THURSDAY, DECEMBER 26, 1912.

AMERICAN ANTHROPOLOGY.

Putnam Anniversary Volume. Anthropological Essays Presented to Frederic Ward Putnam, in Honour of his Seventieth Birthday, April 16, 1909. By his Friends and Associates. Pp. viii + 627. (New York: G. E. Stechert and Co., 1909.)

THIS is a spacious, richly illustrated volume, finely printed on Normandy vellum, consisting of twenty-six valuable contributions to anthropological knowledge, a noble tribute in substance and form rendered by friends and associates to a master. To the true master nothing could be more delightful than an exhibition of excellent work done by those who live in his light and follow his leading. Few and brief are the biographical and eulogistic remarks about the recipient of this magnificent birthday present, but one feels his presence throughout the book, and no formal eulogy could have been more eloquent than the last paper in the series, "Bibliography of Frederic Ward Putnam," by Frances H. Mead. In addition to very extensive "Editorial Labours," a list is given of 404 items of publications. *Si monumentum requiris, circumspice.*

The papers are formal scientific reports, and a bare list of titles and authors should serve a useful purpose:—The archæology of California, by A. L. Kroeber; ancient Zuni pottery, by J. Walter Fewkes; pottery of the New England Indians, by Charles C. Willoughby; the Seip mound, by William C. Mills; the fish in ancient Peruvian art, by Charles W. Mead; a study of primitive culture in Ohio, by Warren K. Moorehead; cruciform structures of Mitla and vicinity, by Marshall H. Saville; conventionalism and realism in Maya art at Copan, with special reference to the treatment of the macaw, by George Byron Gordon; the exploration of a burial room in Pueblo Bonito, New Mexico, by George H. Pepper; tribal structure: a study of the Omaha and cognate tribes, by Alice C. Fletcher; the dates and numbers of pages 24 and 46 to 50 of the Dresden codex, by Charles D. Bowditch; notes on religious ceremonials of the Navaho, by Alfred Marston Tozzer; certain quests and doles, by Charles Peabody; a curious survival in Mexico of the use of the Purpura shellfish for dyeing, by Zelia Nuttal; Gotal, a Mesalero Apache ceremony, by Pliny Earle Goddard; the Cayapa numeral system, by S. A. Barrett; stature of Indians of the south-west and of northern Mexico, by Aleš Hrdlička; notes of the Iroquois language, by Franz Boas; outlines of Wintun grammar, by Roland B. Dixon; a new Siouan dialect, by John R. Swanton; primitive industries as a normal college course, by Harlan I. Smith; a visit to the German Solomon Island, by George A. Dorsey; the Pillars of Hercules and Chaucer's "Trophee," by G. L. Kittredge; notes on the Irish practice of fasting as a means of distraint, by F. N. Robinson; Dusares, by C. F. Toy; and the bibliography already mentioned.

It is very curious that with one exception the authors avoid the important matter of pre-Columbian periods and dates. They give excellent measures and oriented plans, with scarcely a word to show why such measures should be carefully made at all. The British archæologist thinks first and foremost of dates; in America the whole subject seems to be left very much in abeyance. About the only reasoned estimate of pre-Columbian times is given in the paper on primitive culture in Ohio. There three distinct types of culture have been made out, one of which is thought to be "at least eight hundred years old" (p. 147). The author remarks: "The natural history method applied to a study of these sites will go far towards establishing their age." This reveals "the open mind." On the whole, the restraint exercised by the writers in the matter of time-measuring is a very hopeful sign, and when Americanists will seriously consider the meaning of the coincidences and harmonies which lie on the very surface of most of the papers in this volume, their treatment of the facts will be as unhampered by badly informed traditions as that of the present facts discussed certainly is.

There are here and there some misprints, and there is one very serious defect to be mentioned. Here lies buried in Normandy vellum an encyclopædic mass of fresh facts of the utmost value, with slight hope of a resurrection. A quarto volume of more than 600 pages without an index!

JOHN GRIFFITH.

CERAMIC CHEMISTRY.

Ceramic Chemistry. By H. H. Stephenson. Pp. vii + 91. (London: Davis Bros., 1912.) Price 6*s*.

EVERYONE interested in the science of pottery manufacture will welcome the appearance of this little handbook. Mr. Stephenson is known to be a practical pottery chemist, and should, therefore, be competent to remove the reproach often made against the English that they have contributed little or nothing in the way of

scientific text-books dealing with the practical side of pottery, though France, Germany, and the United States have each in turn shown great activity in this special department of work.

We must, however, confess to a little disappointment with the work, for, instead of a reasoned, adequate discussion of the many problems which beset the potter such as we had a right to expect, it proves to be a reprint, almost without alteration, of a series of articles that appeared rather more than a year ago in the columns of a trade journal. Perhaps it is for this reason that the volume resembles far too much the mere note-book of a diligent student, valuable in its way as a record of salient points and of the latest published work, but more valuable to the writer than to the reader.

We may mention as an example the opening paragraph of chapter ii. :—

"There are numberless varieties of clay, but it [*sic* !] may roughly be divided into ball clay, china clay, and fireclay; or, in other words, plastic clay, non-plastic clay, and refractory clay."

This is certainly very curious information for a potter, considering what a large part the ordinary surface clays of all countries have always played, and still play, in practical work. It is only the modern English earthenware manufacturer who could possibly conceive that such a statement was even approximately true.

On p. 13 we find the statement that "Two properties of clay—plasticity and cleavage—are of prime importance to the potter." Plasticity we understand, but that the cleavage of clay has anything to do with the potter is certainly not proved in the pages of the book.

One might criticise in the same way the chapters dealing with "glazes" and "enamels," where a number of statements are made as if with authority, though, to say the least, they are exceedingly dubious.

In the same way the chapter on industrial diseases does not merit its place, for if it were a true statement of the facts of the case the manufacturers have no defence to offer, whereas it is well known that there are the greatest practical difficulties in adopting the solution of the problem recommended, viz., the use of lead silicates of low solubility in dilute acid mixtures. Mr. Stephenson remarks that "the problem is one of ways and means, the chemistry of the subject being fairly simple." Certainly, for this is only another way of saying that the theory is very simple, but the practice happens to be difficult.

W. B.

TWO BOOKS ON HEREDITY.

(1) *Heredity and Eugenics.* A Course of Lectures Summarising Recent Advances in Knowledge in Variation, Heredity, and Evolution, and its Relation to Plant, Animal, and Human Improvement and Welfare. By William Ernest Castle, John Merle Coulter, Charles Benedict Davenport, Edward Murray East, William Lawrence Tower. Pp. vii+315. (Chicago: University of Chicago Press; London: Cambridge University Press.) Price 10*s.* net.

(2) *Richtlinien des Entwicklungs- und Vererbungsproblems.* By Dr. Alfred Greil. Zweiter Teil: Anpassung und Variabilität, Ererbung und Erwerbung, Geschlechtsbestimmung. Pp. iii+364. (Jena: Gustav Fischer, 1912.) Price 10 marks.

(1) "HEREDITY and Eugenics" consists of a series of lectures delivered at Chicago in 1911 by five of the best-known American students of the subject. It deals with plants, animals, and man, and is intended as a popular exposition of recent advances of our knowledge of heredity. The lecturers had evidently not consulted each other with regard to the parts of the subject to be dealt with by each, with the result that there is some overlapping, but in a book intended for those who have made no serious study of the problems involved, this is not a serious disadvantage. All the chapters are simply and clearly written, and the book is well illustrated with excellent figures. In general the cases chosen are well suited to the purpose, and for the untrained reader the book will give a clear idea of the present state of our knowledge and of its bearing upon practical problems.

The student who has attempted to keep abreast with recent work will find very little that is new to him; everything has been already published elsewhere, usually in an accessible form. To the trained biologist the long chapter by Prof. Tower will probably appear the most interesting; it is in parts difficult to follow, but gives a very useful summary of his large work on variation in Chrysomelid beetles, which to many is probably known only from reviews and abstracts.

The book as a whole appears to us to suffer from one rather serious defect—the dogmatic style in which most of the chapters are written. For a popular audience it is doubtless necessary to be as definite as possible, and to avoid undue emphasis on apparent exceptions which are really easily explicable. But the writers of this volume seem to carry this principle to lengths which may be absolutely misleading, and to confuse fact and inference in a way which almost inevitably tends

to the discredit of the subject. In Prof. Tower's chapter this tendency shows itself chiefly in his references to the faulty methods of other investigators (Kammerer, Woltereck, Sumner, and others are mentioned in this connection), although no clear statement is given as to where the fault lies. The objections may be sound, but it is scarcely fair thus to impugn the accuracy of the work of others without making it quite clear in what the inaccuracy consists.

In some of the other chapters the dogmatic attitude appears rather in the form of leading the reader to believe that problems are completely understood when, as a matter of fact, many points with regard to them remain obscure. This is exemplified in Prof. Castle's short account of sex-determination in Rotifers and Daphnids, and more seriously in some of Prof. Davenport's statements about the inheritance of certain characters in man. That the statements are made in a more definite form than is justified by the known facts is doubtless explained by the necessity of making them clear and impressive to an untrained audience, but it is unfortunate that in preparing the lectures for publication more care was not taken to differentiate between facts which are absolutely known, and inferences which do not as yet admit of rigid proof.

