Plant Growth and of Manures upon the Soil: the Retention of Bases by the Soil." By A. D. **Hall** and N. H. J. **Miller**. Communicated by Prof. H. E. Armstrong, F.R.S.

The investigation deals first with the variations in the amount of calcium carbonate—the only basic substance usually available in soils—in the experimental plots at Rothamsted. In four of the fields which have been unmanured during a long period, the loss of calcium carbonate amounts to about 1000 lb. per acre per annum. This rate of loss is much increased on some of the manured plots; the use of ammonium sulphate and chloride, as sources of nitrogen, causes an increased loss of calcium carbonate which is equivalent to the amount required to neutralise the acid of the salts applied.

When sodium nitrate is used as a manure the rate of removal of calcium carbonate is lower than on the unmanured plots. Farmyard manure has also a similar conserving effect on the calcium carbonate in the soil. Evidence is also brought forward showing that many soils which are initially very poor in calcium carbonate retain their fertility unimpaired for many years, and even show

[1] Elster and Geitel, "Terrestrial Magnetism," vol. iv., p. 213 *et seq.*

no decline in the small amount of base they contain, although nitrification is always going on and requires a supply of base from the soil. The authors show, from experiments with water cultures and from a consideration of the analyses of field crops, that the growing plant withdraws more acid than base from the neutral salts dissolved in the soil water, leaving behind a basic residue in the form of bicarbonate. Calcium oxalate and other organic salts in plant residues are converted by bacterial action in the soil into calcium carbonate. These two agencies restore bases to the soil in quantities approximately equivalent to their removal by nitrification, and so maintain a neutral reaction in the soil.

Zoological Society, May 2.—Dr. W. T. Blanford, F.R.S., vice-president, in the chair.—Specimens of domestic chicks to illustrate peculiarities in the hereditary transmission of white plumage: W. **Bateson.**—On *Leucosolenia contorta* (Bowerbank), *Ascandra contorta* (Haeckel), and *Ascetta spinosa* (Lendenfeld): Prof. E. A. **Minchin.** The author pointed out that the nomenclature of the Calcarea Homocœla was in a more tangled state than that of any other group of the animal kingdom, with, perhaps, the exception of the malarial parasites. Dr. Bowerbank, who founded the species, gave a diagnosis that would fit any Ascon, and his type specimens were jumbles of three or four species; consequently Prof. Minchin declared his name to be of no systematic value whatever. To Haeckel's name *Ascandra contorta*, Prof. Minchin referred a sponge extremely abundant on the Mediterranean coasts of France. Prof. Minchin preferred to name *Ascandra contorta*, H., as *Clathrina contorta*. He believed that the *Ascetta spinosa* was only an age variation of *Clathrina contorta*, not yet possessing monaxon spicules.—Anatomy of the ferret-badger (*Helictis personata*), based on a dissection of a specimen that had recently died in the society's gardens: F. E. **Beddard.**—The osteology of the Eurylæmidæ, and the question of the systematic position of this group: W. P. **Pycraft.** While agreeing with the general consensus of opinion as to the primitive character of these birds, the author held that the isolated position which they were supposed to occupy with regard to the remaining Passeres was by no means justified by facts. The pterylography, osteology, and myology of the Eurylæmidæ all tended to show that the nearest allies of these birds were the Cotingidæ. Although undoubtedly primitive, the group, Mr. Pycraft pointed out, presented a number of specialised characters, which were especially marked in the skull and muscles of the wing.

Entomological Society, May 3.—Mr. F. Merrifield, president, in the chair.—A series of *Xenarthra cervicornis*, Baly, from Ceylon, illustrating the curious structure of the antennæ of the ♂: M. **Jacoby.**—Specimens of *Tephrosia consonaria*, ab. *nigra*, and melanic examples of *Boarmia consortaria*, all from a wood in west Kent: G. T. **Porritt.** These forms were exactly on the same lines as the melanism in west Yorkshire, and it is curious they should occur in such widely separate localities. The two genera, however, are evidently prone to melanism, as Mr. Porritt had now seen black, or almost black, specimens of all the British species except *Tephrosia punctulata*.—(1) Two specimens of the very rare Staphylinid, *Medon castaneus*, Grav., taken in the Oxford district during the last week of April; (2) several examples of both sexes of the giant flea *Hystrichopsylla talpae*, Curtis, from field-mouse nests in the same district; (3) the type-specimen of the Bostrichid beetle *Dinoderus ocellaris*, Steph. (taken by the late Prof. Westwood at "Little Chelsea" previous to 1830), from the Hope collection at Oxford: Commander J. J. **Walker.**—Heliotropism in Pararge and Pyrameis: Dr. G. B. **Longstaff.**—The structure and life-history of *Psychoda sexpunctata*, Curtis: J. A. **Dell.**—The three-colour process as applied to insect photography: Dr. D. H. **Hutchinson.**

