THURSDAY, JUNE 30, 1904.

MATHEMATICAL BOOKS.

(1) *An Introduction to the Study of Geometry.* By A. J. Pressland, M.A., F.R.S.E. Pp. 40. (London: Rivingtons, 1904.) Price 1*s*.

(2) *Elementary Geometry.* By Cecil Hawkins, M.A. Part i. Pp. viii+165. Part ii. Pp. 166–296. (London: Blackie and Son, Ltd., 1904.) Price 2*s*. each volume.

(3) *Geometry for Technical Students.* By E. H. Sprague, Assoc.M.Inst.C.E. Pp. viii+60. (London: Crosby Lockwood and Son, 1904.) Price 1*s*.

(4) *Graphs and Imaginaries.* By J. G. Hamilton, B.A., and F. Kettle, B.A. Pp. 42. (London: Edward Arnold, 1904.) Price 1*s*. 6*d*.

(5) *Five-figure Tables of Mathematical Functions.* By John Borthwick Dale, M.A. Pp. xvi+92. (London: Edward Arnold, 1903.) Price 3*s*. 6*d*. net.

(6) *Logarithms for Beginners.* By Charles N. Pickworth. Pp. 47. (London: Whittaker and Co., 1904.) Price 1*s*.

(7) *Calculating Tables.* By Dr. H. Zimmermann. Translated from the German by L. Descroiz. Pp. xxxi+204. (London: Asher and Co., 1904.) Price 6*s*. net.

(1) MR. Pressland adopts the heuristic method in this course of experimental geometry for beginners. The first exercises only require the use of a pencil and a graduated straight edge cut from ruled school paper. With these the boy draws triangles and quadrilaterals, bisects lines and erects perpendiculars. Symmetrical figures, such as the square, rhombus, kite, &c., are made by paper folding.

A ruler with two edges decimally subdivided into inches and centimetres is then introduced, together with two set squares and a protractor. Parallel and perpendicular lines are now readily drawn, and the work becomes quantitative, lengths, angles, and also areas being measured.

The pupil is next required to use compasses, and becomes acquainted with some properties of circles. Two or three pages are then given to proportion and graphic arithmetic. The book concludes with a set of examples in practical geometry, and a table of general properties of figures, only partially enunciated, and intended to be completed by the pupil himself from observation and discovery in the course of his experimental work.

The aim has been to train the hand and eye, to create interest, and to make the boy acquainted with the groundwork of the subject. Deductive geometry is not introduced, nor is there any attempt at a logical sequence. The author states that many features of his book are due to his experience as an inspector of schools in Canton Zürich. The course seems a good one within its limited sphere, but the experimental work might with advantage have been somewhat more extended and varied.

(2) In so far as the subject is dealt with, Mr. Hawkins's geometrical course is a very good one. It is confined to plane geometry, part i. relating to simple rectilineal figures and the circle, and part ii. dealing more particularly with areas, proportion, similar figures, and further properties of the circle. The author follows the reform movement, the propositions required for the Previous Examination under the new Cambridge syllabus being marked with an asterisk. A prominent feature of the work is the very large number of examples which are given, extending to upwards of 1500, of varied character, and affording ample choice for practice in experimental, practical, and theoretical work. The only thing lacking is a collection of the numerical answers. The examples are appended to the successive propositions, and in addition, at the end of each volume is a set of miscellaneous examples, carefully graduated, and covering the whole of the previous ground.

By omitting any reference to simple functions of angles, the author has deprived himself and his readers of a very instructive and fruitful field for examples in ratio and proportion, and of elementary calculations of right angled triangles; and the omission of solid geometry leaves the course incomplete. But the general scheme is well planned and developed, and the book cannot fail to give satisfaction to many readers.

(3) The plan of Mr. Sprague's book is based largely on experience gained by the author in the teaching of engineering students for the Chinese Government, and is intended more especially for those who take up geometry as part of their professional training as engineers.

The more important fundamental properties of plane figures, including the triangle and circle, and of simple geometrical solids are established by deductive methods, comprised in forty-eight propositions with corollaries, and accompanied by a few exercises, and the book concludes with fourteen problems in practical plane geometry.

In comparison with many recent manuals, this textbook seems to be deficient. It will not satisfy those who require a good theoretical course of elementary geometry, nor yet others who are more interested in the experimental and practical development of the subject, and the work is not likely to be generally adopted by any class of students.

(4) In graphing the parabola $y=ax^2+bx+c$, the object being to solve the quadratic equation $ax^2+bx+c=0$, the authors show that when the roots are unreal, say $\alpha \pm i\beta$, the points $\alpha \pm \beta$ lie on a second parabola. The latter is easily drawn, being the former turned into a new position, and α and β can then be measured. In like manner the coordinates of the imaginary points where an external line cuts a parabola are shown to be readily found by making use of the properties of a certain companion or "shadow" parabola.

The authors then give the "circle method" of solving a quadratic, and by means of a "shadow" circle extend the solution to the case of unreal roots. Further examples of shadow circles are given, applied to the imaginary points of intersection or contact of lines and circles. The constructions are curious and interesting, but of little or no value to young students, whose time should not be employed on them.

K

(5) Mr. Dale's tables have been compiled with the view of meeting the requirements of workers in physical science and applied mathematics, and exclude such functions as are of use only in navigation. They comprise tables of common and hyperbolic logarithms, of reciprocals, squares, cubes, square roots, and cube roots; natural and logarithmic functions of angles; elliptic, Bessel, gamma, exponential, and hyperbolic functions; zonal surface harmonics and some other tables.

The table of logarithms of numbers is modelled on the ordinary four-figure log tables now so largely employed. It has the same number of rows of figures, the mean differences for each row being given, and it occupies only three pages. From it the five-figure log. of any three-figure number can be read directly. For a four-figure number the tabulated difference would require to be added, and for a five-figure number an additional difference for the last figure must be added. In the early part of the table the mean differences vary so quickly as to be of no use for five-figure accuracy, and, indeed, here the fourth figure is scarcely trustworthy. In such cases the author ingeniously recommends the use of the table of anti-logs, in which at the corresponding region the differences vary slowly.

The tables of trigonometrical functions each take up four pages. Five-figure values are given for intervals of 3′ or 0°.05, and the mean differences for each row are given for 1′ and 2′.

Probably these five-figure tables of logarithms and functions of angles are not quite so convenient in use as the more lengthy five-figure tables provided with a thumb index. But occupying as they do only about one-tenth the space, the author has been able to include in a handy volume, at a moderate cost, tables of many transcendental functions which hitherto have not been very readily accessible, and they will be welcomed by the class of people for whom they are intended.

(6) Mr. Pickworth states that the object of his little book is to give a more detailed and practical explanation of the use of logarithms than is to be found in the text-books of algebra and trigonometry. The ordinary two-page tables of four-figure logarithms and anti-logarithms of numbers are given, and the detailed explanations are accompanied by exercises for practice, the answers to which are collected at the end. There is also a short table of the logarithms of some numbers which are of frequent occurrence in numerical work.

Students who are being taught practical mathematics at the present time, and who use a suitable modern text-book, will find in the latter all the information they need on the subject, without having recourse to a book like Mr. Pickworth's. The work seems specially adapted to meet the case of those who received their mathematical training at a time when logarithms were neglected or relegated to the higher branches, and who wish to be able to use this method of computation.

(7) In the preface the author of these tables expresses the opinion that the ordinary aids to arithmetical calculation, such as slide rules, tables of logarithms, &c., are not adapted for general use. Thus he states that logarithms are only understood by very few, that they involve considerable trouble in searching the pages, and that they are seldom employed except for trigonometrical work. However true this may be of Germany, it is scarcely applicable to this country at the present time, where, thanks largely to the influence of South Kensington, logarithms are being taught to large numbers of youths in the classes for practical mathematics, and four figure log tables are in very general use throughout the kingdom.

The author's plan of meeting the common want of the computator is to supply a large multiplication table, which covers 200 pages and goes up to 100 times 1000. That is, the product of any two numbers one of which contains not more than three digits, and the other not more than two, can be taken directly from the table. Running along the bottom of the pages is a table giving, for three-figure numbers ranging from 0·1 to 99·9, the square and square root, cube and cube root, reciprocal, logarithm, and the products $\pi n/2$ and $\pi n^2/4$. On the last two pages are several useful subsidiary tables. In the introductory pages the uses of the tables are fully explained and illustrated with examples, worked out. It is shown how to deal with numbers of more than three digits, and how to perform division, square and cube root, &c. One advantage in the use of these tables is that the calculations are readily adapted to any degree of accuracy that may best suit the particular case under consideration, and contracted methods of working are explained by means of which all superfluous figures may be omitted.

The book should prove very useful for many purposes, such as in mercantile calculations, the evaluation of convergent series, the compilation of tables, &c. Every care has been taken by both author and printer to make the tables thoroughly trustworthy, and to facilitate reference. They are printed in clear bold type, and the general arrangement is very attractive.

RECENT ENTOMOLOGICAL WORKS.

Monograph of the Coccidae of the British Isles. Vol. ii. By Robert Newstead. Pp. 270; pls. F., xxxv.–lxxv. (London: Ray Society, 1903.)

The Coccidae of Ceylon. By E. Ernest Green, F.E.S. Parts i.–iii. Pp. xliii+249; pls. i.–xciii. (London: Dulau and Co., 1896, 1899, 1904.)

New Zealand Neuroptera; a Popular Introduction to the Life-histories and Habits of May-Flies, Dragon-Flies, Caddis-Flies, and Allied Insects inhabiting New Zealand, including Notes on their Relation to Angling. By G. V. Hudson, F.E.S. Pp. ix+102; with eleven coloured plates. (London: West, Newman and Co., 1904.) Price 10*s.* 6*d.*

ENGLISH entomologists and horticulturists are to be congratulated on the completion of Mr. Newstead's important work, which furnishes us, for the first time, with a satisfactory account of the British species of one of the most destructive families of insects, the Coccidæ or scale insects. They are peculiarly destructive to trees and greenhouse plants,

though by no means exclusively attached to them, and are consequently very liable to be carried from one country to another. But it is rather startling to read in the preface,

"The number of species found within the British Isles is eighty-eight, with four varieties; of this total, fifty-one species and two varieties have been found living under glass, and have undoubtedly been introduced from other countries. A few of these aliens have, apparently, existed in this country as plant pests for more than half a century; while others have been introduced within the last fifteen years, and with the exception of a few species, have apparently come to stay, and add to the difficulties of plant-culture."

The males are small delicate insects, and the females are apterous, and are sometimes ornamented with elegant laminated appendages of wax, as in the species of Orthezia, which are not uncommon on grass, nettles, and other low plants. It must not be forgotten that although the Coccidæ include such destructive insects as the American blight and the San José scale, other species furnish us with some of the most useful products obtained from insects, such as cochineal, lac, &c. It remains to add that Mr. Newstead has given us a very full account of the transformations, habits, &c., of each of our British species, and that the plates are excellent.

There are few more useful, and at the same time few more injurious, families of insects than the Coccidæ, and also few which have been so much neglected by entomologists until within the last ten or fifteen years, though latterly they have been so much studied by good observers in most parts of the world that our knowledge on the subject has advanced by leaps and bounds. Thus, in 1891, only seven species of Coccidæ were recorded from Ceylon, but Mr. Green took up the study immediately afterwards, and in November, 1894, he was already able to enumerate not seven, but seventy-two distinct species which he had observed up to that date. In the preface to the present work, dated September, 1896, he says:—

"This large number will be almost doubled in the present work, . . . and when other parts of the island have been properly explored, it is probable that considerably over two hundred species will be recognised."

It is needless to say that such estimates usually prove to be very much below the mark. The three parts of Mr. Green's book already published include ninety-one species, belonging to three subfamilies out of eleven (Conchaspinæ, Diaspinæ, and Lecaniinæ, of which last only the genus Lecanium is at present monographed), and nine genera, besides preface, glossary of terms, introductory and supplementary chapters on habits, classification, remedial measures, &c. We are not told how many more parts will be required to complete the work, and it is possible that Mr. Green himself cannot at present decide, for there will no doubt be large additions required to the earlier portions. He appears to have done his work very completely and thoroughly, and the illustrations are excellent. Respecting these, Mr. Green writes:—

"The lithographic plates, reproduced from my own drawings, have been most carefully printed in colours by P. W. M. Trap, of Leiden."

We are pleased to see that Mr. Hudson is continuing his efforts to make the small, but highly interesting, insect fauna of New Zealand more widely known, and we hope he will continue to deal with other orders in succession. As in other groups of animals, the Neuroptera exhibit the usual characteristics of the fauna, a very small total number of species, a striking absence of most of the characteristic Australian groups, and the presence of a very few remarkable species peculiar to New Zealand. Among the latter we may mention the handsome dragon fly *Uropetala Carovei* (named by Adam White after the author of the "Story Without an End"), which superficially resembles our British *Cordulegaster annulatus*, Latr., but is larger.

Mr. Hudson describes the early stages of many of the species he notices, and figures several larvæ and pupæ in addition to the perfect insects. In an appendix he discusses the food of trout in New Zealand, founded on an examination of the contents (chiefly insects) of sixty trout stomachs. On the other hand, the larvæ of some of the larger Neuroptera may (like those of Dytiscus among the Coleoptera) be destructive to fish. Thus we read (p. 5), "The larva of *Stenoperla prasina*, Newm., might perhaps prove destructive to very young fish."

The Mallophaga and Psocidæ are not included in the present volume, and the Embiidæ and Panorpidæ are unrepresented in New Zealand. We have thought a comparison of the number of species of the families dealt with by Mr. Hudson, found in Britain and New Zealand respectively, might be interesting:—

Families	Britain	New Zealand
Termitidæ (White Ants)	0	3
Perlidæ (Stone Flies)	24	3
Odonata (Dragon Flies)	40	10
Ephemeridæ (May Flies)	37	13
Sialidæ (Alder Flies)	2	1
Hemerobiidæ (Lace-winged Flies) ...	48	8
Phryganeidæ (Caddis Flies)	136	24

W. F. K.

DARWINISM AND THE STATE.

La Concurrence sociale et les Devoirs sociaux. By J. L. de Lanessan. Pp. 308. (Paris: Félix Alcan, 1904.) Price 6 francs.

M. DE LANESSAN has added yet another to the many books that undertake to show the working of Darwinian principles among civilised races, and this, like so many other books dealing with the same subject, shows no real knowledge of Darwinism. The author is strongly anti-Darwinian, and maintains that the struggle for existence leads to degeneration in the labouring class, which finds itself over-matched in the struggle against an aristocracy or a plutocracy.

At the outset some clear definition is needed. What is meant by degeneracy? Apparently our author means the under-development of the individual through defective nourishment and unhealthy conditions generally. This is, no doubt, a great evil, but it is not racial degeneracy. Would M. de Lanessan deny that the physical strength of civilised peoples is maintained by the large amount of elimination that still goes on? (In England nearly 50 per cent. of the population die before the average age of marriage,

and so approximately that percentage is from the evolutionist's point of view, of no account.) The most thorough-going Darwinian would agree that a nation is weakened by class antagonism, just as a hive of bees would suffer if the workers were divided into two factions who were always thwarting one another. The struggle for existence often takes the form of a struggle between communities, not between individuals, and it scarcely needs to be said that one which is not distracted by disunion is stronger than one which is. Disunion within is a bad thing, but opposition from without may be a blessing. The constant presence of an enemy almost at the gates was the making of ancient Rome. M. de Lanessan owns that war, more than anything else, strengthens the bond of union among citizens and fosters the growth of patriotism. Indeed, without war national feeling would not have existed. Our author, after half admitting this, speaks of a supreme phase of evolution when there will be no distinction of races.

The second part of the book is more practical and more interesting. Anti-Darwinism disappears for a while, and we hear only of the duties of the State. Since unchecked competition, whether between classes or individuals, is disastrous, the State must limit and regulate it. The State must deal with questions of public health, inspect factories, and see that workmen are not exposed to unnecessary dangers and are compensated if injured. The State should see that distress is relieved. Old age pensions should be provided even for those who are too poor to contribute towards them themselves. But saving should be encouraged in every way, though our author owns that accumulations of capital lead men to choose the wrong women as wives. The State must make every effort to prevent war between capitalists and their employés. A long chapter is devoted to the progress of the race, no distinction being drawn between evolution and progress in civilisation. Mothers and their children must be better cared for. The length of the working day must be curtailed, since this would ennoble the lives of workmen, and so improve future generations. Education must be supplied gratis by the State, and should be of a practical kind, the subjects being such as will help a boy in after life. Science, not literature, is what is wanted. Finally, morality and religion come up for discussion. The State must instil moral principles and leave religion alone. Altogether the State has a great deal of work to do. F. W. H.

CHEMISTRY OF THE SUGARS.

Die Chemie der Zuckerarten. By Prof. E. O. von Lippmann. Dritte Auflage. Two vols. Pp. xxxiii+2003. (Brunswick: Vieweg und Sohn, 1904.) Price 30 marks.

THE appearance of a new edition of Prof. von Lippmann's well known treatise is of importance to all interested in the chemistry of the sugars. To workers in this field the book has long been indispensable and in daily use. The author is to be congratulated on the care and accuracy with which he has compiled the third edition. Since the appearance of the previous edition, in 1895, the work has almost doubled in size, owing to the very large amount of investigation which has been done in connection with the carbohydrates, especially on the physiological side. Two new chapters, dealing with formation in the plant and physiological behaviour of the sugars, have been appropriately introduced. The book preserves its former arrangement: under each sugar is given its occurrence, preparation, properties, estimation and a complete glossary of its derivatives, so that reference to any particular point is very easily made. Special chapters are devoted to constitution, configuration and synthesis and to the relationship between the physical constants of the various sugars. The book is clearly printed in large type and space formulæ are liberally used. The inclusion of investigations published early this year shows how completely the account has been brought up to date and reflects the greatest credit on author and printers alike.