In conclusion, it should be mentioned that the last two chapters include a couple of slips which might mislead the reader: on p. 277 *diabetes insipidus* (which appears to be confused with the common diabetes) is correctly placed among abnormalities which appear to be dominant, but it is stated that two normal parents may have defective children; and on p. 286 the statement is made with regard to recessive abnormalities that "two affected parents have exclusively normal children," where affected children is, of course, meant.

(2) Prof. Greil's book is of a very different character. It is an attempt to show that all the phenomena of development, inheritance, and sex-determination can only be properly considered from the point of view of epigenesis. The word "epigenetisch" appears on almost every page, and much dialectical skill is expended in showing that cases in which some form of predetermination appears to be the natural explanation are really epigenetic in character. The motto of one of the chapters—

> "Was du ererbt von deinen Vätern hast,
> Erwirb' es, um es zu besitzen,"

is the central theme of the book—that the germ only receives inherited tendencies, and that these cannot be studied apart from the manner and conditions of their development. In general, this is of course true, but in his treatment of it the author will seem to many readers to carry his thesis to extreme lengths. Since the development of an inherited tendency is a physiological process, it should theoretically be possible to induce a similar physiological process without any inherited tendency; therefore the inheritance of acquired characters must be possible in certain cases. Although in some cases the presence of a specific sex-chromosome causes the individual to become of one sex, in the absence of a sex-chromosome influences which bring about the same physiological condition in embryonic life will also cause it to be of that sex. Telegony must exist, because the bearing of young of a different breed must cause the mother to become "in a certain sense a hybrid." The whole hypothesis of Mendelian factors must be given up because it savours of preformationism rather than epigenesis. To summarise chapters in sentences of this sort is perhaps scarcely doing the author justice, but they give a fairly accurate idea of his attitude.

The book suffers from the absence of headings to chapters or paragraphs; there is no table of contents and an entirely inadequate index, so that it is very difficult to find out in what part of the book any given subject is treated. The style also is overloaded and difficult to follow. The last 130 pages are devoted to a critical account of theories of heredity, closely printed in exceedingly small type. L. DONCASTER.

PHOTOGRAPHIC ANNUALS.

(1) *The British Journal Photographic Almanac and Photographer's Daily Companion*, 1913. Edited by George E. Brown. Pp. 1448. (London: Henry Greenwood and Co., n.d.) Price: cloth, 1*s*. 6*d*. net; paper, 1*s*. net.

(2) *The American Annual of Photography*, 1913. Edited by Percy Y. Howe. Pp. 328. (New York: George Murphy, Inc., 1912.) Price 75 cents.

(1) ABOUT this time of the year nearly every photographer places on his bookshelf the 1912 edition of his B.J. Year Book, probably well ear- and thumb-marked, and becomes possessor of the 1913 issue, a volume of about equal size and weight. The current work, which is the fifty-second issue, covers 1448 pages, but of these about two-thirds are advertisements, and, as experience has shown, are most useful to both professional and amateur photographers. While the general contents of this well-known annual need no special reference, some notable items in the present issue deal with the important subject of the fitting up of the dark-room by the editor, an excellent and thoroughly practical article on methods of telephotography by Capt. Owen Wheeler, and 120

hints in picture form of "how to do it," being a useful set of wrinkles for the beginner.

Space does not allow us to do more than name such useful items as the year's progress, working formulæ, tables of various kinds, &c., as are brought together in this storehouse of photographic information. Excellent indices make it quite easy to find anything contained in the volume, and the usual price of one shilling makes the issue available to everyone.

(2) The second book has for its object the presentation of a selection of articles on current photographic topics combined with reproductions of numerous specimens of photographic work.

The editor evidently had a very large amount of material to handle, and his selection contained in this volume should meet the requirements of most photographers. The list of contributors is quite large, and the subjects dealt with exceedingly varied, so that the volume forms a series of short essays on many very useful hints in different branches of the subject. The illustrations are good throughout, and the frontispiece is a fine reproduction on buff linen. The last portion of the book is devoted to a typical collection of formulæ and tables selected from the working methods of practical photographers.

OUR BOOKSHELF.

Studies in Light Production. By Dr. R. A. Houston. Pp. iii+115. (*The Electrician* Series.) (London: *The Electrician* Printing and Publishing Co., Ltd., n.d.) Price 5*s*. net.

THE publication in one volume of Dr. Houstoun's papers on artificial illumination will be welcomed by all those interested in that subject. The collection consists of ten chapters which have appeared in *The Electrician*, together with two others. It may at once be said that the contents are not only extremely interesting, but will also serve as a useful and important handbook for lighting engineers.

The intention of the author has been to collect information respecting the various illuminants at present in use for purposes of comparison and with the view of suggesting the lines upon which future progress may be made. Thus we find following the first two chapters (which are devoted to the consideration of the energy spectrum and the black body) a chapter on each of the following light sources: flames, the Welsbach mantle, the carbon glow-lamp, the arc, the Nernst lamp, metallic filament lamps, and the mercury arc. Comparisons of the luminous and radiant efficiencies are given, showing how great improvements in these have been made in recent years. In chapter x. the author discusses the question of the light of the future particularly with reference to the possible use of vacuum tubes containing nitrogen, or, according to Claude, neon by preference. Some very striking figures are given which certainly seem to indicate the probability of great saving of energy by this mode of lighting. Attention is also given to fluorescence, and, although the author advises caution in this case, this also may some day be used.

Chapter xi. is a reproduction of Dr. Houstoun's Royal Society paper on the absolute measurement of light, the proposal being to measure light by means of a thermopile which receives the energy surviving the passage through a suitable filter, *i.e.* one which cuts off the infrared and ultraviolet and is transparent to the various luminous radiations in proportion to their visibilities. Since, however, the data required for this can only be obtained by visual observation, this light measurer is not really independent of the human eye, and therefore scarcely surmounts the colour difficulties experienced in ordinary photometric measurements.

Modern Mine Valuation. By M. Howard Burnham. Pp. xi+160. (London: Charles Griffin and Co., Ltd., 1912.) Price 10*s*. 6*d*. net. (Griffin's Mining Series.)

IN this book the author discusses the fundamentals of mine valuation—a subject too seldom ventilated and too little introduced into the training of mining engineers.

The subject is treated mathematically. The less secure an investment, the greater the interest required; the less an ore-body is disclosed, the greater the insecurity and the greater the interest demanded. According to the author, every occurrence of ore, whether it be but an outcrop untouched or whether it be an underground block honeycombed with exposures, may, by the application of a "risk rate" especially applicable to its condition, be valued mathematically and logically. The descriptions of "positive," "probable," and "possible," as applied to statements of ore-reserve, disappear by this method; each block becomes rated at a present value corresponding to the rate of interest demanded by its sufficiency or insufficiency of exposure. Into this calculation, also, deferment is entered until the mathematical formulæ will overwhelm the mining engineer who took to mining under the idea that observation was the one important faculty to cultivate.

The procedure in calculating the results of sampling is also carefully discussed, and towards the end many useful tables of present values, at various rates of interest, are given. Most of the first portion of this book appeared in *The Mining Magazine* late last year, when its value was increased by the discussion forthcoming from various engineers.

Although some of the views expressed and the novel mathematical treatment may not command entire agreement from his colleagues, they are all assured that his work can only result in putting the purchase and sale of mines upon a more logical footing. A careful reading of this book, though it may be hard to many, will be of interest and benefit to mining engineers generally, each of whom, at some time or another, will find application for some of the points elaborated.

S. J. TRUSCOTT.

Wimbledon Common: its Geology, Antiquities and Natural History. By Walter Johnson. Pp. 304. (London: T. Fisher Unwin, 1912.) Price 5*s.* net.

THE natural history—using the term in its widest sense—of any restricted area has a charm of its own, though it may appeal but to a limited number. A thorough study of the geology, antiquities and natural history of a district is a valuable piece of education, somewhat akin to the study of "types" in biology, and anyone who has pursued such a course will have his interest stimulated, and be in a far better position to enjoy the charms of his own or of a foreign country than had he not done so.

The present book deals with Wimbledon Common, a stretch of moorland and wooded country, in the heart of which it is difficult to realise that Whitehall is but half-a-dozen miles or so distant. An interesting account is given of the geology, botany and zoology of the district, and the antiquarian and historical sides are well done. We have a personal acquaintance with the common and can testify to the general accuracy of the book, and the perusal of it has added much to our knowledge of the district. Mr. Johnson expresses the hope that his chapters may be of service in the cause of "nature study," and we can cordially recommend it for such a purpose. The book is well illustrated with a number of plates and drawings and four maps. R. T. H.

Telephotography. By C. F. Lan-Davis. Pp. xi + 130. (London: G. Routledge and Sons, Ltd., n.d.) Price 2*s.* net.

THE getting of a large enough image of distant objects, or of near objects without an unpleasant proximity to them, is a difficulty that often presents itself to the photographer. A lens of greater focal length is theoretically serviceable in such cases, but the long camera that it would require may not be available, and if provided would often be troublesome to manipulate. This accounts for the popularity of telephotographic lenses. Some of them have the positive and negative elements fixed with regard to each other, and then they differ little, if at all, in their use from lenses of the ordinary simple type. But when the two elements are adjustable with regard to each other, in order to allow of obtaining various sizes of the image, many new problems arise. We therefore welcome this little volume, in which these problems are dealt with in a practical and very concise manner.