Mathematical Society, May 11.—Prof. Forsyth, president, in the chair.—The following papers were communicated:—The intersection of two conic sections: J. A. H. **Johnston.** The object of the paper is to determine the number (0, 2, or 4) of the real intersections of two real conics by means of formulæ involving the invariants, or other concomitants of the system. The discrimination depends upon the signs of the coefficients of a certain cubic equation, one root of which can be interpreted, when all the intersections are real, as the area of the quadrilateral formed by them. It is shown that one of the conditions of reality obtained by previous writers admits of very great simplification.—On a system of conics yielding operators which annihilate a cubic, and its bearing on the reduction of the cubic to a sum of four cubes: H. G. **Dawson.**—Informal communications were made as follows:—High Pellian factorisations: Lieut.-Colonel A. **Cunningham.** A method was explained for constructing very large factorisable numbers of the form y^2+1 (with complete resolution into prime factors) from the Pellian equation $y^2-Dx^2=-1$. Examples were given, among them being a number of 78 digits, viz. $(2^{128}+3\cdot2^{42})^2+1$; this was shown to be expressible as $(2^{84}+1)(2^{86}+1)^2$, for which the resolution of the factors $2^{84}+1$ and $2^{86}+1$ had been obtained by Lucas.—The stability of a loaded column: Prof. A. E. H. **Love.** When the column can be treated as a "thin" rod, and the contraction of the longitudinal filaments is taken into account, the critical length is slightly greater than that obtained by the ordinary method, due to Euler, in which this contraction is neglected. The correction of the critical length is found to be $\frac{1}{4}\pi k$, where k is the radius of gyration of the cross-section of the column about an axis through its centroid at right angles to the plane of bending.

PARIS.

Academy of Sciences, May 15.—M. Troost in the chair.—The president announced the death of M. Potier, member of the section of physics.—The permeability of glass vessels: M. **Berthelot** (see p. 88).—The propagation of musical sounds in a tube of 3 metres diameter: J. **Violle** and Th. **Vautier.** Notes of low pitch carry much better than those of high pitch, the distance at which the sound ceases to be clearly a musical note being inversely as the square root of the number of vibrations, this result being in accord with the theoretical investigations of Lord Rayleigh. From a large number of observations the conclusion is drawn that the velocity of sounds of different pitch is the same to an accuracy of 1 part in 1000.—On the menthones and menthols obtained by the reduction of pulegone by the catalytic action of reduced nickel: A. **Haller** and C. **Martine.** Pulegomenthone was obtained when the nickel was maintained at 140° to 160° C.; its physical and chemical properties are given, and there is reason to suppose that the ketone obtained is a mixture of menthones, and further work is being carried out in this direction. By slightly modifying the conditions of the reduction an additional pair of hydrogen atoms is taken up, giving pulegomenthols, two of which, in addition to ordinary menthol, were isolated from the product of the reduction.—On the constitution, saccharification, and retrogradation of potato starch: L. **Maquenne** and Eug. **Roux.** Natural starch is regarded by the authors as a mixture of two substances, distinguished by the names amylocellulose and amylopectine, possessing different reactions towards iodine and malt extract.—The basic magnesium carbonates from the Santorin eruption of 1866: A. **Lacroix.** The structure of this mineral, the quantities of which were too small for quantitative analysis, agrees with that of the basic carbonate $4MgCO_3.Mg(OH)_2.4H_2O$. As this appears to be a new species, the name of giorgiosite is proposed for it.—On the lifting power of a motor-driven helix: **Prince of Monaco.**—M. Louis Henry was elected a correspondant for the section of chemistry in the place of Prof. Williamson.—On a photographic meridian telescope for determining right ascension: Jean **Mascart** and W. **Ebert.**—On the forces giving rise to conical trajectories: Cyparissos **Stéphanos.**—On the electrostatic rigidity of gases at high pressures: Ch. Eug. **Guye** and H. **Guye.** Measurements were made of the explosive potential in gases at varying pressures. The gases studied were nitrogen, air, oxygen, hydrogen, and carbon dioxide, the pressures varying from 2 to 65 metres of mercury. Up to 10 atmospheres, the explosive potential is a linear function of the pressure, but for higher pressures the ratio of explosive potential to pressure diminishes. The results were unaffected by the presence of a radium salt.—On the effects of Foucault currents and the hysteresis of iron on oscillatory sparks: G. A. **Hemsalech.** By means of a