It is easy, with the aid of such a work, to take stock of the progress made in sugar-chemistry during the last ten years, the second edition having been published shortly after Fischer's classic syntheses of the hexose sugars. To the eleven out of the possible sixteen aldohexoses, synthesised by this chemist, no new additions have been made, though the degradation methods of Wohl and Ruff have enabled us practically to complete the series of the inferior sugars—thus there are described two aldo- and one keto-trioses, four aldo- and one keto-tetroses and seven aldo- and four keto-pentoses, only one aldo-pentose, *l*-lyxose, remaining to be synthesised. But our shortcomings are also painfully evident. Although the series of the monosaccharides is almost complete but little progress has been made either in characterising or in determining the structure of the disaccharides; and from the synthesis of cane-sugar by purely chemical means we are seemingly as far off as ever. One natural biose—melibiose—however, does appear to have been obtained synthetically and the most recent work points to the possibility of synthesising biose sugars by means of enzymes, a process which must be closely allied to that taking place in nature. It is in this direction, in fact, that we have grounds to hope for the next great advance in our knowledge.

The relationship between configuration and susceptibility to the action of enzymes or to alcoholic ferments affords one of the most striking chapters in physiological chemistry. Thus the only fermentable sugars contain six carbon atoms—neither more nor less. The statement that glycerose syrup was fermentable has since been withdrawn and we believe also that the supposed fermentability of mannononose has been recognised as incorrect. Of the eleven known aldo-hexoses only three—glucose, mannose and galactose—and but one ketose—fructose—are fermentable. Not only do these fermentable hexoses occur naturally but three of them are so closely related that they possess a common enolic form; it is all the more remarkable that the closely related aldopentoses, arabinose and xylose, which are so abundant in nature, are not fermentable.

Regarding the work as a whole, it is beyond question that not only those interested in the carbohydrates but chemists generally owe Prof. Lippmann a great debt of gratitude for his labours. E. F. A.

OUR BOOK SHELF.

Religion and Science: Some Suggestions for the Study of the Relations Between Them. By P. N. Waggett, M.A. Pp. xii+174. (London: Longmans, Green and Co., 1904.) Price 2*s.* 6*d.* net.

IT is pleasant to find in a book which seeks to deal from the religious standpoint with the relations between religion and science, a full and candid recognition of the claims of natural knowledge. The author of the present volume, whose qualities would no doubt have carried him far had he chosen the field of scientific research for the exercise of his chief activity, has not forgotten his early training. We should not expect from Father Waggett, nor do we find, the least attempt to blink or to minimise the results of scientific investigation in any department of learning. "Religion," as he says, "can have no possible interest in believing what is not true"; nor, it may be added, can religion afford to ignore what *is* true, from whatever quarter the demonstration of truth may arrive.

The book is not to be taken as a manual of apologetics—in fact many of those to whom it is primarily addressed may be inclined to complain of the author for not coming to closer quarters with the outstanding questions between religion and science. Its object is rather to state the present position, to suggest the lines on which future discussion should proceed, and to indicate the most hopeful means of arriving at a satisfactory conclusion, whether in the realm of thought or conduct. This object is carried out temperately and fairly, and with no lack of appreciation of what is strong in the scientific and philosophical position.

The author speaks, with possibly undue modesty, of his own opinions on the "domestic" issues that divide biologists. Holding, as he does, that "natural selection remains scientifically the most probable and philosophically the most welcome account of the adaptations of animal and vegetable life," he is perhaps inclined to attach too much weight to the arguments that have been brought forward by various scientific authorities on the other side. We miss any explicit reference to the views of Baldwin, Osborn and Lloyd Morgan, which have an important bearing on the whole question of adaptation, and go far towards removing some of the difficulties inherent in the rigid view of heredity. More stress might also have been laid on the quantitative aspect of variation, which is now taking definite shape in the hands of Karl Pearson and other workers. The book, however, on the whole is well abreast of modern inquiry, and may be studied with advantage by many others besides the class of readers for whom it is chiefly intended. F. A. D.

The Thompson-Yates and Johnston Laboratories Report. Vol. v. (New Series). Part ii. December, 1903. (Published for the University Press of Liverpool by Longmans, Green and Co.) Price 12*s.* 6*d.*

THIS new volume of the "Thompson-Yates and Johnston Laboratories Reports" opens with obituary notices of the Rev. Stephen Yates, to whose munificence the Thompson-Yates Laboratories owe their foundation, and of Prof. Nocard. The preliminary report of the trypanosoma expedition to Senegambia of the Liverpool School of Tropical Medicine occupies two-thirds of the volume, the authors being Mr. Dutton and Dr. Todd, to whom praise is due for the careful and detailed account of their journey and researches. (This has also been published as a separate report.) The laboratory methods of investigation are first described, and the results of the examination of a number of natives and of various animals for the presence of trypanosomata are then detailed. Only a small proportion of natives was found to be infected, and various experiments on the transmission and pathology of the trypanosoma are given at length. Horses were found to suffer from a fatal trypanosoma disease differing apparently in some respects from nagana. Trypanosomes were also detected in a number of birds, frogs, tortoise, mice, &c. The report is copiously illustrated, and forms an important contribution to the subject of trypanosomiasis, the appended bibliography being a very full one. Mr. Theobald adds notes on the species of mosquitoes collected in this expedition. Among these is a new species coming very near Stegomyia, for which a new genus is created, Catageiomyia. Prof. Ronald Ross contributes a brief article on a new human parasite, the Leishmann-Donovan body, which has already been referred to in these columns (NATURE, vol. lxix. p. 495). Messrs. Glynn and Matthews give some interesting details of the numbers of bacteria and their variation under different conditions in swimming baths, and Dr. Stephens and Prof. Boyce detail the examination of a diseased haddock, with description of a parasite the nature of which is not clear. The general "get-up" of the volume maintains the standard of its predecessors, paper, printing, and illustrations all being excellent.

R. T. HEWLETT.

L'Industrie de la Soude. By L. Guillet. Pp. 178. (Paris: Gauthier-Villars, n.d.) Price 3 francs.

THIS little book is a publication of the Encyclopédie Scientifique des Aide-Mémoire. It treats of the extraction of common salt, and the hydroxide and carbonates of sodium and of sodium peroxide, and within its compass it gives a fairly accurate account of the modern methods of manufacture of these articles. It is not obvious, however, for what class of readers the work is intended. It is too technical for ordinary people; indeed, most manuals of theoretical chemistry give quite as much information on these special subjects as is contained in this book. On the other hand, no technologist or person actually interested in the manufacture of these articles would rest satisfied with the extent and nature of the descriptive matter. There may, however, be persons to whom a book with a modicum of theory and a minimum of practice appeals.

Telephoto-Work. By G. H. Deller. Pp. 64. (London: Dawbarn and Ward, Ltd., 1904.) Price 1*s.* net.

THIS little book on telephoto work is one that will appeal to the numerous photographers who now keep a telephoto lens among their photographic equipment. The late author has described fully, illustrating his remarks with an excellent set of process reproductions, the many directions in which this lens may be successfully used, such as in landscape work, architecture, portraiture, and, finally, in short exposure work. Two other useful chapters, by H. Wild and H. M. Hames, deal respectively with the advantages of the "Adon" lens, and with an inexpensive means of practically learning the elements of telephotography by means of a home-made lens.

Buy English Acres. By C. F. Dowsett. Pp. 224. (Published by the Author, Winklebury, Basingstoke.) Price 3*s.* 6*d.* net.

THIS is not a book in the ordinary sense. It is a collection of miscellaneous arguments, extracts from books, and biographical notes, all intended to prove that pleasure and profit may be derived from the purchase of English land. The absence of any attempt at coherence or sustained economic discussion is atoned for, so far as possible, by the author's great earnestness. Apart from that, the book has no serious qualities.

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.]*

Variation of Atmospheric Absorption.

REFERRING to a communication from me in NATURE of November 5, 1903 (vol. lxix. p. 5), to the effect that a definitely less amount of heat had been received at the earth's surface in the last years than in preceding ones, I would ask attention to an article published in June in the *Astrophysical Journal*, in which I have further indicated that the diminution of the heat received in 1903 may well have been due not only to an increased absorption in our own atmosphere, but in part to a real change in the solar emission, connected with a diminished transmissibility of the solar envelope.

Still more recently I have made further experiments, as yet unpublished, on changes in the transmissibility of the solar atmosphere. These experiments, made by the study of homogeneous rays from a large solar image formed by a horizontal telescope of 140 feet focus, are independent of changes in the earth's atmosphere, and have indicated that the absorption in the solar envelope has decreased within the last six months.

In agreement with this, independent computations of the total solar radiation through our own atmosphere (and so far less trustworthy than those just mentioned) tend to show that the radiation of the sun has somewhat increased during the same interval. I desire not to be understood as stating that these recent changes have undoubtedly occurred, but I feel that there is increasing probability of the confirmation of this result.

There is no novelty in the suggestion that there may be an increase or diminution of solar heat and light due to various causes, and since my earliest statement of the absorption of the solar atmosphere, in the *Comptes rendus* of the Paris Academy of Sciences for March 22, March 29, and September 6, 1875, the subject has, in fact, engaged my continued attention.

What I wish to remark now is that it is only in comparatively recent years that the gradual perfection of the bolometer and other apparatus is providing specific data which render it likely that such changes are now coming within our means of direct recognition.

In sum, the result of the most recent spectrobolometric observations is an increasing probability that the solar radiation itself varies in a degree appreciable to our present means of daily observation, and a strengthening of the belief I have elsewhere expressed that it probably varied through much larger ranges in the past, and may do so again in the future

It will be seen that I do not venture yet to assert without restriction conclusions like these, which, so far as they may be shown to be true, are not merely of abstract interest, but which in a utilitarian sense may be said to be of far-reaching concern; yet I think it time to ask more general attention to them. S. P. LANGLEY.

Smithsonian Astrophysical Observatory, June 20.

Use of Radium in Section Cutting.

EVERYONE who has to cut microtome-sections of material embedded in paraffin-wax is frequently troubled by the electrification of the sections. The electrification causes the sections to adhere to the microtome-knife and to fold on themselves instead of being pushed easily across the blade of the knife so as to form a smooth ribbon. The adhesion to the knife also renders the transference to the microslip difficult, and often leads to the breaking up of sections and consequent loss of continuity in the seriation. Further, even when successfully detached from the knife, the electrified sections are apt to fly about in such an erratic way that it is often a matter of difficulty to arrange them in an orderly manner on the slip.

These undesirable phenomena may be completely avoided by fixing a 5 mg. tube of radium bromide on the microtome-knife close to where the paraffin ribbon is forming. Apparently the radiations from the radium discharge the electrification of the paraffin sections by ionising the air in their neighbourhood. HENRY H. DIXON.

Botanical Laboratory, Trinity College, Dublin.

The Blondlot *n*-Rays.

THERE is reason to think that M. Blondlot has rendered very valuable service to science by directing the attention of physicists to the remarkable, if not altogether mysterious, class of phenomena with which he has recently had to deal.

There can be no doubt that the phenomena, strange as they may seem to be, which he and his colleagues have observed, whether appearances or realities, or, should I say, subjective or objective effects, still leave something that remains unexplained. Psycho-physiological phenomena are not the less interesting because they happen not to be *physical effects* as ordinarily understood, and if they can lead scores of trained physicists astray, they should be regarded as all the more important.

For one, I am unhappy in that I cannot merely not see the effects, but neither have I been fortunate enough to meet with anybody who, on severe cross-examination in the dark, did not satisfy me that the variations in brightness which he had observed were altogether subjective, and the result of imagination or fatigue, for expectation counts for a great deal in these observations, and concentration of attention for still more.

The one thing that seemed conclusive about these rays was that they produced so great an increase in the brightness of a small spark that the effect could be photographed, and M. Blondlot has himself shown us photographs which it would appear show unmistakably this result.

I have followed in his footsteps as closely as I could, but unfortunately have not obtained any difference in the photographic effects which could not be attributed to a spurious cause. In M. Blondlot's experiment there is no proof that the diminished brightness of the spark, when a lead screen is interposed, is not due to the presence of the metallic screen itself, which is so close to the spark that it would damp the oscillations of the spark and affect its photographic effect. I have preferred to put out the source of *n*-rays altogether, and to wait for some time, ten minutes or so, or to place a lead screen at a considerable distance from the spark.

I have used a spark of about 1/10th mm. between two brass spheres, each of about 1 cm. radius. The effect on a photographic plate 2 cm. away is that of a luminous band the edges of which are close to the spark, practically straight lines, and at a greater distance curve round, being branches of two hyperbolæ.

A change in the brightness of the spark is accompanied by a broadening of the band, and a change in the intensity of the diffuseness of the plate. The breadth of the band depends upon the exposure, and conversely upon the brightness of the spark. Except when there were errors in the adjustment of the apparatus, the two photographs taken on the same plate indicated the same brightness.

It is interesting to note in connection with this point that M. Jean Becquerel maintains that the alleged change in brightness of a phosphorescent screen is really due to an effect on the retina due to the *n*-rays which are reflected by the luminous body. This explanation, however, will not fit in with M. Blondlot's photographic effects, as these rays are not supposed to produce any direct photographic effects. But M. Becquerel's conclusion confirms my result that the *n*-rays, if there be any such, do not really intensify the brightness of a luminous body, even if this be the property by which they were supposed to have been discovered. JOHN BUTLER BURKE.

Cavendish Laboratory, June 21.

ABORIGINAL AMERICAN BASKETRY.[1]

THE attention of our readers has several times been directed to papers and memoirs by American students on aboriginal American basketry; some authors, like L. Farrand ("Basketry Designs of the Salish Indians," *Mem.* Am. Mus. Nat. Hist., ii., 5), G. T. Emmons ("The Basketry of the Tlingit," *l.c.* iii., 2), R. B. Dixon ("Basketry Designs of the Maidu Indians of California," *Am. Anthrop.*, June, 1900; "Basketry Designs of the Indians of Northern California," *Bull.* Am. Mus. Nat. Hist., xvii.), and a few others have studied the designs plaited in baskets, and have discovered their symbolism. W. H. Holmes ("A Study of the Textile Art in its Relation to the Development of Form and Ornament," Sixth Ann. Rept. Bureau Ethnol.) was one of the first to direct attention to the effect of the technique on the ornamentation of baskets, while the technique itself of basketry has persistently been studied by Dr. Otis T. Mason, and now he has increased the indebtedness of ethnologists to his labours by the publication of a monograph which gives a much needed general survey of aboriginal basketry in America.

As is usual in publications coming from the United States, this work is lavishly illustrated, there being 212 figures in the text and 248 beautiful plates, several of which are coloured. The memoir deals with basket

FIG. 1.—Pomo Basket-maker.

making (including a valuable section by F. V. Coville on the plants used in basketry), ornamentation and symbolism, uses of basketry, and ethnic varieties of baskets. The last section is the most valuable, as it enables us for the first time to make a comprehensive survey of this beautiful industry as practised by the aborigines of North America, for, despite its title, the basketry of Mexico and of Central and South America is only cursorily dealt with in this monograph.

Owing to differences of climate, rainfall, and other characteristics of environment, the materials for

FIG. 2.—Modified Forms on Basketry.

basketry vary greatly from region to region throughout America, and this in spite of all ethnic considerations. Again, the motives for the use of basketry differ from place to place, so much so that peoples of one blood make one ware in this place and another in that. Finally, however, writes Dr. Mason, it must never be forgotten that the ideas, utilitarian and artistic, in the minds of the manufacturers themselves, serve to bestow special marks upon the work of different tribes, so as to give to them ethnic or national significance in any circumstances. Were there no mixture of tribes it might be possible to state in every case the maker of each specimen from the technique and the ornamentation; but throughout the entire continent the practice of capturing women was common, and in each case the stolen ones carried to their homes the processes they had been familiar with in their native tribe, and, further, the materials for basketry were traded, as were probably the baskets themselves. New designs are occasionally introduced along with ancient patterns, as may be seen in Fig. 2, where dogs and horses are interspersed among pre-Columbian decoration; indeed, the influence of the white man is very rapidly modifying native American basketry; "in methods, forms and colours truly old things have passed away, and, behold, all things have become new."

A. C. H.

[1] "Aboriginal American Basketry: Studies in a Textile Art without Machinery." By Otis Tufton Mason. Report of the Smithsonian Institution, 1902, U.S. National Museum (1904).

THE MINING STATISTICS OF THE WORLD.

ONE of the recommendations of a Departmental Committee of 1894 was that the British mining industry should be compared with similar industries of other countries, and from that time Sir Clement Le Neve Foster compiled annually for the Home Office an invaluable collection of comparative mineral statistics. Every year the report showed improvement, and every year the difficulties arising from want of adequate official statistics were more nearly obviated. While the present report was in preparation Sir

Clement Le Neve Foster died, and it has therefore not had the advantage of his exceptional technical knowledge, literary skill, and critical acumen in its final revision. His loss to the Home Office is a serious one, and it will be difficult to find an editor with his wide acquaintance with foreign mining literature to fill his place.

The information given in the report deals with the number of persons employed, the quantity and value of minerals produced, and the loss of life from accidents in mines and quarries throughout the world. The statistics given in this concise, intelligible and inexpensive form are of the greatest importance from a commercial point of view. In the United Kingdom alone the value of the minerals produced in 1902, the year under review, was 107,104,884*l.*, and the vast sums representing British capital invested in mines in all parts of the world will be readily appreciated. Some indication of the growth of the mining industry during recent years is indicated by the following comparison of the world's output of metals in 1889 and in 1902 :—

	1889 Metric tons	1902 Metric tons
Iron	26,000,000 ...	42,669,000
Gold	182 ...	447
Silver	3,900 ...	4,753
Copper	266,000 ...	572,000
Lead	549,000 ...	803,000
Zinc	335,000 ...	503,000
Tin	55,000 ...	93,000

In 1902 the world produced 803,157,000 tons of coal, 22,869,000 tons of petroleum, and 13,279,000 tons of salt. Of the coal supply, 34 per cent. was furnished by the United States, 29·5 per cent. by the United Kingdom, and 19·4 per cent. by Germany. Although the United States outstripped Great Britain in production, the value of the British product was 93,521,000*l.*, whilst that of the American was 75,373,000*l.*

As gold producers, the British possessions take the first place, furnishing more than half the world's supply. Australia supplied 24 per cent., the Transvaal 12 per cent., and Canada 7 per cent. of the total. The United States contributed 27 per cent. The value of the total production exceeds 60,000,000*l.* Nearly one-fourth of the world's salt and three-fifths of the tin are produced by the British Empire. On the other hand, the production of copper, lead, petroleum, silver, and zinc is small in comparison with the world's output. Of copper, the United States, with the enormous output of 299,000 tons, produce more than half the copper of the world, and Spain and Portugal together about one-tenth. The United States also produce most lead, 30 per cent. of the world's total, Spain and Germany following. Russia and the United States are the two great petroleum producers. In the British Empire, Canada and Burma are the only oil regions, and their production is comparatively small. Of silver, the United States again are the largest producers, followed closely by Mexico. The German Empire, with its rich Silesian mines, is the leading zinc-producing country, furnishing one-third of the world's supply. The United States take second place in the list. Of other valuable minerals raised in 1902, diamonds to the value of 4,950,000*l.* were produced in Cape Colony. Italy has no equal for its sulphur (value 1,706,000*l.*), Chili for its nitrate of soda (value 9,500,000*l.*), Germany for its potassium salts (value 2,000,000*l.*), Spain for its mercury (value 173,000*l.*), and the United States for their phosphates (value 1,000,000*l.*).