The book includes some remarkable illustrations, such as a photograph of Mount Kenya, in British East Africa, taken from a distance of ninety miles, while at the other extreme as to distance is a photograph of an Emperor moth about life size. A short chapter on "telephotomicrography" deals with an application of these lenses that is too often neglected. The magnification conveniently obtainable with instruments at present on the market is always very low, the advantage being in the greater distance between the lens and the object, which improves the perspective and facilitates the lighting.

LETTERS TO THE EDITOR.

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

The Natural Fracture of Flint.

SIR E. RAY LANKESTER, K.C.B., in his learned and comprehensive article in NATURE of November 21, has suggested the various lines of research which it will be necessary to follow if a thorough-going knowledge of the mode of origin, structure, and fracture of flint is to be obtained.

The first two, which are intimately associated with the sciences of chemistry and physics, I am, owing to a lack of knowledge of these subjects, unable to deal with. But having for some time past carried out a series of experiments with flints subjected to natural percussion and pressure, I have been able to discover certain facts which I think may interest prehistorians, and help them to decide with more certainty what is human flaking upon any given stone, and what is not.

In order to provide conditions in which flints would strike each other fortuitously, I could think of no better plan than to get a large sack, and, placing eight or nine stones in it, shake it violently about for some considerable time, and afterwards observe whether any of the flints had been flaked in the process.

For my experiments with pressure I used a converted letterpress and a differential screw-press, with which very considerable pressures were obtained.

The rudimentary character of these appliances may be used by some as an argument against the value of the results obtained, but it seems to me that the nature of a blow does not differ whether it is delivered in my sack, or on a sea-beach, or in a fast-running river. In the same manner, pressure is pressure, whether applied in my presses or under a mass of gravel, ice, or other weight of material.

Moreover, I have noticed that stones found on sea-beaches which have been flaked by the action of the sea exhibit the same characteristics as those resulting from my sack experiment, and I think that the flaking on my specimens will be found to be in accord with that of any stones from any geological deposit which can be proved to have been flaked by fortuitous blows or pressure.

I propose now to give a description of the flaked specimens resulting from my experiments, and to show how, in my opinion, they differ from flints found in various pre-river-drift deposits, and which I and others look upon as having been flaked by man.

I will deal first with those chipped by fortuitous blows in my sack experiment.

(1) Flaking was produced upon stones which were more or less of a wedge shape, the thinnest end of the wedge being that from which the flakes were removed.

In the deposits which we examine we find that the flaked flints are of all and every shape, and this leads us to conclude that man has been the fracturing agent.

(2) The large majority of the fortuitous flakes were short and cut deeply into the stone, showing that the blows which caused their removal had impinged almost directly upon the edge itself. This opinion is supported by the fact that the edge is blunted where blows have fallen upon it.

The large majority of the flakes which have been removed from the stones considered to be human are, in the first place, differently formed and longer, and

were evidently detached by blows delivered *on the side of the edge*.

When flaking flints I find that it is only this type of blow which will produce a sharp cutting edge; I conclude that these were flaked for that purpose, and consequently that they have been fabricated by man for some cutting or scraping purpose.

(3) The fortuitous flakes also nearly always show on their surfaces prominent undulations or ripple marks, caused by the fact that they were detached by blows which struck the edge obliquely (Fig. 1).

As there are 180 angles at which a flake can be removed from the edge of a flint, and as it is only the higher angles which will remove flakes showing no ripple-marks, it is seen that nature has many more chances of delivering oblique blows which detach flakes showing this peculiarity. Observations have shown that as the obliquity of the blow increases or decreases, the visibility of the ripple-marks increases or decreases. It has been found that to detach a flake obliquely is a very difficult task, and that generally in doing so several blows have to be delivered which have the effect of shattering and blunting the edge which is being produced.

It is, however, a very easy matter to detach flakes by *vertical* blows (Fig. 2), and, moreover, by so doing an excellent sharp edge is formed. As the flaked flints I find have been flaked by vertical blows, I conclude that man has been the fracturing agent.

(4) It was also noticed that the fortuitous flakes had been removed by blows falling at different angles to the edge of the stone (Fig. 3).

The method I adopt to arrive at the angle at which the blow fell which detached any particular flake, if the actual bulbar cavity is not visible, is to draw a line down the centre of the flake and at right angles to the ripple-marks, and then to draw two others on each side of and equidistant from the centre one, and also at right angles to the ripple-marks as they curve upwards (Fig. 4).

These three lines must then be continued out until they meet, and the point of juncture will be found to be the spot where the blow fell which detached the flake. The other method is to examine the surface of the flake for those small fissures which result from a blow and "fan out" from the point of impact (Fig. 5).

The flints considered to be "human" show that the flakes have been removed at a *constant* angle to the edge of the flint, and by flaking stones I find that this must of necessity be so (Fig. 6). To try to put an edge on a flint by blows delivered at different angles would be a very troublesome and useless procedure. I also found that the flaked edges of the flints produced in my sack experiment showed a large number of truncated flakes. On one specimen I counted seventeen on one edge 4½ in. long. These truncated flakes are those which have got diminished in size or cut off by the later flaking of the edge (Fig. 7).

In my sack experiment, where the rain of blows is practically continuous, the edge of the flint is continually being re-flaked, and in consequence truncated flakes are formed. On the other hand, the stones I look upon as having been humanly struck do not show many truncated flakes, and, as when flaking flints myself I find it is not necessary to make many such flakes in forming a cutting edge, I conclude that man has been the fracturing agent in the case of these specimens.

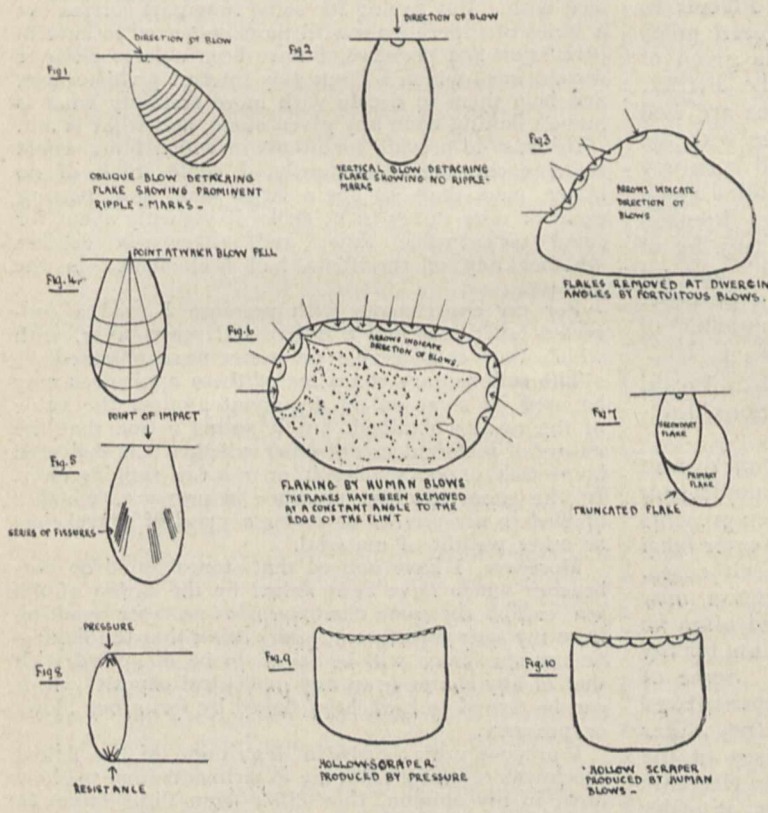
In nearly every flint which I have flaked by fortuitous blows I find that a distinct sinuous edge, similar to that seen upon many Palæolithic and Neolithic implements, is produced, and at first sight might lead to the conclusion that nature can exactly imitate man's work, but an examination of the details of the individual flakes, such as I have outlined above, at once shows that this is not so.

I will now give the results of my experiments with flints under pressure.

(1) I find that when a flint is placed upon the hard floor of the press, and a large amount of pressure exerted upon it with the ram, it will break in half, and that the broken surface exhibits two bulbs, at each point where pressure and resistance acted (Fig. 8).

The bulb which is formed on the side of the flint resting on the floor of the press is always more prominent and better formed than that at the opposite side, where the ram impinged. I am, however, unable at present to say why this should be so. None of the flaked flints found in the pre-river-drift deposits show these two bulbs, and I therefore conclude that man has produced them, because it is impossible to form two such bulbs on one flake by detaching it with a blow.

(2) It was found that if a folded duster or piece of cloth was placed upon the floor of the press, thus giving the flint a soft base upon which to rest, with greater pressure than was needed in the former case, a flake was detached showing only one bulb. This bulb, however, is of a different character from one produced by a blow, being flat and only partly developed, and as I do not find such bulbs on the flints we look upon as "human," I conclude that man



produced those showing on these latter specimens (that is, of course, when they have obviously not been detached by fortuitous blows).

(3) I find that by bringing pressure to bear upon a flint with a sharp edge resting upon a rounded pebble a "bay" can be produced upon the uppermost stone which has the appearance of a "hollow scraper" made by man.

By carefully watching one of these sharp-edged stones in the process of being flaked, it was seen that so long as the pressure was applied the flaking was continued.

The flint was evidently breaking along the lines of least resistance, and very thin flakes being removed, the hollow produced having a totally different appearance from one made by blows.

The reason for this difference was seen to be owing to the fact that as it is impossible to strike the flint near enough to its edge to remove flakes as thin as are detached by pressure, the hollow scraper produced by blows has a rougher appearance because each individual flake has cut deeper into the flint (Figs. 9 and 10). The hollow scrapers which are derived from the pre-river-drift deposits have obviously been produced by blows, delivered at a constant angle to the edge, and it is therefore concluded that man has made them.