photographic method it has been found that the effect of Foucault currents is to augment the frequency of the oscillations per second without influencing the number of oscillations in each discharge. Hysteresis destroys the oscillations and diminishes, more or less, the frequency. —A study of the radiographic power of an X-ray tube: S. **Turchini.** The radiographic effects, as measured by the action on a photographic plate, are found to follow the same laws as the radioscopic effects, and there is reason to suppose that the radiotherapeutic effects will follow similar laws as regards the relation between efficiency and the length of the equivalent spark.—On the conductivity of the gases from flames: Eugène **Bloch.** The ions contained in the gases given off from a flame, at the end of a time sufficiently long take a mobility of the order of 0·01 mm., and hence should be classed as large ions.—On the ionisation and coefficient of magnetisation of aqueous solutions: Georges **Meslin.**—The properties of pyrrhotine in the magnetic plane: Pierre **Weiss.**—On the causes of varieties of halation in photographic plates: A. **Guébhard.** —The triboluminescence of metallic compounds: D. **Gernez.** The luminous effect observed when certain crystals are broken is not, as has been supposed, essentially a property of organic compounds, and a list of seventy-four inorganic compounds is given in which this effect has been observed.—The properties of some anhydrous chlorides of metals of the rare earths: Camille **Matignon.** Details are given of the crystalline form, colour, density, melting points, heats of solution and formation of the chlorides of lanthanum, praseodymium, neodymium, and samarium. —On a reaction of rhodium: Piñerûa **Alvarez.** Chlorine, acting on an alkaline solution of a rhodium salt, gives a characteristic blue colour, due to the formation of sodium perrhodate.—The action of the metal ammoniums on alcohols: a general method for the preparation of the alcoholates: E. **Chablay.** The alkali ammoniums, acting upon a solution of the anhydrous alcohol in ammonia, give a quantitative yield of the alcoholate.—Propionylcarbinol and its derivatives: André **Kling.**—Contribution to the study of the derivatives of benzodihydrofurfurane: A. **Guyot** and J. **Catel.**—On methæmoglobin: M. **Piettre** and A. **Vila.**—Researches on the mode of action of philocatalase: F. **Batelli** and Mlle. L. **Stern.** The name philocatalase is given to a ferment which is present in many animal tissues, although without direct action on catalase it possesses the property of protecting the catalase against the destructive action of anticatalase. The present paper deals with the mechanism of this reaction. —Researches on the comparative power of adhesion of different copper solutions employed as a remedy against mildew: E. **Chuard** and F. **Porchet.**—On a bacterial decay of cabbage: Georges **Delacroix.**—The classification and nomenclature of arable earths according to their mechanical constitution: H. **Lagatu.**—The termination of the motor nerves in the striated muscles of man: R. **Odier.**—On the problem of statical work: Ernest **Solvay.** —On the overlapping strata in the Piedmont zone: Maurice **Lugeon** and Émile **Argand.**—On an extraordinary halo: M. **Pernter.**

DIARY OF SOCIETIES.

THURSDAY, MAY 25.

ROYAL SOCIETY, at 4.30.—Croonian Lecture, "The Globulins": W. B. Hardy, F.R.S.

ROYAL INSTITUTION, at 5.—Electro-magnetic Waves: Prof. J. A. Fleming, F.R.S.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—Wireless Telegraphy Measurements: W. Duddell and J. E. Taylor.

FRIDAY, MAY 26.