Any strictly accurate comparison between the number of persons employed in the mining industries of the various countries is impossible. The figures collected are, however, sufficient to give a general idea of the relative importance of mining in each country. The total number of persons engaged in mining and quarrying throughout the world may be taken at 4,500,000, of whom one-fifth are employed in the United Kingdom and one-third in the British Empire. More than half the total number were employed in mining coal, Great Britain employing 750,000, the United States and Germany each 500,000, France 165,000, Belgium 135,000, Austria 123,000, and India 100,000.

The accident statistics are not so complete as might be wished. For coal mines, the figures show that the death rate from accidents in mines and quarries per 1000 persons employed is 1·24 in the United Kingdom, 1·46 in the British Empire, 1·09 in France, 1·93 in Germany, and 3·25 in the United States. The death rate for foreign countries generally is 2·20. It is evident that mining is conducted in Great Britain with a far smaller risk of accident to the workers than in most other countries.

The first part of the general report on mines and quarries for 1903 has also been issued. It contains statistics of the number of persons employed, the output of minerals, and the number of accidents in the United Kingdom. The British production in 1903 included 230,334,469 tons of coal, 16,198,021 tons of clays and shale, and 13,715,645 tons of iron ore.

B. H. B.

NOTES.

IN the long list of birthday honours published on Friday last, we notice that Mr. Charles Booth, F.R.S., has been made a Privy Councillor; and that the honour of knighthood has been conferred upon Prof. J. Dewar, F.R.S., and Dr. T. Stevenson, scientific analyst to the Home Office. The Colonial Office list includes the name of Prof. W. Baldwin Spencer, F.R.S., who has been appointed a Companion of the Order of Saint Michael and Saint George (C.M.G.).

H.R.H. PRINCESS HENRY OF BATTENBERG will privately inaugurate the annual exhibition of the Beni Hasan excavations committee at the rooms of the Society of Antiquaries in Burlington House. The exhibits include the antiquities discovered at Beni Hasan and Negada by Mr. John Garstang, reader in Egyptian archæology in the University of Liverpool, and paintings by Mr. Harold Jones, artist to the expedition. The exhibition will be open from July 8–23 inclusive.

THE French Society of Civil Engineers has this year awarded its prizes as follows :—the annual prize to M. J. Bernard for his work on the installation in the Red Sea of three lighthouses in circumstances of especial difficulty. The Michel Alcan prize was awarded to M. L. Guillet for his researches on the composition of steel, and the F. Coignet prize went to M. V. Picou for his work on the regulation of dynamos. A prize was awarded to Prof. E. Hospitalier for his works on the study of phenomena which by their rapidity and frequency baffle ordinary methods of analysis.

H.R.H. THE PRINCE OF WALES has consented to become patron of the Royal Meteorological Society.

THE twenty-second congress of the Sanitary Institute will be held in Glasgow from July 25–30, under the presidency of Lord Blythswood. Sir Richard Douglas Powell, Bart., K.C.V.O., will deliver the lecture to the congress on "The Prevention of Consumption." It appears from the programme that 250 authorities, including several county

councils and county boroughs, have already appointed delegates to the congress, and as there are more than 3300 members and associates in the institute, there will probably be a large attendance in addition to the local members. In connection with the congress, a health exhibition of apparatus and appliances relating to health and domestic use will be held as practical illustration of the application and carrying out of the principles and methods discussed at the meetings. Popular lectures will be given in the exhibition on physical development, by Dr. P. Boobbyer; care of eyesight, by Dr. James Kerr; care of the teeth, by Mr. G. Cunningham; feeding and digestion, by Prof. A. Bostock Hill; and healthy houses, by Prof. H. R. Kenwood. The sections and their presidents are:—(1) Sanitary science and preventive medicine, Prof. J. Glaister; (2) engineering and architecture, Prof. H. Robinson; (3) physics, chemistry, and biology, Prof. Frank Clowes. There will be eight special conferences, the subjects and presidents of which will be as follows:—Municipal representatives, Mr. W. F. Anderson; industrial hygiene, Mr. J. Steele; medical officers of health, Sir C. A. Cameron, C.B.; engineers and surveyors to county and other sanitary authorities, Mr. W. Weaver; veterinary inspectors, Prof. James McCall; sanitary inspectors, Mr. T. F. Strutt; women on hygiene, the Duchess of Montrose; the hygiene of school life, Prof. John Edgar.

THE death is announced of Lieut.-General Dubrovin, who was for a long time secretary of the Imperial Academy of Sciences at St. Petersburg.

PROF. W. KAUFMANN, of Bonn, has been awarded the Von Baumgartner prize of the Vienna Academy.

PROF. VAN 'T HOFF has been appointed honorary director of the medical faculty of Utrecht, and the newly erected chemical laboratory there has been named the Van 't Hoff Laboratory in his honour.

THE Imperial Academy of Sciences of Vienna announces the following grants:—To the Vienna Society for Solar Observation, 1600 krone for observations on climatic changes in the Goldberg glacier, and to Prof. Ritter Beck von Managetta (Prague) 600 krone for studies of plant distribution in the Julian Alps. From the Wedl bequest, to Drs. Obermayer and Pick (Vienna) 600 krone for the chemistry of immune substances, to Dr. Moritz Probst 800 krone for continuation of work on the brain, to Dr. Karl Camillo Schneider 400 krone for a zoological expedition to Grado, to Prof. Julius Tandler 1000 krone for studies in the development of birds. The committee of the Treitel legacy awards the following grants:—To Prof. Hans Skraup (Graz) 1500 krone for studies on albumens, to Dr. Franz Werner 6000 krone for a zoological expedition to the Egyptian Soudan, to Prof. Julius Wiesner 4000 krone for effects of light on plant life in the Yellowstone district, to the Austrian Meteorological Society 4000 krone for investigations of the upper atmosphere, and to the Earthquake Commission 5465 krone 39 heller.

THAT the depopulation of rural districts is a social problem of the times in France no less than in this country is evident from the report presented by Dr. A. F. Plicque to the *Bulletin de la Société d'Encouragement* for April. The author makes a special study of the conditions prevailing in the canton of Donnemarie-en-Montois (Seine et Marne). This canton is situated in the midst of a fertile agricultural district possessing an excellent climate, and within moderate distance of Paris, and from 1869 to 1891 there was a falling off in the population of from 9764 to 7683 inhabitants. It is also noteworthy that an inquiry in 1893 in the same district showed that 63 per cent. of the farm labour was imported from outside, and that without this imported labour agriculture in this fertile region would come to a standstill. The author traces the causes of the depopulation to ignorance of sanitary precautions leading to a high rate of infant mortality, emigration of young people to towns, effects of conscription, alcoholism, &c., and he considers the remedy to consist in improvements in primary and technical education, which should, in his opinion, "not merely give the child verbal forms, devoid of ideas, which he cannot understand, but should give children of rural communities an instruction suited to the surroundings in which they ought to live, and should develop, from their earliest years, a taste for agriculture." M. Plicque instances the success of this method in Belgium. In other words, the successful and contented ploughboy should not be encouraged to leave his plough in order to become an unsuccessful and discontented teacher.

WOULD life be possible if the nitrogen of the atmosphere were replaced by hydrogen? This is a question discussed by Regnault and Reiset, who gave an affirmative answer in their well known treatise on respiration. A fresh investigation of the question is now given by Dr. Arturo Marcacci in the Lombardy *Rendiconti*, xxxvii., 9, whose experiments were conducted at Palermo. The author found that animals introduced into such an atmosphere soon died, the symptoms all indicating that the death was due to cold, caused by the high thermal conductivity of the hydrogen. Another phenomenon was the marked increase in the absorption of oxygen and evolution of carbonic anhydride.

IN 1902 the *Zeitschrift für Krystallographie und Mineralogie*, founded by Prof. P. Groth, completed the twenty-fifth year of its publication. Many mineralogists in various countries felt the occasion provided a fitting opportunity to commemorate the services rendered to mineralogy and crystallography by Prof. Groth by initiating and editing that journal. Profs. M. H. N. Story-Maskelyne, W. J. Lewis, H. A. Miers, and Mr. L. Fletcher formed themselves into a committee, and in response to an appeal a sufficient sum of money was obtained to secure the services of Prof. E. Grützner, of Munich, to paint a portrait of Prof. Groth. The picture was formally presented to Prof. Groth on April 30 last, and was accompanied by a letter from Prof. Story-Maskelyne expressing the appreciation of Prof. Groth's work on the part of the subscribers. A photogravure of the portrait, executed by Dr. E. Albert and Co., of Munich, and a statement of receipts and expenses, will be forwarded shortly to each subscriber to the testimonial.

A NEW scheme for a North Polar expedition was described by M. Charles Bénard at a meeting of about fifty men of science held in the house of the Prince of Monaco, in Paris, on June 19. According to the Paris correspondent of the *Times*, M. Bénard explained at length why the only feasible and rational route of penetration of the Polar Sea was one a little north of that followed by the *Fram*. The expedition ought to start from a Norwegian port, cross the southern portion of Barents Sea, take in dogs at Karabora, coast along Yalmal, ship its coal at Port Dickson, transported thither by special steamer, pass at the end of the summer along the Peninsula of Taimyr, arrive by the end of the autumn at the islands of New Siberia, and then, instead of going northward, as did the *Fram*, manage at all costs, even if it be necessary to winter in the Liakhoff or Bennett Islands, to reach a point on the 150th degree of east longitude. Thence the ship or ships need only drift with the

ice. M. Bénard urges the utility of having the expedition composed of two vessels in touch with each other by means of wireless telegraphy. The expedition should take three years, but be provisioned for five. It would not cost more than 1,500,000 francs (60,000*l*.). The assembled company signed a memorandum declaring this expedition to be of scientific utility.

AT a recent meeting of the Royal Photographic Society, Mr. Conrad Beck described the unofocal (or unifocal) photographic objective which has been worked out by Dr. Steinheil, of Munich. The principle of the new construction consists in the employment of positive and negative lenses all of which have the same focal length and the same mean index of refraction, thus overcoming the difficulty of satisfying the "Petzval condition." A positive focus is obtained by separating the positive and negative elements. An example with a maximum aperture of *f*/4·5 appears at first sight like a symmetrical triplet consisting of three single lenses, with the central negative lens divided to allow space for the diaphragm. But the inner faces of the two negative lenses are concave to each other. In the series with an aperture of *f*/6, there is a greater space between the negative elements, each of which is much nearer to the outer positive component that it is more immediately associated with. Mr. Beck stated that even the *f*/4·5 lens gives telescopic central definition, perfect freedom from distortion and flare, and a flat field of 60° well corrected for astigmatism. An incidental advantage of the construction is that it gives a more even illumination, as oblique beams are transmitted more fully than when the elements of the combinations are in contact.

THE Paris correspondent of the *Times* states that M. Henri de la Vaulx is now completing his preparations for a third Mediterranean cruise in a specially constructed balloon, some particulars of which were given at Monday's sitting of the Academy of Sciences. M. de la Vaulx will employ a 20-horse power engine of the automobile type, attached to the car, which will work an aluminium screw seven metres in diameter.

A CORRESPONDENT informs us that the optical illusion mentioned in NATURE of June 2 (p. 107) is described in the *Proceedings* of the Royal Society of Edinburgh (vol. x., 1878–9). In the experiments described in that paper circular rotating discs, and also travelling bands of paper, were used for exciting the eye, and it is shown that whatever the nature of the motion impressed on the eye, the surface afterwards looked at appears to move in the opposite direction. If a rapidly flowing stream, for instance, be looked at steadily for a time, and the eye afterwards directed to the bank, part of the bank will seem to flow through the middle of the field of view. The image of the part of the bank that falls on the part of the retina affected by the image of the moving water seems to flow slowly in a direction contrary to that of the stream, causing that part of the solid earth to appear as if it had become plastic.

WE have received from M. A. Lancaster the *Annuaire Météorologique* of the Royal Observatory of Belgium for 1904. For sixty-eight years the observatory published annals devoted to astronomy and meteorology combined, but since 1901 each science has been dealt with separately. The work consists of some 660 pages, and, in addition to monthly and seasonal meteorological data for various places, contains some valuable papers by M. Lancaster and others connected with the service, including the motions of cirrus clouds, and the dispersion of hail clouds, by M. Vanderlinden. The latter subject is still a controversial matter, and although the results hitherto attained by shooting and other methods are not generally considered satisfactory, the experiments are likely to be continued for some years.

THE *Transactions* of the South African Philosophical Society (vol. xv., part i.) contain an important paper by Mr. J. R. Sutton on South African rainfall, being the fifth of a valuable series of studies on meteorological subjects which have appeared in the same publication. The tables exhibit the daily and monthly rainfall at Kimberley recorded by Mr. F. W. Matthews between 1877 and 1902, together with the diurnal variation and other useful details; also the monthly and annual rainfall at a large number of selected stations. The values relating to Kimberley have been discussed statistically and by the process of harmonic analysis. The yearly falls from Mr. Matthews's series vary from 9·34 inches in 1878 to 31·30 inches in 1891. The greatest average annual fall occurs at Maclear's Beacon, on Table Mountain (86·81 inches), and the least at Port Nolloth (2·46 inches). Speaking of the Kimberley values, Mr. Sutton states that March is the wettest and July the driest month, the increase or decrease from one to the other being gradual. Referring to South African rainfall generally, outside the Cape Peninsula and west coast, the author concludes that rainfall decreases on the whole with distance from the coast, and that it occurs with a high barometric pressure at Durban and a low pressure at Kimberley; it comes chiefly with south-westerly winds at the former station and with north-easterly winds at the latter. The principal barometric disturbances come from the south.

A SMALL brochure, in which Mr. G. M. Woodrow treats of the cultivation and varieties of the mango, "the choicest fruit of Hindustan," has been published by Mr. Alexander Gardner, of Paisley, and can be obtained from the office of the *Gardener's Chronicle* and certain agents in India.

IN the matter of floral variation, several of the violets offer an attractive field of study, and a paper by Mr. C. E. Britton dealing with floral variations among Surrey violets will be found in the *Journal of Botany* (May). The most important aberrations occur in the corolla, where, in the case of *Viola hirta*, all stages, from the normal single-spurred petal to the symmetrical condition of five-spurred petals, were observed. The condition of regular symmetry in the case of *Viola Riviniana* appears to be produced by the suppression of the spur, but the petals are all slightly pouched at the base.

THE principal historical events and appointments connected with the Royal Botanic Gardens, Ceylon, are summarised by Mr. J. C. Willis in No. 10, vol. ii., of the *Agricultural Journal*. The expansion of the gardens has not only included the formation of five branch institutions situated in different climatic regions of the island, but during the term of office of the present director the scientific staff has been increased by the appointment of several specialists. Although the introduction and investigation of plants of economic value have been carried out in Ceylon since the institution of the gardens in 1860, there has been a gradual change in the scope of the work, and systematic collection and identification have given place to physiological research and experimental cultivation.

THE skull of the dinosaur *Triceratops serratus* is described by Dr. R. S. Lull (*Bull.* Amer. Mus. Nat. Hist., xix.). A figure of the palatal aspect shows the extreme length to be about 6 feet 4 inches.

IN the *Ottawa Naturalist* for May, Mr. L. M. Lambe describes the phalanges of the manus of *Ornithomimus altus*, which evidently had long and sharp claws. He considers that this dinosaur was capable of rapid motion in pursuit of prey, and had the power of tenaciously grasping with its fore limbs.

TO vol. xv., part ii., of the *Proceedings* of the Royal Physical Society of Edinburgh, Mr. N. Annandale communicates the first instalment of a series of papers on the zoology of the Færöes, dealing in this instance with the land and fresh-water molluscs, isopods, and insects, each group being treated by a specialist.

FROM the Field Columbian Museum we have received publications of the geological series, vol. ii. In No. 3 Dr. S. W. Williston gives a detailed description of the skeleton of the American pterosaur *Nyctosaurus gracilis*, which was formerly regarded as Pteranodon, and in No. 4 Mr. E. S. Riggs gives a description and restoration of the dinosaur Apatosaurus (formerly Brontosaurus). Mr. Riggs remarks that there is a striking similarity between his figure and the original restoration of the genus by Marsh. Later on Marsh, evidently dissatisfied with its proportions, inserted additional vertebræ and ribs, and otherwise modified the skeleton, almost to the extent now rectified by the evidence since acquired.

THE whole of the seven articles in the first part of vol. vi. of the *Bulletin* of the College of Agriculture at Tokyo University are from the pen of Prof. C. Sasaki, all but one dealing with insects of commercial value, more especially silk-producing moths. Special interest attaches to the description, illustrated with two coloured plates of the adult insect and larva, of native methods of rearing the fine Yamamai moth (*Antheroea yamamai*). Five of the other papers treat of various races of silkworms and different modes of feeding them, while the sixth is devoted to the life-history of the wax-producing coccid *Ericerus pela*. In the eighth and last paper the author describes a new field-mouse, under the name of *Arvicola hatenedzumi*, which appears to be the Japanese representative of *A.* (or *Microtus*) *subterraneus*.

A NUMBER of experiments have been carried out by Konradi on the duration of life of pathogenic bacteria in water (*Centr. f. Bakt.*, xxxvi., No. 2, p. 203). These show that the anthrax bacillus, the *Micrococcus pyogenes aureus*, and the typhoid bacillus may ultimately displace the ordinary bacterial forms of water and survive for a long period, anthrax for 3½ years, the *M. aureus* for as long as 545 days, and the typhoid bacillus for more than 500 days, their pathogenic properties still being retained.