It is, of course, possible that these early men in some cases may have edge-flaked their flints by pressure applied with another stone or a bone point, as the later Neolithic people did, but it does not seem likely that this was the case. Experiments were conducted with flint flakes covered by an inch or inch and a half of fine sand in an iron dish, and it was found that the greatest pressure obtainable with the differential screw-press was unable to break them.

A similar experiment was also conducted under the same conditions except that no iron dish was used and the sand was allowed to flow under the pressure. Here again, however, no fracturing of the flint took place. I think these results should induce caution in asserting that large stones lying under many feet of fine sand have been broken by pressure. I found that with pressure-flaking the small fissures in the flint, which are so common in flaking by percussion, are very rare, and I think this is due to the different methods of fracture. Also the surface of a pressure-flake is very seldom so glossy as that produced by a blow, which fact can perhaps be explained on the same hypothesis.

I may say that my experiments were carried through a great number of times with all sorts of flints, and the same results obtained.

In conclusion, I would like to state that specimens demonstrative of all the foregoing experiments are housed in the department of ethnology of the British Museum (Bloomsbury), and can be seen and handled by anyone who wishes to do so.

J. REID MOIR.

12 St. Edmund's Road, Ipswich, November 25.

Excitation of γ Rays by α Rays.

IN a paper shortly to be published in *The Philosophical Magazine*, one of us has shown that when the α rays from radium C impinge upon matter, they excite a small but detectable amount of γ radiation. In continuation of this work a systematic investigation of the radiations from bodies which expel α rays has been commenced. So far the radiations from ionium, radio-thorium, and radio-actinium have been investigated. Working with a very strong source of ionium, we find that, after all radio-active products likely to emit β or γ rays have been removed by chemical treatment, ionium emits, in addition to its α rays, a certain amount of γ radiation, but no detectable amount of β radiation. The amount of γ radiation compared with the total α radiation is much smaller than that emitted by a typical γ ray product like radium C. The amount, however, is of about the same order as that excited by the α rays of radium C in external matter. Since there is no evidence of the existence of a product accompanying the ionium and emitting γ rays only, it is natural to suppose that these γ rays are excited either in the ionium, or in the thorium which is mixed with it, by the α rays.

Analysis of this radiation by means of absorption measurements gave the interesting result that it consists of three types at least. The least penetrating of these consists of a radiation, the absorption coefficient divided by the density (μ/D) of which has a value in aluminium of about 400 $(cm.)^{-1}$, the second of about 8·2, and the third type, which has not been investigated in detail owing to the weakness of the source, of about 0·15, *i.e.* it is of about the same order of penetrating power as the hard γ rays from radium C, viz. 0·04. It will be noticed that the second type has approximately the same value of μ/D as the characteristic radiation of series L excited by X-rays in thorium, as found recently by Chapman. It is therefore natural to suppose that all three types are characteristic radiations of ionium of different series.

We find also that radio-thorium emits γ rays, and also a small amount of β radiation. This radiation has not been studied in as much detail, owing to the rapid formation by the radio-thorium of thorium X and subsequent products, expelling intense β and γ rays. The ratio of the amount of γ to α radiation emitted by radio-thorum is approximately the same as the corresponding ratio for ionium.

The results obtained with radio-actinium, which is the product in the actinium series corresponding to radio-thorium in the thorium series, and to ionium in the uranium series, are very different. Dr. Hahn has shown that radio-actinium emits, in addition to α rays, some soft β rays, and also a radiation which is either a hard β or a soft γ radiation. We have repeated his work, and find that it expels, in addition to soft β rays, γ radiation of two types, the more penetrating of which is of the same order of penetrating power as the hard rays from radium C. The amount of β and γ radiation emitted by radio-actinium, however, is much too large to be ascribed to α rays alone.

It has hitherto been supposed that radio-actinium is a single product, having a period of 19·5 days, but we have succeeded in showing that it consists of two successive products. The parent product has the period of 19·5 days, as found by Hahn, and emits little or no penetrating β or γ radiation, and very probably no α rays. The second product expels α, β, and γ rays, and has a period of about thirteen hours. So far we have not succeeded, by means of a single chemical operation, in separating completely one product from the other, but, by means of a series of operations, we have been able to obtain a fraction of either product free from the other. It is of interest to note that Dr. Geiger and Mr. Nuttall predicted, from their well-known relation between rate of transformation and range of α rays, that radio-actinium probably consists of two successive products, the first of these having the period of 19·5 days, as found by Hahn, and the second giving the α rays and having a period of about one day. It is seen that this prediction was surprisingly accurate.

We intend to continue this work by investigating the γ and β radiations expelled by intense sources of radium, polonium, thorium X, and other α ray products.

J. CHADWICK.
A. S. RUSSELL.

Physical Laboratories, Manchester University,
December 16.

The Prickly Pear in Western China.

MR. F. KINGDON WARD, in a very interesting paper in *Annals of Botany*, October, 1912, describes the occurrence of the prickly pear in the arid regions of western China. He states that it grows on granite rocks, and he has traced it from Kansu through Ssüchuan to south-eastern Tibet and southern Yunnan. He is not able to determine precisely how it got there, but "two suggestions present themselves—the first that it was brought across the Pacific by the Chinese themselves, the second that it was introduced from Europe after it had been brought into the Mediterranean region from across the Atlantic; a third alternative, that it was quite recently introduced by the Jesuit missionaries who came from America to China about the time of the fall of the Spanish Empire, is hardly tenable in view of its present wide distribution in western China." He adds: "There can be little doubt that the Chinese visited California long before Columbus or possibly even the Norsemen discovered America."

Mr. Ward states that the species is *Opuntia vulgaris*, but it seems doubtful whether he critically examined it. If specimens were preserved, the determination of the species would help to decide the question of its origin. The original *Opuntia vulgaris* is the common plant of the eastern United States, which is not likely to have reached China by any of the means suggested. Probably *Opuntia ficus-indica*, sometimes called *O. vulgaris*, is the plant intended. This is the tropical American species, naturalised in the countries bordering the Mediterranean. A plant brought from California would be different, perhaps *O. littoralis*, which is so abundant along the coast of southern California. Would this or *O. ficus-indica* grow in western China and Tibet? Perhaps some more northern plant is represented. In any event, the precise determination of this Chinese cactus would be of much interest.

T. D. A. COCKERELL.

University of Colorado, Boulder, December 2.

ANTHROPOLOGY IN INDIA AND MALTA.[1]

(1) THIS is one of the excellent monographs on the wilder tribes of eastern India which were started by the Government of Eastern Bengal. It may be hoped that the recent changes in the provincial jurisdiction will not interfere with the completion of this project. The present volume is written by an officer who possesses the indispensable qualification of an intimate knowledge of the people. He gracefully dedicates it to Lieut.-Col. T. H. Lewin, whose valuable works have been the standard authority on the people of this district. There is some difficulty about the nomenclature of these tribes, because the terms Kuki, Naga, Chin, Shendu, and many others are not recognised by the people to whom we apply them. Kuki, however, has come to possess a

Photo] [*Lt.-Colonel H. G. M. Cole, I.A.*

FIG. 1.—A rest by the way—on the way to the Jhums. Lushais and Pois. From "The Lushei Kuki Clans."

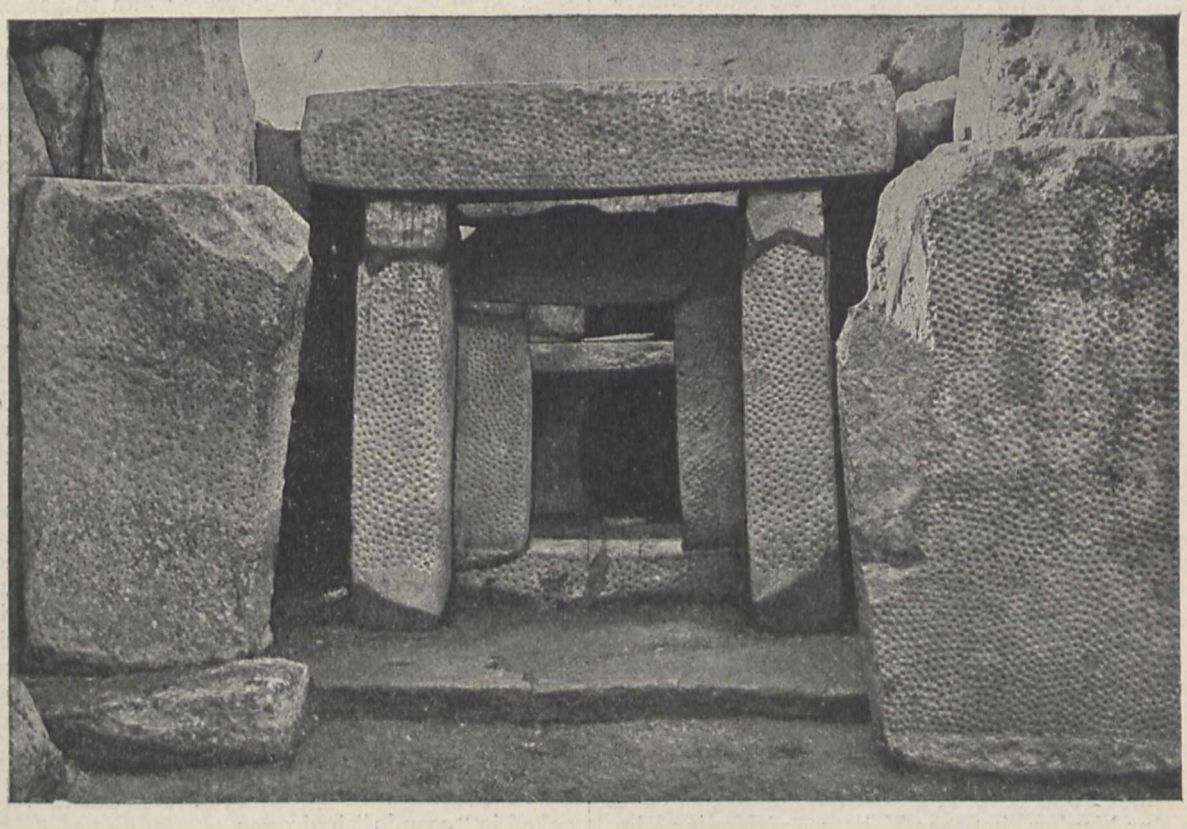
1 (1) "The Lushei Kuki Clans." By Lieut.-Col. J. Shakespear. Pp. xxiii+250. (London: Macmillan and Co., Ltd., 1912.) Price 10*s.* net.