ROYAL INSTITUTION, at 9.—The Development of Spectro-chemistry: Prof. J. W. Brühl.

PHYSICAL SOCIETY (at the National Physical Laboratory), at 3.30.—The Specific Heat of Iron at High Temperatures: Dr. Harker.—The Measurement of Small Inductances: Mr. Campbell.—Two New Optical Benches: Mr. Selby.

SATURDAY, MAY 27.

ROYAL INSTITUTION, at 3.—The Evolution of the Kingship in Early Society: Dr. J. G. Frazer.

THURSDAY, JUNE 1.

ROYAL INSTITUTION, at 5.—Electro-magnetic Waves: Prof J. A. Fleming, F.R.S

INSTITUTION OF MINING ENGINEERS (in the Rooms of the Geological Society), at 11 A.M.—The Firing of Babcock Boilers with Coke-oven Gases: T. Y. Greener.—Compound Winding-engine at Lumpsey Mine: M. R. Kirby.—Note Supplementary to a Paper on the Electric Driving of Winding-gears: F. Hird.—Electric Winding-engines at the Exhibition of the North of France, Arras, Pas-de-Calais: Ed. Lozé.—The Education of Mining Engineers in the United States: Prof. Howard Eckfeldt.—An Outline of Mining Education in New Zealand: Prof. James Park.—Goaf-blasts in Mines in the Giridih Coal-field, Bengal, India: Thomas Adamson.

LINNEAN SOCIETY, at 8.

CHEMICAL SOCIETY, at 8.—(1) The Constituents of the Seeds of *Hydnocarpus Wightiana* and *Hydnocarpus Anthelmintica*. Isolation of a Homologue of Chaulmoogric Acid.—(2) The Constituents of the Seeds of *Gynocardia Odorata*: F. B. Power and M. Barrowcliff.—The Relation of Ammonium to the Alkali Metals. A Study of Ammonium Magnesium and Ammonium Zinc Sulphates and Selenates: A. E. H. Tutton.—Camphorylazoimide: M. O. Forster and H. E. Fierz.—Influence of Substitution on the Formation of Diazoamines and Aminoazo-compounds. Part III. Azo-derivatives of the Symmetrically Disubstituted Primary Metadiamines: G. T. Morgan and W. O. Wootton.—Diazo-derivatives of Mono-acylated Aromatic Para-diamines: G. T. Morgan and Miss F. M. G. Micklethwait.—The Significance of Optical Properties as Connoting Structure; Camphorquinone-hydrazones-oximes; a Contribution to the Chemistry of Nitrogen: H. E. Armstrong and W. Robertson.—Solubility as a Measure of the Change undergone by Isodynamic Hydrazones. (1) Camphorquinonephenylhydrazone. (2) Acetaldehydephenylhydrazone: W. Robertson.—The Design of Gas-regulators for Thermostats: T. M. Lowry.—The Constitution of Barbaloin. Part I.: H. A. D. Jowett and C. E. Potter.—Influence of Substitution on the Formation of Diazoamines and Aminoazo-compounds. Part IV. 5-Bromo-*as*(4)-Dimethyl-2: 4-diamine-toluene: G. T. Morgan and A. Clayton.—The Action of Hypobromous Acid on Piperazine: F. D. Chattaway and W. H. Lewis.—The Action of Magnesium Methyl Iodide on Pinene Nitroso-chloride: W. A. Tilden and J. A. Stokes.—Racemisation Phenomena during the Hydrolysis of Optically Active Menthyl and Bromyl Esters by Alkali: A. McKenzie, and H. B. Thompson.

FRIDAY, JUNE 2.

INSTITUTION OF MINING ENGINEERS (in the Rooms of the Geological Society), at 10.30 A.M.—The Conveyor-system for filling at the Coal-face, as practised in Great Britain and America: W. C. Blackett and R. G. Ware.—Underground Fires at the Greta Colliery, New South Wales: J. Jeffries.—The Geology of Chunies Poort, Transvaal: A. R. Sawyer.—Underground Horses at an Indian Colliery: T. Adamson.—Description of the Eimbeck Duplex Base-line Bar: W. Eimbeck.

SATURDAY, JUNE 3.

ROYAL INSTITUTION, at 3.—Exploration in the Philippines: A. H Savage Landor.

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