PROF. LINGARD raises the question whether the *Piroplasma bigeminum*, the parasite of Texas fever of cattle, can find a habitat in the human subject (*Centr. f. Bakt.*, xxxvi., No. 2, p. 214). He describes a case in which a native cattle attendant staying near bovines, the subjects of Texas fever, developed an illness partly malarial, but partly, perhaps, due to infection with the Piroplasma, the special symptoms being continued remittent fever unaffected by quinine, hæmoglobinuria, and the presence in the blood of parasites similar to the Piroplasma.

PROF. GRINDLEY and Mr. Mojonnier, of the United States Department of Agriculture, have published the results of experiments on the losses occurring during the cooking of meat (*Bulletin* No. 141). The chief loss in weight during the boiling, sautéing, and panbroiling (cooking in frying pan without fat) of meats is due to removal of water. In the roasting of meats, the loss is due to both water and fat. When beef is cooked in water, 3·25–12·67 per cent. of nitrogenous matter, 0·6–37·4 per cent. of fat, and 20·0–67·4 per cent. of mineral matter of the uncooked meat are found in the broth. In roast meat the loss is much less, 0·25–4·5 per cent. of the nitrogenous matter, 4·5–57·5 per cent. of the fat, and 2·47–27·2 per cent. of the mineral matter being found in the dripping. As a rule, the larger the piece of meat cooked by boiling or roasting, the smaller is the relative loss. Panbroiling seems to be the mode of cooking that occasions the least loss. A statement which will cause surprise to some is that beef which has been used for the preparation of beef-tea or broth has lost comparatively little in nutritive value, though much of the flavouring material has been removed.

THE Geological Survey in Ireland has just issued a memoir on the geology of the country around Belfast, with a specially prepared one-inch map of the district colour-printed to show the various drift deposits and solid strata where these appear at the surface. On the margin of the map are engraved and coloured two longitudinal sections to explain the general structure of the country—a useful feature, which serves to render this excellent map more intelligible to the uninitiated. The memoir and map are the work of Messrs. G. W. Lamplugh, J. R. Kilroe, A. McHenry, H. J. Seymour, W. B. Wright, and H. B. Muff. The description of the older rocks, from the Ordovician (or Lower Silurian) series to the Tertiary basalts, is based largely on the previous work of the Survey, supplemented by the information published by private workers. The drifts, on which the field-staff was specially engaged, are very fully described, and in the explanation of their mode of origin reasons are given for rejecting the marine theory and for adopting the land-ice theory. There is much, however, of practical as well as of scientific interest in this volume; agricultural geology is especially dealt with, and there are notes on water supply, house sites, building materials, &c., records of deep borings, petrographical notes on the igneous rocks, and a bibliography.

IT may be said that the Austrian Empire covers a wide field; but its manifold activity in matters of geological research is none the less remarkable. Among recent memoirs received by us are two by Dr. W. Teisseyre on the north-eastern foreland of the Karpathians (*Verhandlungen der k.k. geol. Reichsanstalt*, 1903, pp. 289–308, and *Beiträge zur Paläontologie und Geologie Österreich-Ungarns*, Bd. xv., 1903, pp. 101–126). In these the author traces the influence of older movements, and of the resulting crust-blocks, on the present structure of the Podolian lands, and seeks to reconstruct the country as it was, firstly, at the time of the Cenomanian marine transgression, and, secondly, at the opening of the Miocene period. In so doing, he is led to regard an anticlinal mass in Podolia, upheaved in Upper Jurassic times, as a somewhat belated offshoot of the Triassic folds of the Sudetic. Dr. Tietze's report on the work done by the Geologische Reichsanstalt in 1903 (*Verhandlungen*, 1904, pp. 1–44) describes the distribution of the field-surveyors, and the visits undertaken to other lands. Among the papers issued under his energetic guidance in 1903, we note F. Kerner's description of the "Fenster," or pseudo-inliers, of the Mosor Planina, where little patches of Eocene Flysch appear in the floor of hollows excavated naturally through Cretaceous limestone. Other evidence is forthcoming to show that the latter series has been thrust over the former. W. Hammer

(*Verhandl.*, 1903, p. 345) contributes a valuable paper on pegmatites in the Ortler Alps, in which he opposes the still popular view that such veins have been formed by lateral segregation from the surrounding rocks. Dr. Romberg (p. 365) adds yet another paper to the discussion of the inter-relations of the Monzoni rocks, in which he tilts vigorously against Dr. Doelter and his associated champions.

A TENTH edition of Mr. A. Jamieson's "Elementary Manual on Steam and the Steam Engine" has been published by Messrs. Charles Griffin and Co., Ltd.

MARCONI'S Wireless Telegraph Company, Ltd., has published a catalogue dealing with Röntgen ray and high-frequency apparatus, instruments and accessories. The pamphlet, which is well illustrated, contains numerous useful hints as to the use of induction coils and the charging of batteries. Particulars as to the cost of instruments described are conveniently arranged, and the catalogue should be of service to workers in these branches of science.

WE have received a copy of the *Bulletin* for November, 1903, published by the Permanent International Council for the Exploration of the Sea, the contents of the first part of which were described in the issue of NATURE for June 9, p. 139. The present *Bulletin* is divided into four parts, dealing respectively with the following subjects:—the condition of the atmosphere and of the surface water; the temperature and salinity at various depths expressed in metres; the nitrogen, oxygen, and carbonic acid dissolved in sea-water; plankton tables for Finland, Sweden, Denmark, Germany, Holland, Belgium, England, Scotland, and Russia. Attached to the several parts are numerous charts showing the results arrived at by observers of different countries. The *Bulletin* may be procured from MM. Andr. Fred. Høst et Fils, of Copenhagen.

THE April number of the *American Journal of Psychology* contains a paper by Mr. C. Spearman entitled "'General Intelligence' Objectively Determined and Measured." By means of statistical methods of considerable refinement and elaboration, the writer claims to have proved that an absolute correspondence exists between the degree of general intelligence and general power of sensory discrimination, and that there is a variable correspondence between the latter and the more complicated intellectual activities of practical life. He believes in an underlying universal unity of the intellectual function, the psychical nature of which is to be discussed in a later paper.

THE second part of the first volume of the *British Journal of Psychology* was issued on June 10. It contains four papers and the proceedings of the Psychological Society. Dr. C. S. Myers writes on the taste-names of primitive peoples, and refers to the results of a few experiments he made with Dr. Seligmann in the islands of the Torres Straits. He found that the literal meaning of the phrase commonly used in the Torres Straits to denote sweetness is "tasting good"; that the same phrase is applicable to denote saltness, the usual word for which is derived from sea-water; the taste-names for salt and sour tend to be confused; and there is no specific name for the bitter taste. Precisely similar features are found when the taste-names of Indo-Germanic languages are examined. Dr. Myers extends his inquiry to other primitive peoples, and the results are given in his paper. Mr. W. H. Winch has a paper on immediate memory in school children. Prof. R. Latta contributes notes on a case of successful operation for congenital cataract in an adult, and Prof. W. McDougall deals with the variation of the intensity of visual sensation with the duration of the stimulus.

A VERY readable paper on radium, by Mr. E. P. Poulton, is contained in the March issue of the *Transactions* of the Oxford University Junior Scientific Club.

WE have received *Communications* No. 87 and No. 88 from the physical laboratory of the University of Leyden. In the first of these Dr. Kamerlingh Onnes describes the methyl chloride circulation used in the cryogenic laboratory, and in the second the results of the determination of the isothermals of mixtures of oxygen and carbon dioxide by Dr. W. H. Keesom are given.

IT is well known that the extension of the theory of the asymmetric carbon atom by Wislicenus to account for the isomeric relationships of ethylene derivatives is in many cases unable to explain observed experimental facts. In the current number of the *Zeitschrift für physikalische Chemie*, vol. xlviii. p. 40, Dr. Pfeiffer shows how it is possible to account for many of these observations by a modification of the van 't Hoff-Wislicenus theory. With this modification the formation of the *cis*- or *trans*-isomer can be predicted, whether the ethylene compound is obtained from an ethane or an acetylene compound.

THE Carnegie Institute of Washington has just issued a pamphlet (No. 7) containing an account of a new method for determining compressibility by Messrs. T. W. Richards and W. N. Stull. Bromine, iodine, carbon tetrachloride, chloroform, bromoform, water, and mercury have been examined. In the case of a substance like bromine, the liquid is hermetically enclosed in a very thin, flexible glass bulb, and subjected to compression under mercury, correction being made for the change in volume of the mercury and the glass. A new form of high pressure manometer is described the working of which depends upon the difference between the compressibility of water and mercury.

IN a recent experimental investigation by Dr. T. Wulf, published in the *Zeitschrift für physikalische Chemie* (vol. xlviii. p. 87), it is shown that the electromotive force at which hydrogen ions are liberated from solution, when determined galvanometrically, is quite independent of the pressure when this is varied between 0·01 and 800 atmospheres. On the other hand, the polarisation of the hydrogen electrode increases with the pressure, and this increase is in quantitative agreement with Helmholtz's formula. The experiments show very clearly that the passage of a current through the solution is not necessarily accompanied by the liberation of the gas in the form of bubbles.

THE question as to whether the so-called colloidal or pseudo-solutions are essentially different in character from ordinary solutions has been the subject of much discussion and experimental investigation of late years. By applying the optical method of Tyndall to solutions, Messrs. Lobry de Bruyn and Wolff, in the *Recueil des Travaux chimiques de Pays-Bas*, vol. xxiii. p. 218, arrive at the conclusion that there is no sharp line of demarcation between ordinary solutions and pseudo-solutions. Solutions of bodies of high molecular weight, such as tristearine and the hexabenzoyl derivatives of mannite and dulcite in methyl alcohol, chloroform and acetic ether, exhibit optical properties of the same nature as colloidal solutions. Light is reflected laterally from a beam incident on the solution, and this reflected light is polarised.

OUR ASTRONOMICAL COLUMN.

ASTRONOMICAL OCCURRENCES IN JULY:—

July 2. 11h. 7m. Minimum of Algol (β Persei).
6. 13h. Conjunction of Jupiter and Moon. Jupiter 1° 49′ N.
9. 13h. 24m. to 13h. 44m. Moon occults 71 Tauri (mag. 4·6).
,, 14h. 5m. to 14h. 58m. Moon occults θ^1 Tauri (mag. 3·9).
,, 14h. 12m. to 15h. 0m. Moon occults θ^2 Tauri (mag. 3·6)
,, 17h. 31m. to 18h. 24m. Moon occults α Tauri (mag. 1·1).
11. 11h. 34m. to 13h. 28m. Transit of Jupiter's Sat. III. (Ganymede).
15. Venus. Illuminated portion of disc = 0·999, of Mars = 0·995.
18. 15h. 41m. Transit (ingress) of Jupiter's Sat. III. (Ganymede).
25. 9h. 38m. Minimum of Algol (β Persei).
27. Ceres stationary 3½° S. of α Scorpii (Antares).
28. Saturn. Major axis outer ring = 43″·33. Minor axis = 10″·87.
28–30. Epoch of Aquarid meteoric shower (Radiant 339° − 11°).

SMITHSONIAN INSTITUTION 1900 ECLIPSE RESULTS.—No. 1439 of the *Publications* of the Smithsonian Institution is devoted to a splendidly illustrated account of the equipment and work of the expedition sent out by the Astrophysical Observatory, under the superintendence of Prof. Langley, to observe the total solar eclipse of May, 1900.

In chapter i. the director, who was aided throughout by Mr. C. G. Abbot, gives a concise account of the objects of, and the preparations for, the expedition. Chapter ii. describes the establishment of the eclipse camp at Wadesboro, North Carolina, on the same field as the Yerkes expedition under Prof. Hale.

The loan of a 12-inch lens of 135 feet focal length by Prof. Pickering made the photography of the inner corona one of the most important objects. In summarising the results in chapter iii., Prof. Langley notes, among other things, that large prominences were observed, and appeared to be associated with regions of coronal disturbance. Bolometric observations of the inner corona showed that the heating power of its radiations was unexpectedly small. The search for an intramercurial planet was made with a camera of 3 inches aperture and 11 feet focus, and several suspicious images appeared on the plate, but as there was no confirmatory second photograph the results were inconclusive. Prof. Langley recommends a similar instrument for future observers.

The twenty-two beautiful plates which accompany the report display photographs of the observers and their instruments as erected, the corona, and parts of the inner corona.

THE ORBIT OF THE COMPANION TO SIRIUS.—From a discussion of numerous observations of its position angle and distance, Herr O. Lohse, of Potsdam, has determined the following elements (for 1900·0) for the orbit of the small companion to Sirius:—

T = 1894·337 (1844·956)	Ω = 44°·12
U = 50·381	i = 39°·91
n = −7°·14559	ω = 212°·20
e = 0·598	a = 7″·427

A comparison of the observed places with those calculated from the elements, for various dates since 1862, shows that the elements are fairly correct, the mean error in position angle being generally less than 1°, and in distance less than 0″·2.

An ephemeris, for the years 1900–1912 inclusive, calculated from these elements, gives the position angle at the commencement of the present year as 116°·2, and the distance as 6″·6. Observations made at Yerkes on October 19 and 26, 1903, gave 115°·97, 6″·31, and 115°·06, 6″·33, as the respective position angles and distances for those dates (*Astronomische Nachrichten*, No. 3955).

OBSERVATIONS OF JUPITER DURING 1903.—The results of numerous observations of Jupiter which were made at Juvisy during 1903 are published and discussed by MM. Flammarion and Benoit in the *Bulletin de la Société astronomique de France* for June. From these observations, which agree with those of other observers, it appears that the northern equatorial band progressively diminished during 1903, appearing to condense towards the southern edge. The southern equatorial band appeared to be the centre of great activity, the great red spot forming a marked depression in the band, although not so sharply defined as in past years.

Several large bright spots appeared in the southern tropical zone, two of which, situated in longitudes 180° and 225° respectively, were remarkable. In the southern temperate zone several small white spots were observed which seemed to detach from the southern temperate band a quantity of the material of which the latter is composed. Summarising the observed phenomena, it is obvious that the southern hemisphere of Jupiter is in an active state of disturbance, whilst the northern hemisphere is remarkably quiescent.

OBSERVATIONS OF THE SATELLITES OF SATURN.—In the *Bulletin de la Société astronomique de France* for June, M. Lucien Rudaux publishes the results of a series of observations of five of Saturn's satellites made by him during the years 1892–7 and 1901–3 at his observatory at Donville (Manche).

His particular object was to record the changes in the brightness of each satellite, and from his numerous observations he concludes (1) that the satellites have periods of rotation equal to their respective periods of revolution; (2) that they (especially Japetus) have dark spots, probably permanent configurations, which cause a decrease in the satellite's apparent magnitude when presented to us; (3) consequently the apparent magnitude of each satellite varies periodically with the satellite's position in its orbit. These conclusions are certainly justified by the observations of Titan and Japetus, but in the case of Rhea the result is as yet uncertain.

THE GERMAN ROYAL NAVAL OBSERVATORY.—A quarto volume published by the German Naval Observatory under the general title "Aus dem Archiv der deutschen Seewarte" (twenty-sixth annual publication, 1903) contains papers on the following subjects:—(1) On the calculation of lunar distances by the aid of the Mercator functions; (2) estimation of the latitude of Heidelberg Observatory and its variations; (3) the daily variation of the magnetic declination; (4) the wind variation on the German coast; (5) on the "going" of the standard clocks of the German Naval Observatory; (6) the definitive elements of comet 1887 II. (Brooks). In the last named paper Prof. Dr. C. Stechert has reduced a large number of observations collected from various observatories, and has therefrom calculated the following definitive elements and the probable errors for the orbit of Brooks's comet (1887 II.):—

T = 1887 March 17·427594 ± 0·0061984 (M.T. Berlin)
ω = 159° 26′ 15″·00 ± 14″·91
Ω = 279° 56′ 12″·62 ± 3″·54 } Mean equinox 1887·0
i = 104° 16′ 10″·47 ± 3″·18
log q = 0·2122261 ± 0·0000095
e = 0·9836922 ± 0·0002550.

Dr. Stechert's paper is also published in No. 3957 of the *Astronomische Nachrichten*.

AN INTERESTING METEOR TRAIL.—A peculiar meteoric phenomenon was observed by Senor J. A. Perez at Madrid on October 16, 1903. The meteor first appeared in Perseus at about 10 p.m., and the luminous trail did not entirely fade away until nearly 12 p.m. In the meantime its shape varied considerably. Commencing as an almost closed curve with a loop in it, the loop gradually developed until finally the primary curved trail almost entirely disappeared, leaving only a short faint portion entirely separated from the enlarged loop. Six drawings and a description of the phenomenon are published in No. 16 of *Das Weltall*.

THE ROYAL SOCIETY CONVERSAZIONE.

THE second of the two conversaziones held annually at the Royal Society took place on Wednesday, June 22. Many of the exhibits of recent scientific methods and results on view during the evening were shown at the conversazione held in May, and have already been described (May 19, p. 68), but there were, in addition to these, a number of new objects and experiments, of which a list is here given.

Spontaneous electrification of radium: Hon. R. J. Strutt. A specimen of radium salt in a glass tube is hung up by an

insulating support in an exhausted vessel. An electroscope is attached to the radium tube. Negatively electrified particles are shot off by the radium, and penetrate the glass tube, which is covered with a conducting coating of phosphoric acid, so as to act as an inductor. Thus a positive charge is left, and causes divergence. When the electroscope leaf touches the outer vessel, which is earthed, it collapses, and begins to charge up again. This will go on so long as the radium lasts.—Demonstration of oscillating electric discharges: Prof. A. Schuster, F.R.S., and Dr. G. Hemsalech. The separation of the components of a slowly oscillating electric discharge is effected by blowing a steady current of air through it. The discharge passes between two slightly inclined metal plates, and spectroscopic analysis shows the line spectrum of air in the initial discharge and the band spectrum of nitrogen in the oscillations. The metallic vapour from the electrodes does not seem to take part in the oscillations. The effect of introducing cores of iron or other metals into a coil giving self-induction may be illustrated by this arrangement.—The thermo-galvanometer: Mr. W. Duddell. The instrument is intended for the measurement of very small rapidly varying currents such as telephonic currents and the currents produced in the receiving vertical wire in wireless telegraphy. The sensibility of the instrument is such that either direct or alternating currents from a few micro-amperes upwards can be measured.—A new magnetic balance: Mr. W. Hibbert. The beam of a balance is made of a magnetised steel rod 27 centimetres long. The " centres " of the poles are 25 centimetres apart. The repellent pole of a second magnet being placed over one end of the beam causes this to descend, and the force of repulsion is balanced by a weight sliding on the other half of the beam.