(2) "From the Black Mountain to Waziristan." By Col. H. C. Wylly, C.B. With an Introduction by Lieut.-General Sir H. L. Smith Dorrien, K.C.B., D.S.O. Pp. xx+505+viii maps. (London: Macmillan and Co., Ltd., 1912.) Price 10*s.* 6*d.* net.

(3) "Malta and the Mediterranean Race." By R. N. Bradley. Pp. 335. (London: T. Fisher Unwin, 1912.) Price 8*s.* 6*d.* net.

fairly definite meaning as applied to certain closely allied clans, with well-marked characteristics, belonging to the Tibeto-Burman stock. The name Lushai, which we also use in a somewhat vague, ill-defined way, is an incorrect transliteration of Lushei, the name of a single clan. In this monograph Lushai is used in the wider sense, Lushei being restricted to the clan of that name.

Beginning with a complete bibliography of the published literature, the book follows the order prescribed for the other volumes of the series, with chapters descriptive of the domestic life, laws and customs, religion, folk-lore, and language of the allied groups. It is provided with an excellent collection of photographs, some coloured, with a map and good index. On the whole, the execution is much to be commended, and the monograph will not only be of service to district officers and policemen, but will offer much information useful to the anthropologist.



Photo] [*Mr. T. M Salmond.*

FIG. 2.—View in the Mnaidra, showing pit-markings, dolmen, recess, table, and pillar. From "Malta and the Mediterranean Race."

(2) The north-west frontier of India and its people furnish the most difficult of the many problems which the Anglo-Indian statesman and soldier are compelled to solve. Since the annexation of the Punjab in 1849 these tribes have displayed the most fanatical resistance to our Government. Time after time punitive expeditions have penetrated every part of the wild country which lies between our territories and the kingdom of the Amir of Kabul. Conciliation has been tried without any success, and to-day our relations with these people are as unsatisfactory as they were more than sixty years ago. The only alleviation of this dangerous state of things is that the country has formed a splendid training ground for our troops, that it has developed the gallantry and resource of the British subaltern, and that many of the tribesmen have served with distinction in the armies of their hereditary enemies.

During the course of these expeditions and in other ways, surveys have been made of the borderland, and much information, geographical, statistical, and ethnological, has been collected. But up to the present the Indian Government, with its habitually excessive caution, has decided that these materials should be considered confidential, despite the fact that any foreign State interested in the military problems of India must already, by some underground means, have obtained the necessary information.

The present book, for the first time, provides a *résumé* of some of this accumulated material. But the Indian War Office insisted that the MS. should be submitted to their scrutiny before publication. It begins with a short introduction from the pen of that fine soldier Sir H. Smith Dorrien, and passes on to a general description of the borderland, followed by a series of chapters dealing, each in succession, with a group of tribes, beginning with those of the Black Mountain and ending with the Wazirs. For each tribe or group of

tribes we now have a concise account of their history, customs, and mode of life, a description of their country and the routes by which it can be penetrated, and of the successive expeditions directed against them. Colonel Wylly, who himself knows the ground, has done the work of condensing the material with much discretion and ability, and the book, though in the nature of a summary, is written in a graphic and readable style. It does not profess to give detailed references to the authorities on which it is based, and it is unfortunate that at least a bibliography of the most important literature available for study has not been supplied. A fine set of maps and a good index add to the value of the book. Though from its form it is unlikely to become popular with the general reader, it will be indispensable to the soldier on duty on the frontier and to the student of military history, while for the geographer and the ethnologist it, for the first time, draws aside the veil which has hitherto concealed a most interesting tract of country and tribes which, in spite of their cruelty and fanaticism, possess many admirable qualities. Now that light has been thrown upon them we may learn how to understand them better and establish more satisfactory relations with them.

(3) From its geographical position Malta was necessarily closely connected with that form of eastern Mediterranean culture which finds its most complete presentation in the discoveries made by Sir A. Evans in Crete and by Schliemann at Mycenae and other sites on the mainland of Greece. Hence a monograph summarising the results of the recent important excavations in Malta and a discussion of their relation to those in other parts of the Mediterranean and its border lands will be welcomed by archaeologists. Mr. Bradley has been personally engaged on the work of excavation with Dr. Ashby and the local antiquaries, and is thus in a position to undertake such a task.

In 1910 a prehistoric well tomb was discovered between Attard and Citta Vecchia, where, beneath an upper Punic stratum, human bones mixed with a deep red pigment were found associated with pottery of an early type. About the same time, Prof. Tagliaferro discovered a series of ossiferous caves at Bur Meghez, between Valetta and Hagiar Kim, in which numerous interments, also accompanied by primitive pottery, were unearthed. Perhaps most important of all is the discovery of the Hypogeum at Hal Saflieni, near the head of the Great Harbour. This important megalithic monument consists of two stories, the lower apparently used as a place of storage, being provided with bin-like structures, while above is a sanctuary which seems to have been concealed from public view by a curtain. Mr. Bradley gives a valuable account, accompanied by excellent photographs, of these interesting remains and of the pottery and other objects recovered from them. His theory that the dolmen originated in a cave burial and his survey of the prehistoric pottery deserve attention.

But he has not been content with describing these remains and tracing their analogues in the adjoining regions. The real object of his book, he tells us, is to portray the psychological characteristics of the pre-Aryan population of Europe with a view to explain how a race so highly gifted as the Cretan monuments show it to have been fell almost without a struggle before the Aryan invaders. This is a problem which is obviously only indirectly connected with the archaeology of Malta, though some side-lights useful for its solution may ultimately be derived from the discoveries in that island. But it raises a series of complicated questions, such as the Egyptian, Babylonian, or Phoenician influences in the eastern Mediterranean, the origin of megalithic monuments throughout the world, and so on, for the solution of which he can scarcely claim to possess the necessary qualifications. Such an inquiry is probably much too serious to be undertaken by any single scholar at the present time, and we must be content with a series of monographs dealing with the varied phases of this widespread culture before any comprehensive treatment of the subject as a whole comes to be possible.

NEW HYDROGEN SPECTRA.

IN 1896 Prof. E. C. Pickering discovered a series of lines in the spectrum of the star ζ Puppis which has been attributed to hydrogen in consequence of numerical relationship to the Balmer series ordinarily observed in laboratory experiments. From analogy with other spectra, Rydberg further calculated the positions of lines which would constitute the *Principal* series of hydrogen, and the first line, at 4687·88, has been identified with a line appearing in stars of the fifth type. The ζ Puppis lines have since been observed in the spectra of a few other stars, and because they had not been found in the terrestrial spectrum of hydrogen, even under the most promising conditions, they have commonly been considered to represent a modified form of hydrogen which could only be produced at very high temperatures. Hence, Sir Norman Lockyer gave the name "proto-hydrogen" to the gas which produces the lines in question, while others have called it "cosmic" hydrogen.

A further contribution to our knowledge of the spectrum of hydrogen was communicated to the Royal Astronomical Society on December 13 by Mr. A. Fowler, who has succeeded in producing four lines of the Principal series, three of the ζ Puppis series, and three lines of an ultra-violet series which has not previously been suspected. The new lines were obtained by passing a strong condensed discharge through an ordinary Plücker tube containing a mixture of hydrogen and helium, and it is remarkable that it was not found possible to produce them from hydrogen alone, under apparently identical conditions. At low pressures the lines appeared in the bulbs, close to the junctions with the capillary tube, and were then sharply defined. At higher pressures the lines of the Principal and new series were very bright and broad

in the capillary tube, but the ζ Puppis lines were not observed.

The positions of the observed lines of the Principal series are 4685·98, 2733·34, 2385·47, and 2252·88, all of which are slightly more refrangible than the wave-lengths calculated by Rydberg. Using oscillation frequencies *in vacuo*, the lines are represented by the equation

$$n = 48764{\cdot}0 - \frac{109675}{(m+0{\cdot}999606)^2},$$

where m has the values 1, 2, 3, 4. The wave-length of the first line sufficiently justifies its identification with the high-level line 4685·90 in the chromosphere (Lockyer), the nebular line 4685·73 (Wright), the Orion star line 4685·4 (Pickering), and probably also with 4688 of the bright line stars.