Photographs and diagrams illustrating solar and meteorological changes, and a series of photographs to determine the relative temperatures of the stars: Sir J. Norman Lockyer, K.C.B., F.R.S. This exhibit included (1) enlarged pictures of the sun in " K " light taken with the spectroheliograph of the Solar Physics Observatory. (2) Diagrams illustrating the results of a discussion of sun-spot distribution; the relationship between the positions of solar prominences and the different forms of the corona; the different types, and their distribution, of the short-period barometric pressure variation over the earth's surface; and the close connection between the change of barometric pressure and rainfall. (3) Series of photographs taken with a quartz-calcite prismatic camera of 2-inch aperture and 18-inch focal length to determine the relative temperatures of stars. (4) Composite positives on glass of the sun's limb and disc, taken on the same plate with " K " light.—Photographs and drawings prepared from observations taken by the lightning research committee to illustrate the behaviour of lightning on certain buildings struck and damaged, notwithstanding their being provided with lightning conductors: Mr. Killingworth Hedges.—The physiotype: Mr. Francis Sheridan. This is a method of permanent printing without the use of inks, specially adapted to finger printing and the reproduction of designs from animal and vegetable life. The subject to be reproduced is pressed on paper, and by dusting the invisible impression with a coloured powder a dark and permanent print is produced.—Experiment showing the effect of internal stresses in glass upon light of different colours: Dr. L. N. G. Filon.—Photographic camera with free-swinging lens, and photographs taken with it: Dr. W. M. Flinders Petrie, F.R.S.—(1) Photomicrographs of interior of a rifle barrel; (2) photomicrographs of brass used for cartridge cases: Dr. W. R. Hodgkinson and Captain Hardcastle, R.A.

A new automatic vacuum pump: Mr. C. E. S. Phillips. The apparatus consists of a modified Toepler pump, so arranged that it works automatically through the operation of electrically controlled devices, for the purpose of producing extremely high rarefactions. The pump will reduce the gas pressure within a vessel of 200 c.c. capacity from that of the atmosphere to 0·002 mm. in fifteen minutes.—Vibrograph for recording vibrations photographically: the Cambridge Scientific Instrument Company, Ltd. The instrument is essentially similar to that used by Mr. A. Mallock, F.R.S., for recording vibrations caused by traffic on the Central London Railway.—An experiment illustrating harmonic undertones: Mr. H. Knapman.

The origin and growth of ripple mark: Mrs. Hertha Ayrton. The experiments shown illustrated the way in which the sand ripples are formed on the sea shore. If sand be spread quite evenly on the bottom of a trough, and water above the sand be oscillated so as to produce stationary waves, a small ridge is formed where the horizontal velocity of the water is greatest, next a ridge is started on each side of the first, which grows; then two more ridges are started, the former growing, and so on until the whole surface of the sand is ripple-marked. Each ripple now slowly moves towards the place of greatest horizontal velocity, while fresh ripples form near the places of least horizontal velocity. Pairs of ripples then coalesce here and there, and finally the greater part of the sand is assembled in a ripple-marked heap at the places of greatest horizontal velocity, this final result being attained, for example, in about twenty-five minutes in the case of the six-foot trough exhibited, when the stationary wave is twice the length of the trough. It was also shown that ripples are *not* produced by a *steady* current of water flowing over sand, but that by disturbing this steady current sand ripples may be formed, which, however, are erased on the current becoming steady again.

Crystalline glazes on pottery: Mr. William Burton and Mr. Joseph Burton. The specimens illustrated the decorative application to English earthenware and stoneware of certain recently discovered glazes which develop artificial crystalline silicates during the firing and cooling of the wares. In the " sunstone " and " fiery " crystalline glazes the crystals have the optical properties of micas, though their exact composition is at present undetermined. In the starry and opalescent glazes the radiating needles are akin to the mineral willemite, as is shown both by their optical properties and their composition.—Photographs of volcanic phenomena in the Lipari Islands: Dr. Tempest Anderson. The photographs, which were taken by the exhibitor in April of this year, show, besides the topography of the craters, several changes which have taken place in and about them since a former visit in 1888, and also some explosions from the crater of Stromboli which took place while Dr. Anderson was on that mountain.

Mimetic resemblance of the different forms of a single species of butterfly to two or three different models. Seasonal phases of South African butterflies of the genus Precis: Prof. E. B. Poulton, F.R.S. The fact that the non-mimetic male of the South and East African *Papilio dardanus* possesses three different forms of female, each mimetic of a different species of Danaine butterfly, was discovered by Mr. Roland Trimen, F.R.S. Within the last few months this discovery has for the first time been confirmed by breeding. The exhibited specimens, constituting the entire evidence thus obtained, were bred by Mr. George F. Leigh at Durban, Natal. The evidence of the wonderful seasonal changes in South African butterflies obtained by Mr. Guy A. K. Marshall has been further increased during the present year. His recently obtained evidence was exhibited, and consisted of a wet-season female of *Precis antilope* with its five dry-season offspring.—Colour photographs (Sanger-Shepherd process) of living moths and butterflies in their various stages of larva, pupa and imago: Mr. F. Enock.—(1) Living specimens of young flatfish; (2) methods of determining the age of plaice; (3) charts illustrating the natural history of the plaice in the North Sea; (4) charts illustrating the plankton and hydrography of the English Channel during 1903: the Marine Biological Association.—The cilioscribe, a machine to record the movements of cilia and the effect of physical conditions and chemical reagents upon them: Dr. W. E. Dixon and Mr. O. Inchley.—Specimens of West Indian fire-flies: the Zoological Society of London.

Photography of the movements of plants by means of the kammatograph: Mrs. D. H. Scott. The photographs are taken at intervals varying according to the rapidity of the movements of the plants during several days, and sometimes weeks. They are then shown on the screen in the kammatograph, and the movements of many days can be followed in a few seconds.—Models to illustrate the reduction (heterotype) divisions in animals and plants: Prof. J. B. Farmer, F.R.S., and Mr. J. E. S. Moore.

(1) Model of the external door of the Great Pyramid; (2) ellipsograph: Mr. R. Inwards.

SOME ANCIENT MAMMAL PORTRAITS.

VERY little attention appears to have been hitherto devoted to the correct identification of the wild animals represented in the ancient Assyrian and Babylonian sculptures, and in the frescoes of Egypt under the Pharaohs. Antiquarians and Egyptologists seem in the main to have contented themselves with calling an animal a gazelle, an antelope, or a deer, without the slightest attempt to ascertain whether such titles are correctly bestowed, and in some cases utterly oblivious of the fact that deer (with the exception of the Barbary red deer and the fallow-deer in Tunisia, Algeria, and Morocco) are quite unknown in the African continent. A remarkable instance of this occurs in a comparatively recent publication of the Egypt Exploration Fund, forming the eighth memoir of the Archæological Survey of Egypt, entitled "The Mastaba of Ptahhetep . . . at Saggareh. Part i. The Chapel of Ptahhetep and the Hieroglyphs," by N. de G. Davies. Here a plate depicting a number of antelopes and goats is lettered "The Deer—East Wall." A moment's consultation with a naturalist friend would, of course, have saved the author from this absurd error.

Many of the animals represented in the sculptures and frescoes are obviously mythical; but others equally clearly represent species then living in the country, and these are for the most part so well and characteristically represented, that in many cases there is little or no difficulty in identifying the species to which they belong. Apart from the intrinsic interest of identifying the various species portrayed, a certain amount of information may at the same time be obtained with regard to the former distribution of the species in question, so that the investigation of the subject has considerable scientific interest.

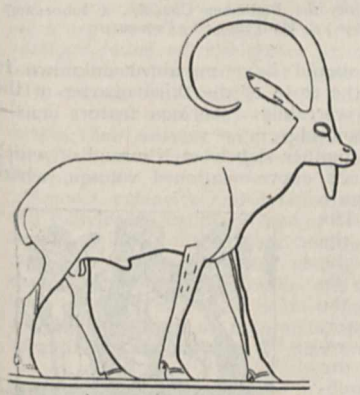

FIG. 1.—Nubian ibex, from the Ptahhetep Chapel.

With these few preliminary observations, I proceed at once to the consideration of such figures as I have been able to identify with more or less certainty, merely adding that these for the most part represent ungulates, the portraits of Carnivora being far more difficult to assign to their respective species.

Commencing with the above mentioned figures from the east wall of the Chapel of Ptahhetep, for copies of which I am indebted to Mr. F. Ll. Griffith, the editor of the publication cited, there is no difficulty in identifying Fig. 1 with the Arabian, or Nubian, ibex (*Capra nubiana*). Although the knotted ridges on their front surfaces are not shown, the circular sweep of the horns is unmistakable, while further evidence for the specific identification is afforded by the long and pointed beard on the chin. It is, however, somewhat remarkable that in another representation of the same animal, from a hunting-scene on the east wall of this chapel, the beard is omitted; possibly one figure represents the animal in the summer dress, and the other in the winter coat. The shortness of the tail in both figures may be cited as a further instance of the artist's fidelity to nature.

Equally unmistakable and characteristic is the portrait of the aoul, or Soemmerring's gazelle (*Gazella soemmerringi*), which is reproduced in Fig. 2. The characteristic inward curvature of the tips of the horns is remarkably well shown, although the relative length of these appendages appears to be somewhat exaggerated. Contrasted with the figure of the ibex, the gazelle-like slenderness and length of limb, as well as the lightness of the whole build, are remarkably well brought out in this portrait. The short tail is also a characteristic gazelle feature. Soemmerring's gazelle, it may be observed, is still fairly abundant in Upper Nubia, and in past times may have been found much lower down the Nile delta.

The next three figures from the Ptahhetep Chapel represent long-tailed antelopes. Of these, the one shown in Fig. 3 is, I take it, probably the lesser kudu (*Strepsiceros imberbis*), if not this, the Abyssinian bushbuck (*Tragelaphus scriptus*); the length and strong twist of the horns render it, however, probable that the picture is intended for the former animal. The absence of a tuft of hair on the throat, as well as the relative size of the drawing and the narrowness of the ears, clearly show that the portrait is not intended for the greater, or true, kudu. Neither the lesser kudu nor the bushbuck are now known from Egypt, although they occur in Somaliland, Abyssinia, and probably Kordofan. The abundant hairing of the lower part of the tail is clearly indicated in the figure.

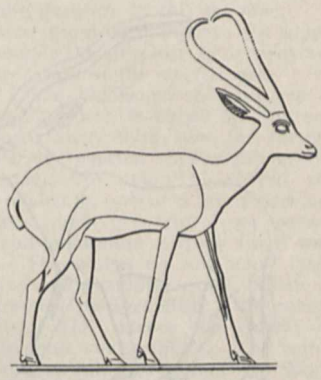

FIG. 2.—Soemmerring's gazelle, from the Ptahhetep Chapel.

From the spiral twist and length of the backwardly sweeping horns, the stout build, and the length of the tail, there can be little doubt that the animal portrayed in Fig. 4 is an addax (*Addax nasomaculatus*), a species of antelope met with at the present day throughout the desert tracts of northern Africa. The artist, it will be noticed, has made the profile of the face markedly concave, and thereby different from that of any of the other antelopes depicted.

Equally characteristic of the north African desert zone is the white, or sabre-horned, oryx (*Oryx leucoryx*), which differs from the other members of its tribe by the long horns sweeping backwards in a bold and graceful curve, instead of rising nearly straight up from the forehead. These features, as well as the long and thickly haired tail, are clearly represented in the portrait reproduced in Fig. 5, which may unhesitatingly be admitted to indicate the species in question. The white oryx is still a comparatively common antelope in the deserts of Upper Nubia and Kordofan. From the nearly straight and more strongly ringed horns, a figure of another antelope in the hunting-scene on the east wall of the Ptahhetep Chapel is intended, I think, for the beisa oryx (*Oryx beisa*), which ranges from the Red Sea littoral in the neighbourhood of Suakim through Abyssinia to Somaliland and north-east Africa generally.

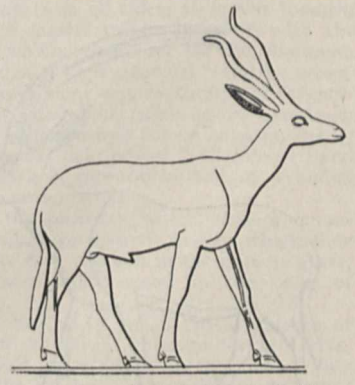

FIG. 3.—Lesser kudu (?) from the Ptahhetep Chapel.

Antelopes of other kinds, including some of the smaller gazelles, are recognisable on various Egyptian frescoes, but their exact specific determination is difficult or impossible. Cattle are frequently depicted, but all appear to be domesticated animals, none of which belong to the humped breed, now so common in Africa. Camels are occasionally represented, but there is nothing to show that these indicate the existence of this animal in a wild state in the country at that date; most probably, indeed, they are domesticated specimens. Very interesting, in a scene representing tribute-bearers from Cush (Goss's "Ancient Egypt," p. 37), is the portrait of a giraffe with a dog-faced baboon clinging to its throat. Curiously enough, the giraffe is

represented with the legs spotted right down to the hoofs, after the fashion of the southern races of this species, and unlike the Nubian form, in which the spotting stops short at the knees and hocks. It must be acknowledged, however, that the artistic merit and attention to details are nothing like so good in the Cush tribute scene as in the Ptahhetep frescoes.

FIG. 4.—Male addax, from the Ptahhetep Chapel.

Among the Carnivora, the lion and the leopard are frequently depicted, but in the aforesaid frescoes of the tribute-bearers from Cush, the spots of the latter animal are represented as more like those of the ocelot. As might have been expected, the ichneumon, or Egyptian mungoose (*Herpestes ichneumon*), the snake-destroying propensities of which render it so venerated among the inhabitants of the Nile delta, is very frequently represented in the frescoes. It is well shown in Fig. 6, *A*., from the Ptahhetep hunting-scene. The fore part of the animal shown at *D* in the same figure seems to be intended for the little African fennec fox (*Canis famelicus*), the projecting appendix seen below the eye in the figure being apparently a conventional mode of representing the bristles or "whiskers," which are remarkably well developed in that species.

The long-tailed and long-hind-legged animal shown at *B* in Fig. 6 is apparently the lesser, or hairy-footed, jerboa (*Jaculus hirtipes*), the small size of the ears showing that it is not intended for the larger jerboa (*Jaculus aegyptiacus*). Another rodent shown in some of the frescoes, as in one of labourers bringing in sheaves of corn (Goss, *op. cit.* p. 195), is the Egyptian hare. The length of the ears, by which the animals are being carried, is, however, greatly exaggerated, the length of these appendages being nearly equal to that of the head and body.

A remarkable instance of fidelity to nature occurs in the two portraits of a hedgehog shown at *C* in Fig. 6, from the Ptahhetep hunting-scene, one of these representing the animal standing in the open, and the second showing it coming out of a hole with a locust in its mouth. The well developed ears clearly show that the species depicted is the long-eared hedgehog (*Erinaceus auritus*), which differs from its European cousin by the large size of the ears.

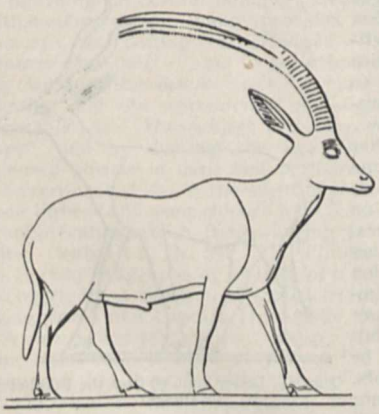

FIG. 5.—White oryx, from the Ptahhetep Chapel.

Turning to certain sculptures from Assyria, Babylonia and other parts of western Asia, I may in the first place direct attention to an illustration in Vaux's "Nineveh and Persepolis," entitled "Figure Carrying Gazelle," which is reproduced in the accompanying cut (Fig. 7). The original slab, which is preserved in the British Museum, was one of those obtained from the palace at Nimroud by Sir Henry Layard, in whose own work it bears the above-mentioned legend. Clearly such a title does manifest injustice to the genius and fidelity to nature of the ancient sculptor, who has faithfully portrayed the palmated and branching antlers and dappled hide of a fallow-deer, spots being, it is almost unnecessary to mention, quite unknown in any species of gazelle. The interest of this sculpture does not, however, by any means end here, for the details of the antlers and other features are sufficient to show that the species portrayed is evidently the Mesopotamian fallow-deer (*Cervus mesopotamicus*), which is a native of the Luristan province of Mesopotamian Persia, and was first definitely made known to European science by the late Sir Victor Brooke in 1875. That a species should have been thus clearly portrayed centuries and centuries ago by a sculptor of the

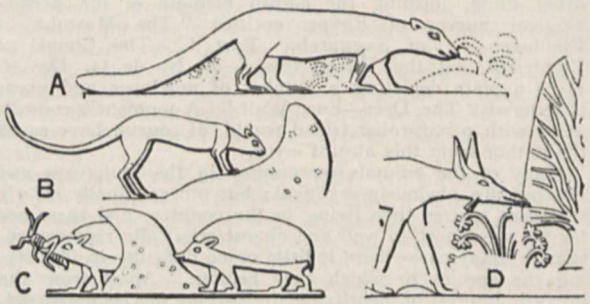

FIG. 6.—Small mammals from the Ptahhetep Chapel. A, Ichneumon; B, Lesser jerboa; C, Hedgehog; D, Fennec.

Babylonian era, and should have remained unknown in western Europe until the close of the third quarter of the nineteenth century, is certainly a curious feature in the progress of human knowledge.

Of minor interest is another slab from Nimroud of which a cut appears in Vaux's above-mentioned volume, where it is lettered "Figure Carrying a Goat." The form of the horns, the general contour of the animal, and, above all, the absence of a beard on the chin, indicate, however, that the sculptor has represented one of the gazelles, which is probably the common Dorcas gazelle (*Gazella dorcas*), which at the present day has a wide distribution in North Africa, whence it extends into Palestine and Syria. It is, however, possible that the figure may be intended for the goitred gazelle (*Gazella subgutturosa*), which ranges from the Caucasus through Persia and Syria, and thence into Central Asia, where it is represented by a distinct local race.

FIG. 7.—Human figure carrying Mesopotamian fallow deer, from the Palace at Nimroud.

The last, but by no means the least interesting, sculpture to which I shall allude is one from Nimroud of which a woodcut appears on p. 225 of the work above cited, where it is described as a "Bull-hunt." The horns of the animals depicted are, however, as shown in the accompanying reproduction of the cut (Fig. 8), quite unlike those of the bulls represented in the Egyptian frescoes, and strongly recall those of the white-tailed gnu (*Connochaetes gnu*) of South Africa. Moreover, the tails of these animals are of the same type as those of the horses shown in this and other sculptures, and are quite different from those of the oxen of the sculptures and frescoes, which have a somewhat club-shaped form. It would appear, therefore, that the portrait is that of an animal with a fully haired tail

like a gnu or horse, and not one with a terminally tufted tail of the ox type. Again, the general form of the animal is much more like that of a gnu than of a bull.

Accordingly, there appears a very strong presumption that this sculpture represents the hunting of a species of gnu, and if this be really the case, it would be a fact of very considerable interest in connection with animal distribution. The two living species of gnu are now confined to Africa, but their near relatives, the hartebeests, range into Syria, while fossil species of that group, as well as of other antelopes of an African type, occur in the Upper Tertiary strata of northern India and China. Nothing is therefore more likely than that gnus should have formerly

FIG. 8.—A gnu (?) hunt, from Nimroud.

had a more extensive range. If this be so, it would be one more argument in favour of the old view that the present antelope fauna of Ethiopian Africa immigrated into the country from the north, and against the modern theory of its autochthonous origin in Africa itself. For it is surely much more probable that animals should have died out in their ancient habitat and flourished in the country in which there are comparatively new arrivals rather than the converse.

A more extensive and detailed study of the old Assyrian and Babylonian sculptures and of the Egyptian frescoes would doubtless lead to the identification of species of animals other than those mentioned above; but such identifications as I have been able to make are sufficient to demonstrate that the subject has a definite bearing on the past distributional history of mammals, and that it ought not to be neglected by students of that branch of zoology.

R. LYDEKKER.

THE ACTION OF RADIUM EMANATIONS ON DIAMOND.[1]

WHEN diamonds are exposed to the impact of radiant matter in a high vacuum they phosphoresce of different hues, and assume a dark colour, becoming almost black when the bombardment is long continued (*Phil. Trans.*, 1879, part ii., p. 658, par. 625).

Some diamonds blacken in the course of a few minutes, while others require an hour or more to discolour.[2] This blackening is only superficial, and although no ordinary means of cleaning will remove the discoloration, it goes at once when the stone is polished with diamond powder. The fact that the black stain is not affected by ordinary oxidising reagents would seem to show that it is not due to a layer of amorphous carbon; but it might be graphite, which is much more resistant to oxidation. Becquerel has shown that graphite is converted into graphitic oxide by long digestion in a warm mixture of potassium chlorate and strong nitric acid, while diamond—even in a very finely powdered state—is absolutely unaffected by the mixture (*Ann. de Chim. et de Phys.*, [4], vol. xix. p. 392).

Some forms of graphite dissolve in strong nitric acid; others require a mixture of highly concentrated nitric and potassium chlorate to dissolve them, and even with this intense oxidising agent some graphites resist longer than others. M. Moissan has shown that the power of resistance to nitric acid and potassium chlorate is in proportion to the temperature at which the graphite has been formed, and with reasonable certainty we can estimate this temperature by the resistance of the graphite to this reagent.

Judging from the long time required to remove the superficial darkening from diamond, the graphite is as resistant as that formed at the temperature of the electric arc.

On one occasion when I had blackened the surfaces of diamonds by molecular bombardment *in vacuo* M. Moissan was present, and took some away with him for further examination. He subsequently reported the results in the *Comptes rendus*, vol. cxxiv., No. 13. He heated the diamond to 60° in an oxidising mixture of potassium chlorate and fuming nitric acid prepared from monohydrated sulphuric acid and potassium nitrate fused and quite free from moisture. The action on the black layer is very slow. There is produced graphitic oxide, which at an increased temperature yields pyrographitic acid, which is easily destroyed by nitric acid. Hence the variety of carbon which coated the diamond was graphite. The transformation of diamond into graphite requires the high temperature of the electric arc. The higher the temperature to which graphite is raised the greater is its resistance to oxidation. M. Moissan concludes that the temperature reached by the surface of the diamond in my radiant matter tubes is probably about 3600°.

The β-rays from radium having like properties to the kathode stream in a radiant matter tube, it was of interest to ascertain if they would exert a like difference on diamond. Two Bingara diamonds, A and B, weighing respectively 0·960 and 1·020 grains, were selected as near as the eye could judge of the same size and colour—very pale yellow, technically known as "off colour." Diamond A was put in a drawer far removed from radium or any radio-active body. Diamond B was kept close to a quartz tube containing about 15 milligrams of pure radium bromide sealed *in vacuo*. It phosphoresced brightly and continued to glow the whole time of the experiment.

After a fortnight the two diamonds were put side by side and compared. I could see no appreciable difference in colour between them. Diamond B was now replaced close to the quartz tube of radium, and they were kept in contact for six weeks. At the end of that time examination again showed scarcely any difference between the two. The one which had been near the radium might be a little the darker of the two, but the difference was too slight to enable me to speak positively.

Diamond B was now put inside a tube with radium bromide, the salt touching it on all sides, as it was thought possible that a screen of quartz might interfere with the passage of emanations which would act on the diamond. The comparison diamond was kept removed from the emanations as before. The experiment was continued for seventy-eight days, when the two diamonds were again examined. There was now a decided difference in colour between them; diamond A was of its original pale yellow "off colour," and diamond B was of a darker appearance and of a bluish tint, with no yellow colour apparent.

It thus appears that the property which radium emanations possess of darkening transparent bodies which they impinge upon—a property very marked in the case of glass, and less with quartz—also holds good in the case of diamond.

Diamond B was now heated to 50° C. in a mixture of strongest nitric acid and potassium chlorate for ten days, the mixture being renewed each day. At the end of this time the diamond had lost its dull surface colour, and was as bright and transparent as the other stone, but its tint had changed from yellow to a pale blue-green.

The radium emanations have therefore a double action on the diamond. The β-rays (electrons) effect a superficial darkening, converting the surface into graphite in a manner similar to, but less strongly than, the more intense electrons in the kathode stream. But the alteration of the body colour of the stone by emanations which are obstructed by the thinnest film of solid matter, even by a piece of thin paper, is not so easy to understand. A superficial action might be expected, but not one penetrating through the whole thickness of the diamond. I believe the alteration

[1] Read before the Royal Society on June 16 by Sir William Crookes, F.R.S.

[2] At a lecture before the Royal Institution on June 11, 1897, I exposed a flat macle crystal of diamond to radiant matter bombardment before the audience for about five minutes, a strip of metal covering part of the stone. On removing the diamond from the vacuum tube and projecting its image on the screen with the electric lantern, the image of the darkening was very apparent.

of colour is a secondary effect; in presence of radium the diamond is extremely phosphorescent, and it continues to shine during the whole time of the experiment. This constant state of vibration in which the diamond was kept for many weeks may have caused an internal change revealing itself in a change of colour. Indeed, it is not difficult to suppose that a chemical as well as a physical action may result. If the yellow colour is due to iron in the ferric state a reduction to the ferrous state would quite account for the change of colour to a pale blue-green.

This alteration of colour may be of commercial importance. If "off colour" stones can be lightened their value will increase, while if the prolonged action of radium is to communicate to them a decided colour they would be worth much more as "fancy" stones.

[*Added June* 16.—After the ten days' heating in the above acid mixture the two diamonds were put together in a glass tube and carried about for twenty-five days, sometimes loose and sometimes in the tube. They then were laid near together on a sensitive film in total darkness for twenty-four hours. On developing, diamond B had impressed a strong image on the film, but only a very faint mark could be seen where the other diamond had been. Probably this slight action was due to a little radio-activity induced in A during its twenty-five days' proximity to B.

The experiment was then repeated for confirmation, allowing the diamonds to remain on the sensitive surface for only five hours. On development, a good image of diamond B was seen, but not so black as in the former case.

The fact that diamond B was strongly radio-active after it had been away from radium for thirty-five days, for ten of which it was being heated in a mixture powerful enough to dissolve off its outer skin of graphite, seems to me proof that radio-activity is by no means a simple phenomenon. It not merely consists in the adhesion of electrons or emanations, given off by radium, to the surface of an adjacent body, but the property is one involving deep-seated layers below the surface, and like the alteration of tint is probably closely connected with the intense phosphorescence the stone had been experiencing during its seventy-eight days' burial in radium bromide.]

THE MARKINGS AND ROTATION PERIOD OF MERCURY.

MUCH new light was thrown upon the rotation period of Saturn during the year 1903, and it seems highly probable that the next planet to afford us information as to the same feature will be the planet Mercury. Spots of very definite and distinct character are certainly visible on the surface of this fugitive little orb, which offers a more promising field for new discoveries than Venus, though it is considerably smaller, at a much greater distance from us, and more unfavourably placed for observation. The markings sometimes perceptible on Mercury appear to be of sufficient prominence to be followed, and if really capable observers are forthcoming, at the opportune period, to study them, it will be possible to ascertain once and for all whether this circumsolar planet turns on its axis once in about 24 hours or 88 days, and an important advance in our knowledge will have been made.

Spots have been discerned on Mercury since the time of Schroeter about a century ago. Among those who have obtained observations of them are the following:—

Schroeter	1800	Denning	1882
Harding	1801	Schiaparelli ...	1882–3
Bessel	1801	Brenner	1896
Prince	1867	Lowell	1896
Birmingham ...	1870	Barnard	1900
Vogel	1871	McHarg	1904

In 1800 Schroeter announced that the rotation period was about 24h. 4m. from blunted appearances of the southern horn, but doubted if the value could be determined to within a few minutes. In 1801 Harding perceived a dusky spot in the southern hemisphere, and derived the period as 24h. 5m. 30s. Further observations, however, obtained by himself and Bessel caused him to reduce this period to 24h. om. 50s. Bessel found 24h. om. 53s. from several of Schroeter's observations extending over fourteen months. In 1882 Denning, at Bristol, thought a period of about 25 hours would satisfy the observations, but Schiaparelli, in the pure Italian sky, arrived at very different results, and concluded that the planet rotated in 88 days, or in the same period as he revolved round the sun. Quite recently McHarg found the time 24h. 8m. from his own observations of a dark spot in April, 1904. He also deduced a period of 24h. 5m. 48s. from a blunting of the southern horn seen by Schroeter in 1800 March, and by Denning in 1882 November.

ON THE DIMENSIONS OF DEEP-SEA WAVES, AND THEIR RELATION TO METEOROLOGICAL AND GEOGRAPHICAL CONDITIONS.[1]

THE following table has been compiled from the original sources after re-calculating the true velocities corresponding to the "Beaufort numbers" in accordance with the alteration of reduction factor adopted by meteorologists since the date of the observations:—

Table showing the Relation between the True Velocity of the Wind in Statute and in Geographical Miles per Hour and the Height of the Wave in Feet, as deduced from Observations by numerous French Observers extending over many years and taking in all the Oceans.

No. of wind on Beaufort's scale of 0–12	Velocity of wind, stat. miles per hour	Velocity of wind, geographical miles per hour	Height of wave in feet	Authority	Velocity of wind in stat. miles per hour divided by height of wave in feet	Velocity of wind in geographical miles per hour, divided by height of wave in feet
						Feet
0·00	2·0	1·7	1·97	Desbois	1·01	0·86
1·50	5·5	4·8	3·28	,,	1·68	1·46
3·00	10·0	8·7	4·92	,,	2·03	1·77
3·60	12·4	10·8	6·17	Antoine	2·01	1·75
4·36	15·8	13·7	6·56	Paris	2·41	2·09
4·50	16·5	14·3	7·55	Desbois	2·19	1·89
4·80	18·0	15·6	9·12	Antoine	1·97	1·71
5·45	21·7	18·9	13·45	Paris ("Grosse Houle")	1·61	1·41
6·00	25·0	21·7	10·83	Desbois	2·31	2·01
6·00	25·0	21·7	13·12	Antoine	1·91	1·65
6·55	28·3	24·6	11·65	Paris	2·43	2·11
7·20	32·2	28·0	17·0	Antoine	1·89	1·65
7·50	34·0	29·5	15·42	Desbois	2·20	1·91
8·18	38·3	33·3	16·57	Paris	2·31	2·01
8·40	39·8	34·6	16·73	Antoine	2·38	2·07
9·00	44·0	38·2	20·67	Desbois	2·13	1·85
9·60	49·2	42·7	21·98	Antoine	2·24	1·94
9·82	52·2	45·3	25·43	Paris	2·05	1·78
10·50	58·2	50·5	28·54	Desbois	2·04	1·77
10·8	61·8	53·7	27·89	Antoine	2·22	1·93
			Average		2·03	1·78

This table gives the average of many hundreds of days' observations conducted at various times during a period of about forty years by independent observers, all French seamen of the navy or merchant service, carried out in almost all parts of the oceans ordinarily visited by ships, and from many different vessels (none, however, of the great size of our modern liners, and therefore better for such observations), and shows the average height of the wave, in open sea with sufficient depth of water, to be in simple arithmetical proportion to the velocity of the wind, *the height of the wave in feet being in round numbers one-half of the velocity of the wind in statute miles per hour.*

This result does not express a dynamical law; it is simply

[1] Extracted from a paper by Dr. Vaughan Cornish in the *Geographical Journal* for May, 1904.

the result of averages, but if confirmed by further observation it will have considerable interest for geographers, meteorologists, and for those who have to do with the sea.

We may take 20-feet average waves and 30-feet occasional waves as the limit in very severe gales in the "seas," and 30-feet average and 45-feet "ordinary maximum" waves as the limit of wave-height for the oceans. Although strong winds will push short waves to a considerable steepness, yet they are not able to attain quite so great a height as somewhat longer waves, because, moving more slowly, their tops give way under the great difference of wind-pressure upon their two sides. Thus the development of the larger waves primarily depends upon the opportunity to attain greater *length*. It is in this respect that our consideration of the size of the cyclone becomes so important for deep-sea waves, especially for explaining the co-existence of the steep storm waves with the swell.

The slighter development of the longer waves is undoubtedly influenced by the dual circumstance that the length of fetch of wind of the required velocity diminishes (the stronger winds only blowing for a short *time* at a fixed station, or for a short *space* in the travelling cyclone), whilst the requisite fetch is greater, for it must be a *large multiple of the wave-length*. Thus the limit of length of the steep waves is rapidly approached from the concurrence of the two causes operating, so to speak, from opposite directions.

Taking T. Stevenson's table ("Enc. Brit.," ninth edition, art. Harbours) of the relation of height of waves to length of fetch, and multiplying the heights by twenty (as a first approximation) to obtain the length, we see that a considerable wave does not become the dominant form except with a fetch *approaching* 2000 *times its wave-length*.

Extending these results to 30-feet (average) waves 600 feet long, *i.e.* fully grown ocean storm waves, we see that 30-feet × 20 × 2000 = 227 statute miles, or 197 geographical miles.

A 9-hours' blow, with wind 64 miles per hour, was recorded in the gale of December 22, 1894. With the average velocity of advance of deep depressions from W.S.W. on our coast, viz. 24·8 (say 25) knots, this would give a length of fetch of 225 geographical miles. The height of wave corresponding to this length of fetch in severe gales, as calculated by stretching Stevenson's formula, is 22·5 feet. If the cyclone had the exceptional speed of 60 knots, the length of fetch of the 64-mile-an-hour wind would be 450 miles, which with Stevenson's formula gives a height of 31·8 feet. A thirty-foot wave from the same formula requires a length of fetch of 400 miles. Both this length of fetch and this height of wave are probably more normal in the southern ocean than in the North Atlantic; the 22·5-foot wave and the 225-mile length of fetch would be more the scale of things there.

If we take the case of a very long swell of 2000-feet wave-length (unusual, but within the records), which is one-third of a geographical mile, then 2000 times this wave-length is 666 miles. The speed of such a swell is 69 knots, and wind of greater velocity than this would only be blowing in a comparatively short strip of even a great cyclone. They would, therefore, not be developed into the dominant wave form, however strong the wind might be there. The reason for this is most easily understood if we imagine a short series of such waves to exist with the steepness of ordinary storm waves. If 76-miles-per-hour wind last one hour at a fixed station (which occasionally happens on our coasts), and the rate of advance of the storm be 25 miles per hour, then the stretch of water at any time exposed to the above force of wind is 25 miles, which would comprise only 75 such waves.

Suppose these, or any of them, to have attained considerable steepness, it is evident that the arrangement would be unstable, for there would be so great a difference of steepness between neighbouring waves that the group would speedily extend itself, multiplying the number of its waves and flattening them out, until the gradation from one wave to the next is almost indefinitely small.

Although the length of fetch in cyclones is inadequate to the development of the longer observed swells to great steepness, the length of run of the cyclones on the oceans is frequently such as afford much more than the time required for the full development of ordinary storm waves. Thus a cyclone travelling a little less than 25 knots, the average speed of deep depressions approaching our shores from the Atlantic, travels with the group velocity of a swell of 16-seconds' period (or 1311-feet wave-length), the speed of such waves being 48·56 knots, and their group velocity being, therefore, 24·28 knots. Such a storm, if brewed in mid-Atlantic, and advancing on our shores from W.S.W., would continually reinforce this swell during three days, a space of time equal to 16,200 times the period of the wave.

It is an interesting coincidence that the average velocity of deep depressions approaching our coasts from points between W.S.W. and W.N.W. (25 knots) is about half that wind velocity called "a severe gale" by Brodie (viz. Beaufort's 10, 53 statute miles per hour, 46 knots). Of the sixty recorded cases of more rapidly advancing storms, twenty-five had a speed of 31 to 34 knots, which is again about half the maximum observed wind velocity (except in gusts).