The new ultra-violet series includes strong lines at 3203·30, 2511·31, and 2306·20, which may be connected by the equation

$$n = 48763{\cdot}8 - \frac{109675}{(m+0{\cdot}499506)^2},$$

where m has the values 2, 3, 4. The limit is identical with that of the Principal series, and the new lines are provisionally regarded as forming a second Principal series. Hydrogen is apparently unique in having two Principal series so related. It has so far only been possible to identify three members of the ζ Puppis series, their approximate wave-lengths being 5410·5, 4541·3, and 4200·3.

The investigation is regarded as giving another indication of the probability that there are no special kinds of matter in celestial bodies, and that most of the celestial spectra are reproducible in laboratory experiments.

PELLAGRA.

THE announcement, a few weeks ago, that pellagra has been found in the British Islands is of no slight importance. For, if half-a-dozen genuine cases have been found, we may be fairly sure that many hundreds are waiting to be found. In the United States, it is only five years since Dr. Babcock and Dr. Watson directed general attention to the presence of this disease in their country. We now have clear evidence that pellagra has been found in no fewer than thirty-five States; and several thousands of cases have already been found and noted. In the final stage, the central nervous system is affected, and the patient is apt to become insane; it is possible, therefore, that many cases will be found, by diligent examination, among the inmates of asylums. Still, we have no reason to believe that pellagra has ever been, or will ever be, so heavy on this country as on Italy.

Out of the admirable work done by the Pellagra Commission (1909) came Dr. Sambon's theory that the disease is one of the insect-borne infections, and that the infecting agent is Simulium, one of the "midges." It is a not improbable corollary, with some direct evidence in its favour, that the organism of pellagra is a protozoon, similar in nature to the protozoon of malaria.

Against this theory, based on long and laborious study of the districts where pellagra lies heaviest on the people, there is the old theory that the disease is due to the eating of unwholesome maize: that some bacterial change in the maize causes it to act as a slow poison. Perhaps, in a few years, these opposed theories, which now seem utterly irreconcilable, may be brought nearer together by a new series of observations, at some level which is not yet in sight. Meanwhile, in the general opinion of experts, the old theory—that bad maize, *ipso facto*, induces pellagra—is losing ground. One is reminded of the old theory that the eating of the manioc-root was the cause of the African sleeping-sickness; and one is tempted to think that the maize-theory of pellagra will have the same fate.

Certainly, if a notable number of cases of the disease be found in this country, the maize-theory will become even harder to hold.

The earliest full account, in our language, of the disease is probably the paper by Dr. Sandwith (Brit. Med. Ass. Edinburgh meeting, 1898). His study of pellagra in Lower Egypt is well known to all pathologists. For the facts about pellagra in the United States we have Dr. Niles's recent book, "Pellagra: an American Problem" (Saunders, Philadelphia, 1912), and, with much other literature, two important papers in the Transactions of the Society of Tropical Medicine and Hygiene (January, 1912), by Dr. Stannus and Dr. Sandwith, with a discussion, in which Dr. Sambon and Dr. Chalmers took part. The reference to pellagra in the British Islands is *British Medical Journal*, October 26, 1912.

It is fairly certain that careful collective investigation will bring to light many cases of pellagra in this country, and the experts will perhaps be enabled thereby to set aside the "maize theory," and all modified forms of that theory, and to class the disease with malaria, yellow fever, and sleeping sickness. Still, it is not impossible that the maize theory and the Simulium theory may, by further study of the facts of the incidence and geographical distribution of the disease, be found less hostile to each other than they appear to be at the present time.

NOTES.

WE heartily welcome the new Society for the Promotion of Nature Reserves. Its objects, as officially stated, are as follows:—(1) To collect and collate information as to areas of land in the United Kingdom which retain their primitive conditions and contain rare and local species liable to extinction owing to building, drainage, and disafforestation, or in consequence of the cupidity of collectors. All such information to be treated as strictly confidential. (2) To prepare a scheme showing which areas should be secured. (3) To obtain these areas and hand them over to the National Trust under such conditions as may be necessary. (4) To preserve for posterity as a

national possession some part at least of our native land, its fauna, flora, and geological features. (5) To encourage the love of nature and to educate public opinion to a better knowledge of the value of nature-study. The president is the Right Hon. J. W. Lowther, M.P., the hon. secretaries are Mr. W. R. Ogilvie-Grant and the Hon. F. R. Henley. The temporary address of the society is the Natural History Museum, Cromwell Road, S.W. There is no subscription. The principle of centralising the various efforts already instituted in this country towards the preservation of its "natural monuments" has for some time past been advocated in these columns. The mechanism by which reservation is to be effected has already been put into operation by the acquisition of Blakeney Point in Norfolk. The highly successful scheme which has been worked in Prussia for some eight years is, we may note, governmental, and has a special commissioner, Dr. Conwentz, the pioneer of the movement, at its head. It seems to us that some such close connection with the national executive is essential for the full success of any society, however strong.

AT the Dundee meeting of the British Association in September last the president of the Zoological Section, Dr. P. Chalmers Mitchell, F.R.S., took as the subject of his address, "The Preservation of Fauna." At the close of the meeting the general committee passed on to the council, for consideration, a resolution, which has now been adopted in the following terms:—"That the British Association for the Advancement of Science deplores the rapid destruction of fauna and flora throughout the world, and regards it as an urgent duty that steps should be taken, by the formation of suitably placed reserves, or otherwise, to secure the preservation of examples of all species of animals and plants, irrespective of their economic or sporting value, except in cases where it has been clearly proved that the preservation of particular organisms, even in restricted numbers and places, is a menace to human welfare."

THE news of the death of Mr. Henry de Mosenthal, which occurred on December 18, at sixty-two years of age, will be deeply regretted by those numerous friends and technologists with whom his long association with the well-known firm of Nobels brought him into relationship. Mr. de Mosenthal had acted as technical secretary since the formation of the Dynamite Trust Company in 1886, but his association with Nobels goes back some years earlier. Mr. de Mosenthal became a member of the Society of Chemical Industry in 1888, and two years later he was elected a fellow of the Chemical Society. He contributed to the publications of each, and the series of three papers on observations on cotton and nitrated cotton appearing in the Journal of the former society in 1904, 1907, and 1911 record a large number of valuable determinations of the physical properties of these bodies, especially in solution. In the first contribution he demonstrated that the cuticle of the cotton fibre is extremely porous, that rows of pores and stomata may be observed on the surface under oblique illumination. His experiments also showed that the single cotton fibre exhibited no capillary action, which is contrary to the commonly accepted view, but that several fibres must be in contact before the well-known capillary action became manifest.

THE Paris Société d'Encouragement has received a legacy of 4000*l.*, bequeathed to it by the late M. Osmond.

THE silver medal of the Zoological Society has been conferred on Major J. Stevenson-Hamilton, Game Warden of the Transvaal, in recognition of his valuable services in connection with the King's African collection.

WE learn from *The Times* that a new cancer institute has been established at the Brompton Cancer Hospital, at a cost of some 6000*l.* The importance of X-rays and other electrical methods in the treatment of malignant disease is now fully recognised, and the institute has in its possession an excellent equipment for this branch of therapeutics.

THE director of the Science Museum, South Kensington, informs us that a temporary collection at the museum in illustration of the history of aëronautics and some of the scientific researches which are applied in the design, construction, and use of aëroplanes will be open to the public from December 23 until the end of January.

THE eighty-first annual meeting of the British Medical Association will be held in Brighton next July. The president's address will be delivered on July 22, and the sections will meet on the three following days. Dr. W. A. Hollis, consulting physician, Sussex County Hospital, is the president-elect. The address in medicine will be delivered by Prof. G. R. Murray, physician to the Royal Infirmary, Manchester, on July 23. The address in surgery will be delivered by Sir Berkeley Moynihan, professor of clinical surgery in the University of Leeds, on July 24. The popular lecture will be delivered by Mr. E. J. Spitta on the evening of July 25. The scientific business of the meeting will be conducted in fifteen sections, which will meet on July 23 to 25. These sections, with their presidents, are as follows:—Bacteriology and Pathology, Dr. J. W. H. Eyre; Dermatology, Dr. J. H. Sequeira; Diseases of Children, including orthopædus, Dr. G. F. Still; Electro-therapeutics, Mr. W. D. Butcher; Gynæcology and Obstetrics, Mr. R. Sanderson; Laryngology, Rhinology, and Otology, Mr. A. J. Hutchison; Medical Sociology, Dr. R. J. Ryle; Medicine, Dr. E. Hobhouse; Navy and Army, and Ambulance, Colonel James Turton, V.D.; Neurology and Psychological Medicine, Dr. J. Taylor; Ophthalmology, Mr. T. H. Bickerton; Pharmacology, Therapeutics, and Dietetics, Dr. W. H. Hale; State Medicine, Dr. E. W. Hope; Surgery, Mr. W. T. Thomas; Tropical Medicine, Lieut.-Colonel Sir William Leishman, F.R.S.