Thus we have a dual correspondence of velocities, the individual wave of the longest swells moving with nearly the velocity of the strongest winds, and the group of swells advancing with nearly the velocity of the great storms.

When, as often happens (in the North Atlantic), a long swell precedes and predicts the arrival of a storm, the rate of advance of the latter is less than half the speed of this swell in deep water.

A slowly moving storm with violent winds will raise a short steep sea with comparatively little swell in it.

The rate at which a wave flattens out when the wind ceases is inversely as the square of its length. Consequently, in oceans large compared with the areas of cyclonic storms, the surface is found to be heaving with a long swell during the intervals between storms (whence the grand surf which rolls in upon oceanic islands). New storms will not, as a rule, catch up a group of such swells, but cyclones brewed upon the ocean find such a swell already running, and, travelling with it, soon increase its steepness. This is particularly true of the circumterrestrial waters of the southern hemisphere, where a long swell from the west is always running.

It is probable (and experience at sea supports the opinion) that in moderately high latitudes of the southern hemisphere, say 40° to 60° S., the cyclones are on a larger scale than in the corresponding latitudes of the northern hemisphere, where atmospheric movements are more broken up by the alternation of land and water. The bigger waves of the southern ocean I attribute only indirectly to the greater expanse of water. The expanse of water in the northern Pacific and northern Atlantic would amply suffice for the development of larger waves than actually occur there were the storms which traverse them framed on a larger scale.

GEOLOGY IN NORWAY.

THE last "Year-book of the Norwegian Geological Survey" (1903) contains five papers bearing on different subjects concerning the geology and topography of Norway.

In the first paper, the aged mining engineer Mr. Friis deals with Jurassic coal beds on the Andö, an island in northern Norway. The sandstones and slates of the Brown Jura contain good cannel coal of 1 metre thickness, but cover rather a small area.

In the second paper, Dr. H. Reusch, the chief of the Survey, describes a journey through the interior of the most northern province of Norway, a desolate and almost uninhabited country, to visit the gold fields near the Russian border. Gold occurs in a Glacial deposit, "aas" or esker, but only in small quantities. Dr. Reusch describes the country upon the whole as a peneplain 300 to 500 metres above the sea. Glacial deposits widely cover the land, and solid rock, mostly archæan and sandstones of supposed Devonian age, is only seldom seen.

In two papers, Mr. Kaldhol and Mr. Rekstad deal with the succession on "Hardangervidda," the wide plateau on an average 1300 metres above the sea, with peaks ranging

almost to 2000 metres, to the east of the Hardangerfjord. On the underlying granite rests a phyllite series, containing at the base black schists with *Dictyonema flabelliforme*, giving the series a place within the Upper Cambrian and Lower Silurian. But above this phyllite, and perhaps concordantly, rest metamorphic schists, beginning with quartzite beneath and ending in a coarse, typical gneiss. Some geologists are inclined to think this inversion due to an immense overthrust. The boundary between the granite and the phyllite is very level, and Mr. Rekstad suggests the surface of the granite to be an Archæan or Cambrian peneplain. The paper is accompanied by a coloured map of the region.

In the last paper Mr. Rekstad shows that the upper limit of the mountain forests has of late subsided 300 to 400 metres in southern Norway, pointing to a decrease in temperature of 2·1° to 2·4° C. In the time of mild climate glaciers must have been almost absent. He places this time to the age of the *tapes*-banks, when the land had performed about four-fifths of its total upheaval since the close of the Glacial period.

The papers are all illustrated by photographs and diagrams. They are written in Norwegian, but each is accompanied by a summary in English. A. D.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

OXFORD.—At the Encaenia on June 22, the honorary degree of D.Sc. was conferred upon the following:—The Hon. C. A. Parsons, Mr. Marconi, Sir William S. Church, Sir Andrew Noble, Sir William Crookes, Sir David Gill, Sir John Murray, Prof. Alfred Marshall, Prof. J. J. Thomson, Prof. Horace Lamb, Prof. A. R. Forsyth, Prof. J. Dewar, and Prof. J. Larmor.

CAMBRIDGE.—In the natural sciences tripos forty-five men and one woman have gained first classes in part i.; thirteen men and three women have gained first classes in part ii.

The Raymond Horton-Smith prize, for the best M.D. thesis of the year, has been awarded to Dr. F. A. Bainbridge, Trinity. Dr. B. N. Tebbs, Queens', receives honourable mention.

The Harkness studentship in geology has been awarded to Mr. O. T. Jones, Trinity.

Dr. H. B. Roderick, Emmanuel, has been appointed demonstrator of surgery.

The Frank Smart studentship of 100*l*. a year for research in botany will be filled up in July. Applications must be sent to the Vice-Chancellor by July 13.

The degree of doctor of science was conferred on Prof. C. S. Sherrington, F.R.S., at the congregation on June 18.

The Wiltshire prize for geology and mineralogy is divided between H. A. Wootton, Clare, and J. A. Crowther, St. John's.

The Hockin prize for physics at St. John's is also divided, between S. H. Phillips and J. A. Crowther.

The Hutchinson studentship for research in physics is awarded to E. Gold, bracketed third wrangler 1903.

Mr. W. G. Fearnsides (natural sciences tripos, 1900) has been elected a fellow, and Dr. E. H. Griffiths, F.R.S., principal of Cardiff University College, has been elected an honorary fellow, of Sidney Sussex College.

DR. O. ASCHAN has been appointed professor of chemistry at Helsingfors.

THE following honorary degrees were conferred at a convocation of the University of Durham on June 22:—D.C.L., Sir Daniel Morris; D.Sc., Prof. R. A. Sampson, F.R.S.; D.C.L., Dr. Harold F. Wilson; D.Sc., Mr. David Woolacott.

THE first number of the second volume of the *Investigations* of the Departments of Psychology and Education of the University of Colorado has been received. It contains papers by Mr. F. H. Clark on the scope and efficiency of the normal schools of the United States; by Prof. Libby on co-education and the raw material of the school; and by Mr. J. H. Bair on factors in the learning process.

THE programme containing regulations for the registration, conduct, and inspection of classes and examination of candidates in technological subjects, and for the award of teachers' certificates in manual training and domestic economy, for the session 1904–5, in connection with the City and Guilds of London Institute, has now been published. The programme may be obtained from Mr. John Murray, price ninepence net.

WE have received from Messrs. Swan Sonnenschein and Co., Ltd., a copy of a useful publication compiled from official records by the editor of the "Schoolmaster's Yearbook and Directory." The title and subtitle serve to indicate satisfactorily the scope of the new volume, which is called a "Register of Teachers for Secondary Schools," being the list of teachers registered in column B of the Teachers' Register, formed and kept by the Teachers' Registration Council, in accordance with the Order in Council, March 6, 1902, and amending orders. Particulars of address, date of registration, qualifications, experience, recorded in the register for each teacher, are also given. The volume costs two shillings net.

A PAPER read last July at the meeting of the National Educational Association at Boston, Mass., U.S.A., by Prof. W. N. Rice, on the proper scope of geological teaching in the high school and academy, has been reprinted in separate form from the *Proceedings* of the National Educational Association. From a copy of the reprint which has reached us, we learn that Prof. Rice believes "that there should be a required course in physical geography in the first year of the high-school curriculum." The geographical course would by this plan precede the bifurcation of the curriculum necessitated by the fact that in most cases the classical students must begin Greek in the second year. Prof. Rice also considers that a course in geology, which should be chiefly dynamical and structural geology, is a most desirable elective in the fourth year of the curriculum.

THE University College of North Wales has organised a department of forestry or sylviculture in connection with its agricultural department. The desirability of providing facilities for the teaching of forestry in North Wales was brought prominently forward by Lord Onslow some months ago in his address at the opening of the College Farm at the commencement of the present session, and it is gratifying to find that the proposed scheme has so soon been realised. Mr. Fraser Storey has been appointed lecturer in forestry. Not only will the Bangor School of Forestry be the first institution of its kind organised in connection with a university college in this country, but a further innovation has been made in extending the work of the department beyond the limits of ordinary class-teaching. A considerable portion of Mr. Storey's duties will consist in acting as an expert adviser in connection with the principal estates in the district, on which the development of forestry is desirable.

THE Earl of Onslow on Friday last, June 24, opened the gardens of the horticultural department of University College, Reading, in his official capacity as President of the Board of Agriculture. It may be pointed out that for some years Mr. Frederick Keeble has given instruction in the principles of horticulture, but only comparatively recently is it that, owing to the kindness of Mr. Alfred Palmer in putting seven acres of land, conveniently placed, at the disposal of the college, justice has been done to the practical side of the work. At the ceremony to which we have referred, the principal, Mr. W. M. Childs, answered the question as to why horticulture is necessary, and gave three reasons:—(1) the enormous increase in scientific knowledge as to the growing of plants; (2) foreign competition; and (3) the training of teachers in connection with rural education. Lord Onslow, in a brief speech, emphasised the remarks of the principal; he dwelt particularly on the third point, and alluded to the need for properly presenting produce to the purchaser. Mr. Martin J. Sutton afterwards said that never before had he attended a meeting at which the teaching of horticulture had received the official recognition of the Government. Seeing the hard struggle which has been made to introduce such teaching of horticulture as gives proper attention to the scientific side, the results which we chronicle are most satisfactory.

THE academic address to the University College of North Wales was delivered on Friday last by Sir Arthur Rücker, F.R.S., principal of the University of London, who chose as his subject "University Organisation in Great Britain." Sir Arthur Rücker traced the various phases through which the university systems of our country had passed, starting with the residential university, represented at the present time by Oxford and Cambridge (and in former days by Stamford). Next in order of development came the purely examining University of London, which led to the formation of provincial university colleges. The federal university came next in the Victoria University and University of Wales. The University of Birmingham represented a new phase, namely, the municipal university, of which at the present time there were two representatives in Lancashire and two in Yorkshire. The impossibility of raising by private subscriptions sufficient funds for the endowment of universities and university colleges resulted in the necessity of Government subsidies, and a great deal more ought to be expected in this direction in the near future. In the further development of university organisation a number of interesting questions would have to be answered. These related to such points as how far Government assistance was to be given to colleges and how far to universities, whether institutions partaking of the character both of colleges and universities should be subsidised under both headings, whether it was desirable to confer on new universities generally the powers of examining external students as provided for in the charter of the Birmingham University, and the extent to which universities subsidised at the same time by municipalities and the Government should be under the inspection of both bodies.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, June 2.—"Colours in Metal Glasses and in Metallic Films." By J. C. Maxwell **Garnett.**

The first part of the paper is devoted to coloured glasses. The phenomena which it seeks to explain were observed by Siedentopf and Zsigmondy.

It is proved in this paper that every medium made up of metal spheres embedded in a non-absorbing substance in such manner that the average distance between two adjacent spheres is much less than a wave-length of light has a perfectly definite colour, depending only on the optical constants of the metal of which the spheres are made, on the refractive index of the substance in which they are embedded, and on the quantity of metal present, but not on the size or distance apart of the spheres.

It is shown that the particles which Siedentopf and Zsigmondy observed in gold glasses are spherical when their diameters are less than 10^{-5} cm. The presence of the metal spheres accounts for the red colour of gold and copper ruby glass, and for the yellow colour of silver glass, and would give a blue-violet colour to "potassium-sodium" glass (potassium-sodium being an amalgam of which the optical constants have been determined by Drude).

Experiments are described proving that these characteristic colours can be produced in a colourless metal glass containing the metal in solution or in combination (the state in the manufacture of gold or copper ruby glass before the second heating) by the β radiation from radium.

The calculated properties of media containing many metal spheres to a wave-length of light account for the changes of colour, for the initial increase in absorption, and for the final change to almost complete transparency which Mr. G. T. Beilby observed during the annealing of gold and silver films. Explanations are given of the changes of colour on heating observed by Prof. R. W. Wood in potassium and sodium films deposited on the insides of exhausted glass bulbs. The increase in strength of colour which was generally observed in the light transmitted by these films when the plane of polarisation of obliquely incident light was changed from that of incidence to a perpendicular position is also explained.

Evidence is adduced to show that the allotropic silvers obtained by Carey Lea are further examples of this type of medium.

"A Method of Measuring directly High Osmotic Pressures." By the Earl of **Berkeley** and E. G. J. **Hartley.** Communicated by W. C. D. Whetham, F.R.S.

This is a preliminary paper describing the authors' method of determining high osmotic pressures. It is as follows:—

A porous porcelain cylinder, glazed only at the ends, has a copper ferrocyanide membrane deposited on its outer surface. The solution surrounds the cylinder, and the inside, which is connected to a graduated glass capillary, is filled with water. By means of a plunger, which works in a steel cylinder and is actuated by a lever and weights, pressure is put upon the solution. So long as this pressure is less than the osmotic pressure of the solution, water from the inside of the cylinder passes through the membrane into the solution, and consequently the water-level in the capillary falls. When the pressure on the solution is gradually increased, the rate at which the level falls gradually decreases, and this continues until the osmotic pressure of the solution is reached; then the level in the capillary is stationary. A further increase of pressure on the solution will then cause the level to rise. The rate of movement of the level in the capillary is a function of the difference between the osmotic pressure and the pressure on the solution, so that by observing the changes in this rate consequent on the corresponding changes in the pressure, the point at which the latter is equal to the osmotic pressure can be deduced. The results of some experiments with cane sugar, extending up to a solution having an osmotic pressure of 45 atmospheres, are given.

The semipermeable membranes are made partly by following Pfeffer and partly by a modification of Morse's electrolytic method. By this means a membrane that withstood 120 atmospheres pressure was obtained.

"On the Electric Effect of Rotating a Dielectric in a Magnetic Field." By Dr. Harold A. **Wilson.** Communicated by Prof. J. J. Thomson, F.R.S.

It was shown by Faraday in 1831 that an electromotive force is induced in a conductor when it moves in a magnetic field so as to cut the lines of force. The object of the experiments described in this paper was to see if a similar electromotive force is induced in a dielectric when it moves in a magnetic field.

According to Maxwell's electromagnetic theory as developed by H. A. Lorentz and Larmor, such an electromotive force should be induced in a dielectric, and should be equal to that in a conductor multiplied by the factor $1-K^{-1}$, where K is the specific inductive capacity of the dielectric.

The method employed was to rotate a hollow cylinder of ebonite in a magnetic field parallel to the axis of the cylinder. The inside and outside surfaces of the cylinder were provided with metal coatings, with which electrical contact was made by sliding brushes. The inside coating was connected to earth, and the outside coating to one pair of the quadrants of a sensitive quadrant electrometer, the other pair of quadrants being connected to earth. The magnetic field was then reversed, so reversing the induced electromotive force in the ebonite. The resulting electric displacement was measured by means of the electrometer, the quantity of electricity required to produce a given deflection of the electrometer needle being determined by means of a small parallel plate guard ring condenser.

The cylinder used was 10 cm. long and $2r_2=4{\cdot}15$ cm., $2r_1=2{\cdot}01$ cm. It was mounted in a solenoid having 95 turns per cm., by which a magnetic field of strength 1500 could be produced. The cylinder was driven by a $\frac{1}{2}$ horse-power motor, and could be run at 200 revolutions per second.

The mean result obtained for the quantity of electricity set free on the outside coating of the cylinder, on reversing the magnetic field, only differs from the amount calculated theoretically by 1 per cent. The specific inductive capacity of the ebonite, as determined by measuring the capacity of the cylinder, was 3·54, while the value calculated from the results obtained was 3·64.

The results obtained are thus in complete agreement with the theories of Lorentz and Larmor, and may be regarded as a confirmation of these theories.

June 9.—"On the Combining Properties of Serum-Complements and on Complementoids." By Prof. Robert **Muir** and Dr. Carl H. **Browning.** Communicated by Sir J. S. Burdon-Sanderson, Bart., F.R.S.

The following are the chief results obtained from the experiments described in this paper. It is, of course, to be understood that they are held to apply only to the cases investigated, viz. the immune-body for ox's corpuscles obtained from the rabbit, used along with rabbit's and guinea-pig's complements and complementoids. Further observations will be necessary to determine whether they obtain generally.

(1) The existence of complementoids in heated sera can be shown in ordinary test-tube experiments, by their preventing (*a*) the union of complement with anti-complement, (*b*) the union of complement with R+IB molecules after lysis.

(2) The amount of complementoid derived from complement as tested by the combining relationships varies; in the case of the rabbit it is approximately equal to the original amount of complement; in the case of the guinea-pig it is considerably less than that amount.

(3) The combining affinity of complementoid, both for anti-complement and for R+IB molecules after lysis, is not much inferior to that of complement.

(4) On the other hand, complementoid has a feeble affinity for R+IB molecules before lysis, *i.e.* for intact red corpuscles treated with immune-body: of the complementoid added only a small quantity enters into combination; hence complementoid does not prevent lysis by complement.

(5) When red corpuscles united with multiple doses of immune-body are lysed by a single dose of complement, the surplus R+IB molecules can be saturated with excess of complementoid, so that almost no complement can subsequently be taken up. This result is obtained also with rabbit's complementoid and guinea-pig's complement, and with guinea-pig's complementoid and rabbit's complement.

"On the Ossiferous Cave-Deposits of Cyprus." By Dorothy M. A. **Bate.** Communicated by Dr. Henry Woodward, F.R.S.

"Further Note on the Remains of *Elephas cypriotes*, Bate, from a Cave-Deposit in Cyprus." By Dorothy M. A. **Bate.** Communicated by Dr. Henry Woodward, F.R.S.

Entomological Society, June 1.—Prof. E. B. Poulton, F.R.S., president, in the chair.—Mr. E. B. **Green** exhibited various insects from Ceylon, including a "carpenter bee" (*Xylocopa fenestrata*, Fab.) and a large asilid fly (*Hyperechia xylocopiformis*, Wlk.) which very closely mimics it; specimens of a Mycetophilid fly and cocoons from which they emerged, showing their beautiful structure; and examples of a tineid moth with remarkable larval cases.—Mr. H. St. J. **Donisthorpe** exhibited specimens of the rare *Tachys parvulus* from the New Forest.—Mr. J. E. **Collin** exhibited specimens of *Mochlonyx velutinus*, a rare British Culicid which he, in company with Messrs. Verrall and Wainwright, had found in numbers near Beaulieu, in Hampshire, on May 22.—Mr. A. J. **Chitty** exhibited an Ophionine ichneumon with the pollen of an orchid firmly attached to the head, making the insect look as though it was attacked by fungus.—Mr. C. P. **Pickett** exhibited long series of *Angerona prunaria* and *Lycaena corydon* showing the remarkable range of variation in both species.—The **President** exhibited specimens of *Paltothyreus tarsatus*, Fabr., an ant belonging to the family Poneridæ, recently received from Dr. S. Schönland, who mentioned that about eight miles west of Palapye Road Station, Cape Colony, he had noticed an awful stench, which, however, passed off after a time. It turned out afterwards that it emanated from these ants living in trees.—The **President** also exhibited a cluster of the green eggs of *Vanessa urticae* fixed to the under-side of a small leaf towards the summit of a nettle-stem. The cryptic resemblance of the eggs to their environment was very remarkable. He then read a note on the courtship and pairing of the species.—Dr. T. A. **Chapman** exhibited two very interesting Erebias caught by the president on the Guadarrama (near Madrid, Spain) on July 25, 1902, at an elevation of about 6000 feet. Though taken together and very much alike, they proved to be of two species, viz. *E. evias* and *E. stygne*, both males. He remarked that the same two species which he found last year in Spain associated together and closely resembled each other, which is not their habit in Switzerland. He also exhibited the ova, larval work, pupæ, and imagines of Anthomyiina, sp., a dipteron that lays its eggs on a fungus, *Epichloe typhina*, Buk., common in June on grass stems. He had often wondered at the curious way of life of this larva, living under a case and burrowing out on the surface of the fungus, making labyrinthine tracks when it ate the incipient spore-bearing layer.—Mr. H. J. **Turner** exhibited several species of the lepidopterous genus Coleophora, and contributed notes on them.—Colonel Charles **Swinhoe** read a paper on tropical African Geometridæ in the national collection.—Mr. W. L. **Distant** communicated a paper entitled "Additions to a Knowledge of the Family Cicadidæ."—The president communicated a paper by Mr. G. F. **Leigh** entitled "Synepigonic Series of *Papilio cenea* (1902–3) and of *Hypolimnas misippus* (1904), together with Observations on the Life-history of the Former," and exhibited specimens to illustrate the same.—Mr. Edward **Saunders,** F.R.S., communicated a paper on Hymenoptera Aculeata from Majorca (1901) and Spain (1901–2).

Zoological Society, June 7.—Dr. F. DuCane Godman, F.R.S., vice-president, in the chair.—A communication from Lieut.-Colonel J. Malcolm **Fawcett** contained descriptions of ten species of butterflies, mainly from high elevations in the north-eastern Himalayas. Eight of them were new species or varieties.—Dr. A. G. **Butler** contributed a paper on seasonal phases in butterflies.—Captain Richard **Crawshay** read some notes on the prey of the lion, and exhibited some tips of porcupine quills that had been found buried in a lion's fore paws, together with the skull and skin of the lion.—Mr. F. E. **Beddard,** F.R.S., read the following papers, based on observations he had made in the society's prosectorium:—(1) Note on an apparently abnormal position of the "brephos" within the body of a skink; (2) contributions to the knowledge of the visceral anatomy of the pelagic serpents *Hydrus platyurus* and *Platyurus colubrinus*; and (3) on the presence of a parasternum in the lacertilian genus Tiliqua, and on the poststernal ribs in that genus.—A communication from Dr. E. A. **Goeldi** contained a description and an account of the habits of the rare rodent *Dinomys branickii*, Peters, specimens of which had recently been received at the Goeldi Museum, Pará.—A communication from Dr. C. **Satunin** contained a description of the black wild cat of Transcaucasia.—A paper was read from Mr. R. **Lydekker** containing the description of a new race of buffalo from East Central Africa. A second paper by Mr. Lydekker contained the description of a new species of deer from Ichang.—Dr. A. Smith **Woodward,** F.R.S., read a paper on two new labyrinthodont skulls which had recently been acquired by the British Museum. One was from the Triassic sandstone of Staffordshire, and the other from a formation of apparently the same geological age in Spitsbergen.

Geological Society, June 8.—Dr. J. E. Marr, F.R.S., president, in the chair.—The palæontological sequence in the Carboniferous Limestone of the Bristol area: A. **Vaughan.** The zonary divisions established are given in a table in the form in which they are finally set out. The corals and brachiopods are chosen as zone and subzone fossils, and genera are selected for zone-indices and circuli (or species-groups) for subzonal indices. To secure definiteness photographic figures are introduced. The relative acceleration of the two groups employed is not identical in different localities, and there is a small relative displacement of one group upon the other. The stratigraphy of all the important sections and isolated exposures in the Bristol area is dealt with. In each case is given a description of the position at which each zone or subzone is exposed and of its lithology, a list of the corals and brachiopods found, and a comparison with the same horizon in other parts of the Bristol area. The author claims that in the area with which he deals, his table of ranges is sufficient to enable any worker to zone any exposure with a considerable degree of accuracy.—On a small Plesiosaurus-skeleton from the White Lias of Westbury-on-Severn: W. F. **Gwinnell.** The matrix of the specimen corresponds

with the White Lias. The remains include more than twenty dorsal vertebræ, with spinous and transverse processes, lying in natural sequence. A pseudomorph of the spinal cord in calcite occurs also in position. Hitherto only single vertebræ or fragmentary bones of Plesiosaurus have been recorded from this horizon in Britain. At present, it has not been found possible to assign the fossil to any existing species.—The evidence for a non-sequence between the Keuper and Rhætic series in N.W. Gloucestershire and Worcestershire: L. **Richardson.** The section at Wainlode Cliff shows a transition in the "bone-bed," from a thin pyritic stratum, crowded with fish-remains, to a micaceous sandstone-bed, usually devoid of such remains and about a foot thick. This sandstone may be called the "bone-bed-equivalent." As the bone-bed can be traced in a single section laterally into a sandstone-bed devoid of those remains, the contemporaneity of the two developments is considered established. Above the main bone-bed the deposits of the Rhætic are persistent, but not below. Black shales are generally present below the bone-bed in Worcestershire, but in places there comes in a sandstone between it and the "tea-green marls." It is found that the greatest thicknesses of the Rhætic rocks under the bone-bed coincide with synclines, and the least thicknesses with anticlines. Thus the earth-pressures recognised in later times were probably at work at the close of the Keuper period. As the area once covered by the waters of the Keuper sea gradually sank, the Rhætic ocean slowly encroached upon the land-surface, and successive overlaps of the several infra-bone-bed deposits resulted.

Physical Society, June 10.—Dr. R. T. Glazebrook, F.R.S., president, in the chair.—Prof. H. L. **Callendar** gave a demonstration of the projection of the indicator diagrams of a petrol motor. The lantern-slides illustrated the working of the motor under various conditions, and were prepared to elucidate the nature of some of the defects which occur in practice. The motor itself was exhibited in action, with the indicator attached, and the actual diagrams were projected on the screen showing the changes of form as they occur when the conditions of running are changed. The motor employed was a Clement-Garrard cycle-motor, with 60 mm. bore and 70 mm. stroke. The engine, like most other internal combustion engines, works on the four-stroke cycle of operations—suction, compression, explosion, and exhaust—and runs at speeds varying from 2000 to 2500 revolutions per minute.—A model illustrating the propagation of an alternating current along a telephone cable, and a simple theory of the same: Prof. J. A. **Fleming.** Although the mathematical theory of the propagation of alternating currents along lineal conductors having capacity, inductance, resistance, and leakage has been developed by many writers in great fulness, the conclusions reached by them have not always been readily assimilated by practical engineers, and in some cases unsound theories have been put forward regarding the conditions limiting telephonic speech along wires. The present paper contains an account of a model (exhibited at the meeting) which has been constructed by the author for the purpose of explaining in a simple manner the physical meaning of the mathematical expressions which are reached in discussing the propagation of alternating currents along a telephone or telegraph cable.—Mr. M. E. J. **Gheury** exhibited a gyroscopic collimator. The instrument is used in connection with an ordinary sextant, the observation being taken as with the sea horizon by bringing the image of an observed body into a field of vision, in which a horizontal grating of a special kind allows the observer to ascertain the direction of the true horizon.

Linnean Society, June 16.—Prof. W. A. Herdman, F.R.S., president, in the chair.—Mr. R. Brooks **Popham** sent for exhibition some calculi from the horse: two of very large size were obtained *post mortem* from a cart-horse employed in hauling coal; a third specimen from the same animal, on being broken, showed the nucleus to be a piece of coal, probably swallowed with its food. Another large stone was associated with many smaller, from a second horse—nearly one hundred in all. The specimens had been obtained from the stomach or intestinal canal of the animals.—Canon F. C. **Smith** sent for exhibition a handsome inflorescence of a scrambling shrub from Freetown, Sierra Leone, in habit resembling our native *Clematis Vitalba*. It proved to be *Rhynchosia calycina*, Guill. and Perr., which is widely spread in tropical Africa, reaching Rhodesia.—On variations in the arrangement of hair on the neck of the domestic horse: Dr. Walter **Kidd.** The author sought to test the validity of the theory that certain phenomena in the arrangement of hair in mammals are produced by mechanical causes. Numerous observations of the changes from a primitive type were figured and described. These changes, being shown to be congenital and of mechanical origin, were held to be instances of the inheritance of acquired characters.—An account of the Jamaica species of Lepanthes: Dr. **Rendle** and W. **Fawcett.**—On blaze currents of vegetable tissues: Dr. A. D. **Waller,** F.R.S. The author showed that these currents were symptomatic of the living tissue, and were not shown by dead organisms. In experimenting upon peas (*Pisum sativum*) the author mentioned the need of access to a garden, in order that the material might be gathered in proper condition, for certain experiences showed that garden produce obtained in the ordinary course from a market had suffered so much from bruising as to be worthless in these experiments.—On British freshwater Rhizopoda: J. **Cash.**—On the place of Linnæus in the history of botany: P. Olsson **Seffer.**

Royal Statistical Society, June 21.—Major P. G. Craigie, C.B., president, in the chair.—In a paper entitled "Observations on the Production and Consumption of Meat and Dairy Products," Mr. **Rew** summarised the conclusions of the committee of the society on both branches of their inquiry. The results suggested that the average consumption per head in this country was, of meat 121·8 lb., of milk 15 gallons, of cheese 10½ lb., and of butter 18½ lb. The meat included 56·8 lb. of beef and veal, 27½ lb. of mutton and lamb, and 36·8 lb. of bacon and pork, but these quantities did not supply all the carnivorous demands of the population, as poultry, game and rabbits, as well as what butchers termed the "fifth quarter," were not included. In the case of milk, allowance should be made for the consumption of separated or skim milk, and also for condensed milk, neither of which was included in the average of 15 gallons. Reference was made to previous estimates, and it was suggested that the home production, both of meat and milk, had increased in recent years, though by no means sufficiently to keep pace with the growth of population. Some figures representing the estimated consumption in certain European countries, in the United States, and in Australasia, were given, and as the result of the comparison Mr. Rew observed that we appear to be well ahead of other European nations in meat consumption, but appreciably behind our American cousins, and remarkably less carnivorous than our Australasian brethren.

DUBLIN.

Royal Irish Academy, June 13.—Prof. R. Atkinson, president, in the chair.—Mr. George **Coffey** and Mr. R. Lloyd **Praeger** read a paper on the Antrim raised beach, in which they discussed the question of post-Glacial oscillations in northern Ireland, their extent and age. Their conclusions point to a submergence, of which the later part amounting to at least 20 feet, is early Neolithic in age, followed by an emergence of some 30 feet, which is later Neolithic, the only post-Neolithic movement being a slight submergence. The area affected by these movements embraces northern England, southern Scotland, and northern Ireland. Beyond this area, the Neolithic emergence appears to be absent.

PARIS.

Academy of Sciences, June 20.—M. Mascart in the chair.—Emanations and radiations: M. **Berthelot.**—On stability of equilibrium: Paul **Painlevé.**—On a new carbide of molybdenum, MoC: H. **Moissan** and K. **Hoffmann.** Molybdenum resembles tungsten and chromium in forming more than one carbide. The compound MoC described in the present communication is formed by heating molybdenum, aluminium, and lamp black together in the electric furnace. It is crystalline, harder than quartz, is attacked by acids with difficulty, except nitric acid, and is not decomposable by water.—The influence of discontinuity of muscular work on the energy expenditure: A. **Chauveau.**

—On the general theory of fundamental functions: W. **Stekloff.**—On the theory of spherical functions: Niels **Nielson.**—On the exceptional case of M. Picard and multiform functions: G. **Remoundos.**—On the construction of aërostats: Ch. **Renard.**—On the refractive powers of dissolved substances: approximate laws: C. **Chéneveau.** Generalisations of the experiments made by the author and by Dijken. It is shown that there is a constant ratio between the molecular refractive power of substances in solution and the square root of the molecular weight.—On the spectrum of calcium fluoride in the electric arc: Ch. **Fabry.** Most salts introduced into the electric arc give only the spectrum of the corresponding metal, but this is not the case with the fluorides of calcium, barium, and strontium. In this case, besides the spectrum of the metal, there is a brilliant band spectrum, which probably arises from the undecomposed fluoride. All the bands can be represented by equations of the form $N = B - Am^2$, in which N is the frequency, A and B constants, and m an integer.—The direct study of the transport of ultramicroscopic particles by the current: A. **Cotton** and H. **Mouton.** The motion of minute particles of colloidal silver has been studied under the microscope. Under the influence of an alternating current the particles are set in vibration, the period of which corresponds to the frequency of the alternating current.—The action of a magnetic field upon the n- and n_1-rays: Jean **Becquerel.** The action of the n- and n_1-rays upon feebly phosphorescent calcium sulphide is not produced when the bundle of rays passes through a magnetic field normal to the lines of force, but the action is transmitted without alteration parallel to the field.—An attempt at a photographic method for studying the action of the n-rays upon phosphorescence: E. **Rothé.** Owing to the difficulties experienced by many experimenters in obtaining definite results with a phosphorescent screen, it is obviously preferable to use an objective method if possible. An account is given of a photographic method.—Influence of the colour of luminous sources on their sensibility to the n-rays: C. **Gutton.** The sensibility of phosphorescent substances varies greatly with their colour. Calcium sulphide with violet phosphorescence is the most sensitive; the sulphides of the alkaline earths and sulphide of zinc, which possess a green phosphorescence, are less sensitive, and with sulphides possessing an orange phosphorescence no effect has been observed with the n-rays.—Remarks on a note of P. Villard on the magnetokathodic rays: H. **Pellat.**—On the electrostatic deviation of the magnetokathodic rays: Ch. **Fortin.**—The continuous registration of gaseous ionisation and of radio-activity by methods of loss of charge: Charles **Nordmann.** An electroscope is connected to the poles of a high voltage battery through a high resistance. Under the influence of the ionised gas the electroscope tends to lose a certain quantity per second, and this is balanced against the quantity coming in through the resistance from the battery. It is shown that the apparatus can be arranged to give the number of ions in the gas studied by a single reading.—On the properties of recently prepared gases: Eugène **Bloch.**—New researches on the cementation of ordinary and special steels: Léon **Guillet.**—On the production of isomorphous mixtures of lime and lithia: P. **Lebeau.** A mixture of the carbonates of lime and lithium decomposed by heat in a vacuum leaves a well crystallised residue of the mixed oxides, the composition of which depends on the temperature and duration of heating. The formation of mixed crystals of lime and lithia renders probable a cubic form for the latter substance.—The electrolytic separation of nickel and zinc: MM. **Hollard** and **Bertiaux.** In the presence of ammonium nitrate the nickel only is deposited. Experimental data are given showing that the separation is complete.—The alloys of magnesium with aluminium and antimony: Hector **Pécheux.**—The formation of dimethylisopropylcarbinol in the reduction of acetone: G. **Denigès.** In addition to isopropyl alcohol and pinacone, the usual reduction products obtained from acetone by reduction with sodium, the author has been able to isolate the above tertiary alcohol. The yield is small.—Syntheses in the pentamethylene series; the diamylene of pentane-diol: 1 : 5-diiodo- and dibromopentane: J. **Hamonet.**—The condensation of phenols and aromatic amines with benzylidene-aniline: Charles **Mayer.**—On the normal presence of formaldehyde in products of combustion and in smoke: A. **Trillat.** A small amount of formaldehyde is always formed in all combustions, even of hydrocarbons. The author regards this as a confirmation of the results of A. Levy and Henriet on the presence of traces of formaldehyde in atmospheric air.—Addition compounds of rosaniline salts; their dissociation, thermochemistry, and constitution: Jules **Schmidlin.**—Researches on the azo colouring matters derived from 2 : 2-dinaphthol: Emm. **Pozzi-Escot.**—On the existence of an oxidising-reducing diastase in plants, and the conditions of its action: J. E. **Abelous.**—On the classification of the Anthozoa: Louis **Roule.**—Parallel adaptation of the host and parasite under the same conditions of existence in certain Lepidoptera and their parasitic Diptera: J. Kunckel **d'Herculais.**—On the early state in some palms: C. L. **Gatin.**—On the geology of the neighbourhood of Barcelona, Spain: Jaime **Almera** and Jules **Bergeron.**—The Coal-measures in the north of Africa: Ed. **Bureau.**—The molecular weight of glycogen: Madame Z. **Gatin-Gruzewska.** The lowering of the melting point observed by Sabanejew for glycogen was due to the presence of impurities, since determinations on the purified substance give a scarcely appreciable lowering. The molecular weight of glycogen from these determinations cannot be lower than 140,000.—Studies on the action of maltase. Constancy of the ferment: influence of the products of the reaction: Mdlle. Ch. **Philoche.**—Contribution to the study of the formation and elimination of urea in man: H. **Labbé** and M. **Morchoisne.**—On the action of blood rendered hepatotoxic by intraperitoneal injections of the nucleoproteids of the liver: H. **Bierry** and André **Mayer.**—On the progressive ripening of cheese: M. **Lindet** and Louis **Ammann.**—Oceanography of the region of the Azores: M. **Thoulet.**

CONTENTS.