THE report of the council of the Scottish Meteorological Society, adopted at the annual general meeting on December 10, shows that during the past twelve months the society's system of observations has been strengthened by the re-establishment on a satis-

factory basis of a station at Braemar, with Mr. A. M. Shirran as principal observer. Observations were originally established there under the direction of the late Prince Consort; a continuous series exists for the period 1856–1905. The Registrar-General for Scotland has been supplied regularly with monthly and quarterly reports from the office of the society, and also, direct from the observers in eight of the large towns of Scotland, with the daily observations of temperature and rainfall required for his weekly reports. The Meteorological Office in London has received direct from the observers at certain stations daily observations of temperature, rainfall, and, in some cases, sunshine for its Weekly Weather Reports. The council regrets to report a shrinkage in the membership of the society, due largely to the deaths of subscribers of long standing. A shrinkage in membership implies a reduction of income, and but for a considerable demand for the society's publications, there would have been a serious deficit for the financial year ending June 30 last. The expenditure of the society has been reduced to the lowest possible limit, but it will exceed the income for the current year unless there is a large accession of new members. The council has lodged an application with the Registrar-General for Scotland for a grant sufficient to defray the entire cost of the reports supplied to him by the society. Mr. J. Mackay Bernard has been elected president for the coming year.

PROF. H. H. W. PEARSON, of the South African College, Cape Town, sends us a copy of a letter from *The Cape Times* of October 29 last, wherein the Hon. A. Wilmot, formerly a member of the Cape Legislative Council, describes the appearance from the deck of ss. *Dover Castle*, then in the southern portion of the Gulf of Guinea, of an object regarded as "the head and neck of a monster—seemingly a serpent—extending at least fourteen feet above sea-level. Mr. Wilmot saw this object, as it pursued its way through the water, six times in the space of about two minutes; and it was independently noticed once or twice by several persons on board. The day, October 17, was exceedingly clear, and, according to Mr. Wilmot, "it is preposterous to talk of five independent witnesses being imposed upon by mistaking porpoises, a flight of sea-birds, seaweed, or cane for the sea monster they undoubtedly did see at a distance estimated at one and a half miles." In the face of this testimony no one will deny that something strange to the passengers, but interpreted as the head and neck of a serpent, was observed by them on the occasion mentioned. But since there is neither sketch nor detailed description of the apparition to help in determining to what class of the animal kingdom it belonged, we venture to suggest that it may have been the upraised tentacular arm of a large kind of pelagic squid swimming near the surface. These arms are long and flexible, and expand somewhat abruptly at the end into an enlargement which at a distance might be mistaken for the head of a snake attached to a slender neck. The size of the object observed is no obstacle to this suggested explanation, since the tentacular arms of some of these gigantic squids reach a length of about thirty feet.

AMONG the Bulletins of the Philosophical Society of the University of Virginia there appeared in July, 1912, a paper by Mr. H. E. Jordan, entitled "Studies in Human Heredity." The characters dealt with are left-handedness, pulmonary tuberculosis, cancer, hermaphroditism, onyxis (ingrowing toe-nails), nephritis, and melancholia. The method of study is the collection of pedigrees, on which a Mendelian interpretation is put with rather too great readiness. It is to be regretted that some care was not taken to describe the actual condition found in each individual. This lack of definite information is particularly noticeable in the case of left-handedness, which occupies more than half the paper. Left-handedness occurs in a variety of forms, and it would have added much to the value of the pedigrees if the author had noted, wherever possible, in what manner it was exhibited. Among the left-handed acquaintances of the present writer one used to write left-handed, but played games right-handed; in the majority this condition is reversed. One was in his early childhood so apt with left hand that he learnt to write with it, and then, having acquired the art of writing clearly and well, he appeared to forget it again; his letters became more and more unformed and slovenly in appearance, until, at the age of six and a half, it was thought better that he should commence again with his right hand. Would Mr. Jordan class all these cases indiscriminately as left-handed?

TO *The Field* of December 14 Mr. Pocock contributes a note, with an illustration, of two long-beaked spiny anteaters now on exhibition in the Zoological Society's Gardens. They form, apparently, part of a consignment of eight recently brought by Mr. Paul Kibler from the Charles Louis Mountains of Dutch New Guinea. In commenting on the height at which the body is carried above the ground—a feature in which these anteaters differ from the ordinary species—Mr. Pocock states that the pose of the limbs should be compared with that of tortoises rather than with that of elephants. The author quotes a letter from the Hon. Walter Rothschild relative to the five races by which the long-beaked species is locally represented in New Guinea.

IN the November issue of the Journal of the East Africa and Uganda Natural History Society reference is made to a decrease in the membership of the society and the lack of sufficient literary matter for the journal, of which only two numbers are in the future to be issued annually. Such want of support is to be deplored, especially in a country so rich in natural history subjects as Uganda. In an article on early man Mr. C. W. Hobley observes that while stone implements are common in Egypt and Cape Colony, they are relatively rare in B.E. Africa; and suggests that this may be due to the sparse population of the country in prehistoric times, when volcanic action appears to have been rife. Most of the implements hitherto found are of a crude type; and if it be true, as some suppose, that Africa was the cradle of the art of working in iron, this industry may have crushed out of existence the manufacture of stone implements, which consequently never attained the beauty and finish characterising those of Neolithic Europe.

THE zoological expedition to the Altai Mountains, Siberia, and Mongolia, organised and carried out by the cooperation of the United States National Museum with the Museum of Comparative Zoology at Harvard, has recently returned to the United States after an especially successful trip of about four months' duration. The expedition was under the direction of Dr. Theodore Lyman, of Cambridge, Mass., and the National Museum was represented by Mr. N. Hollister, of the division of mammals. It was the object of the expedition to collect the mammals and birds of the Altai Mountains, especially the very large wild sheep of this region, and in this respect the expedition succeeded far beyond expectations. Among the small mammals there have been found several new species, diagnoses of which are given in a pamphlet entitled, "New Mammals from the Highlands of Siberia," written by Mr. Hollister, and just published by the Smithsonian Institution, forming publication No. 2157 of the Smithsonian Miscellaneous Collections. The whole collection includes about 750 mammals and birds, among them a fine series of the wild sheep of the Altai region, which is the largest known species of sheep, together with ibexes, gazelles, and other large game. The specimens will be divided between the two institutions interested.

THE U.S. Department of Agriculture has issued (Forestry Service, Bulletin 85) a description of the chaparral, or dwarf forest vegetation of Southern California, by F. G. Plummer. The chaparral, or "elfin wood," is one of the types of stunted forest—a plant formation found in several widely separated parts of the world—and is one of the intermediate forms between a flourishing forest and a desert, representing a condition of balance between certain environmental extremes, a balance at which the growth is dwarfed and the full-grown trees attain only the dimensions of brush, being rarely more than 10 ft. high. It is sharply distinguished in composition from the dwarf forest formations of high latitudes and altitudes on one hand, and from the tropical and subtropical dwarf forests on the other; its dominant species belong to the genera Adenostoma, Arctostaphylos, Ceanothus, and Quercus, though the dominant forms often vary on adjacent watersheds. The memoir includes a discussion of the ecological relations of the chaparral species, the importance of the tree-cover in conserving moisture, the methods of controlling the destructive fires which rapidly sweep the more or less arid vegetation, and the possibility of introducing large tree species; hence it is of interest to the forester and geographer, as well as to the botanist.

ANOTHER text-book, modestly styled a "Guide to the Collection of Gemstones in the Museum of Practical Geology," has been issued by that museum (obtainable through any bookseller from T. Fisher Unwin, London, price 9d.). Mr. W. F. P. McLintock here describes the properties of gems, with an excellent account of the influence of refractive index and internal reflection, and of the mysterious nature of colour. Eight pages are devoted to artificial gems. In the descriptive portion, euclase, benitoite, and variscite take their place as gemstones.

OBERLEHRER L. WUNDER, of Sendelbach bei Lohr, has published separately, through Teubner of Leipzig (price 1.50 marks), his observations on the Kerlingarfjöll and other highlands in Iceland. He has determined barometrically, with due precautions, a number of heights for the first time, and is able to correct some features of the current geological map of the country. His observations on the rapid variations of glacier-streams as the comparatively feeble sunlight waxes or wanes are of considerable interest. In the Hofsjökull a true ice-dome of the Norwegian type is encountered, with marginal glacier-tongues.

THE continued interest taken by geologists in the origin of the British Triassic strata has been more than once noticed in these columns. Mr. T. O. Bosworth has now published, though the Leicester Literary and Philosophical Society, his researches on "The Keuper Marls around Charnwood" (Leicester: Thornley and Son). Particular attention is paid in this excellently illustrated volume to the rock-surfaces exposed by quarrying beneath the Trias, and to the blocks from these surfaces carried into the marls by weathering agents in Triassic times. More than 40 per cent. of calcium and magnesium carbonate has been found in some of the marls. The author believes that the red marls accumulated in comparatively deep standing pools, the alternating grey bands representing coarser matter swept in from the desert areas during rains.

PROF. S. PASSARGE has written, as a part in the *Mitteilungen* of the Geographical Society of Hamburg (Hamburg, L. Friederichsen and Co., 1912), an elaborate survey of morphological geography, which he endeavours to classify with the same precision as a department in zoology. His method can be indicated by quoting an example. In systematic morphology the two "types" are land-forms and coast-forms. In the first of these, volcanic-forms make the second order in the class of endogenous forms, and this order is divided into the family of intrusions and eruption-forms, the latter being separated into one genus (*Gattung*) of explosive discharges and another of effusive discharges, the second consisting of the following specific forms: dome-volcanoes, shield-volcanoes, and flows. This has a very orderly aspect, and examples may be found which can be easily fitted into the several pigeon-holes, but most volcanoes of any size are composite in character, built up of discharges of scoria and flows of lava, and traversed by dykes and other intrusions. To draw hard and fast lines is more difficult in geography than most other branches of science, and, although some technical terms are necessary, it is doubtful whether they can be very precisely defined. Prof. Passarge's work is an example of German thoroughness, with perhaps a corresponding tendency to over-classification, and it will be found, we think, more useful to teachers than to students, for the latter may find that minute attention to the trees rather hinders them from seeing the wood.

DR. PHILIP EREDIA sends us a useful discussion, entitled "The Diurnal Variation of Temperature in Italy" (excerpt from the Annals of the Central

Meteorological Office, part i., 1912). The investigation is based on observations from 1892–1906 at 120 stations, at which no interruption had taken place during the period. The tables include monthly, seasonal, and yearly mean values of the daily maxima and minima, and of their difference (or mean daily range), each being separately treated, except in the annual summary. This special treatment of the various data, especially of the daily range, is of considerable climatic interest. The author also gives, for all stations, the value for each month and season of the varying coefficient involved in Kämtz's formula for obtaining true daily means of temperature. Among many useful results it is noted that, generally speaking, the effect of latitude is not very distinctly shown in the annual values of the maxima and minima, owing to the many local influences at work. The annual range is greatest in the interior, especially in Upper Italy, where, proceeding inland from the Adriatic coast, constantly increasing values occur.

THE International Geodetic Conference, which met at Hamburg in September last, among other important questions discussed the subject of the precision of a level network, and laid down a new standard of accuracy for "nivellements de haute précision." Such a standard will doubtless prova of great value to the directors of large surveys plannning new levelling work, and it will be interesting to see a detailed discussion of the errors of an actual reseau compared with the limiting errors calculated from the formulæ approved by the conference. Short of this, it is not possible to institute a strict comparison between the two, but it would appear that good modern work, such, for instance, as the Indian Survey Department's precision levelling, falls well within the prescribed limit. The thanks of all geodesists are due to Lieut.-Col. Lallemand for the trouble he has taken in this matter, and for his long-continued and most valuable contributions to this branch of geodesy. Pending the publication of the conference volume, a summary of the formulæ in question will be found in the *Comptes rendus* of the Paris Academy of Sciences for October 14, 1912.

THE indefatigable and distinguished seismologist, Dr. F. Omori, in vol. v., No. 7, of the Japan *Astronomical Herald*, has branched off on a new line and given us an interesting and instructive article on the variation of latitude and changes in the mean sea-level of Japan. First we are introduced to a table which gives in millimetres mean sea-level in successive years at nine stations round the coast of Japan. A glance at this shows that although sea-level during twelve months may have increased at one station, at other stations during the same period it may have decreased. The greatest fluctuations appear to have taken place at Misaki, which lies just outside the Bay of Yedo. In 1897 the sea-level at this place remained constant, but by 1909 it had risen 166 millimetres. An annual average value of the records of nine stations, when they are plotted on squared paper, show that sea-level was low in 1897 and 1902, but it was high in 1899 and 1905. Beneath this diagram Dr. Omori has given a curve showing changes in latitude as observed at Tokyo and Mizusawa. The resemblance between these two diagrams is very striking, and from them it appears that a variation of 0″·1 in latitude is accompanied by a change of 42 millimetres in sea-level.

A PAPER on searchlights for the mercantile marine, read before the Manchester Literary and Philosophical Society by Dr. Henry Wilde, F.R.S., on May 7, was reported and commented upon in the issue of NATURE for May 30 (vol. lxxxix., p. 325). On November 12 Dr. Wilde returned to the question in a paper, entitled "On Searchlights and the *Titanic* Disaster," which he read to the same society. In this paper he passes in review the evidence given in connection with the use of searchlights in the report on the loss of the *Titanic*, and also the statements in the report of the Merchant Shipping Advisory Committee of the Board of Trade. After considering these reports, Dr. Wilde concludes his paper thus:—"In view of the facts brought out by the several committees engaged in investigating the causes leading to the loss of the *Titanic*, it only remains for me to repeat and to emphasise the statement made in my paper read before the society in May last, that the ultimate responsibility of a calamity which the world deplores rests upon the British naval authorities through their fatuous policy of excluding searchlights from the Mercantile Marine."

IN the *Journal de Physique* for November, M. J. Bosler, in a paper on the relations between magnetic storms, earth currents, and solar eruptions, puts forward a theory of the production of magnetic storms which he believes to be new. He was, it appears, led to it by finding that the horizontal component of the disturbing force in a magnetic storm is on the average at right angles to the direction of the earth current observed at the same instant at the same station, and that these currents flow at each station in a direction which is nearly constant. At Parc Saint Maur, near Paris, for example, the direction is in general from north-east to south-west. M. Bosler considers these currents the cause of magnetic storms, and explains them as due to the expression for the magnetic induction through the earth having in it a variable term owing to electrified matter projected from the sun. This variable term would result in an electric current about the earth which in turn would produce a magnetic disturbance. Unfortunately, the author does not indicate how the term expressing the variable induction arises, nor does he trace the consequences of his theory any further. It seems, for example, to demand that magnetic storms should be most intense at any instant in the great circle perpendicular to the variable magnetic induction, a conclusion which might have been tested by comparison with observations.

PROF. C. RAVENNA and Mr. G. Bosinelli describe in the *Atti R. Accad. Lincei* (vol. xxi., ii., 355) further experiments to ascertain whether the traces of hydrogen cyanide found in young plants exist therein in the free state, or solely in the form of cyanogenetic glucoside from which they are liberated by the action of an enzyme under the conditions of making the test.

The experiments were carried out with cherry laurel, *Phaseolus lunatus*, and germinating almond, and instead of using boiling dilute alkali to kill the plants, as in former experiments, concentrated salt solutions boiling at 110° were employed; in this way the plant enzymes were more rapidly destroyed, with the result that the amount of hydrogen cyanide indicated was thereby considerably diminished. It is thus considered probable that free hydrogen cyanide does not occur as such in the plant.

REPORT OF THE DEVELOPMENT COMMISSIONERS.

THE second report of the Development Commissioners, for the year ended March 31, 1912 (Wyman and Sons, price 8*d.*), was issued recently. It will prove convenient to review the report briefly under the chief headings contained therein.

General Position of Commissioners and Principles of Action.—As previously announced, the Commissioners cannot themselves make grants or loans, do not possess executive powers, and must receive applications through Government departments before reporting to the Treasury. It is gratifying to learn that the recommendations of the Commissioners have been adopted in all cases of importance. Owing to the fact that money must be entrusted to some suitable body, difficulties have arisen with regard to canals, roads, and some other matters coming within the scope of the fund, but it is expected that such difficulties will ultimately be overcome. The system of block grants has been adopted, which, though entailing some delay, is held to secure greater efficiency.

Although existing expenditure is not to be relieved, and local contributions are required, it is felt that authorities which have spent freely in the past should not be expected to find so large a proportion of the total sum to be expended in their areas as authorities which have been less enterprising.

The principle of loans is adopted for schemes expected to give a direct return ultimately. In some cases, such as afforestation, advances will be made on condition that the extent of the operations be varied according to the state of the labour market, so that some relief of unemployment may result. This does not apply to such part of the 325,000*l.* allotted to farm institutes as may be required for erecting buildings, these being urgently necessary.

The principle that the fund must not be used to benefit private individuals directly creates difficulties in the case of canals, estate afforestation, and light railways; for grants are here debarred, although private profits are associated with public benefits of an important kind. A different view must be taken of applications from public authorities for money to be applied in loans or grants to individuals, *e.g.* to fishermen. Such loans or grants would appear to be legitimate if they place individuals in a better position to help themselves, as in the case of advances enabling fishermen to acquire motor-boats.

The Commissioners consider it their duty to recommend expenditure when and where most likely to be remunerative with reference to the economic development of the United Kingdom as a whole, even though this may appear unfair to certain localities. The provision of harbours for steam-drifters, for example, is regarded as more important than the development of small centres employing more antiquated methods of catching fish.

I. *Agriculture and Rural Industries.*—Three chief lines of action are reaffirmed as those of greatest importance, *i.e.* scientific investigation, research, and education as means of improving the quality and increasing the amount of agricultural products; supply of information regarding new crops and industries to cultivators for enabling extended practice; improvement of commercial methods by promotion of cooperation.

It is considered that pure research is not a local matter, and that it must be continuous and concentrated. Hence the selection of a comparatively small number of centres for research in the eleven main branches of agricultural science. It is recognised that research and education should be in close touch with one another, and although the fund is to be devoted to economic development, the Commissioners feel that when subsidising research the canon of apparent economic value should be cautiously applied.

In addition to grants to institutions, a sum of 3000*l.* per annum (probably to be increased to 5000*l.*) is reserved for individual investigators much on the lines adopted for the 4000*l.* per annum entrusted to the Royal Society for distribution. In this way it will be possible to utilise individual research ability wherever found. For purposes other than research England and Wales are to be divided into twelve provinces, each with its agricultural college providing the highest kind of agricultural education, demonstrating the results of research, and giving advice to farmers. The lower grades of instruction and advice will be provided by the farm institutes. The Commissioners consider that such an institute should possess two essential characteristics: first, the provision of shorter, simpler, and cheaper courses than those given at colleges; secondly, that it should serve as the headquarters of the county staff. A very large amount of elasticity is regarded as desirable, and there need be no "material embodiment in bricks and mortar." The general lines approved closely resemble those advocated at the cooperative conferences held between the governors of the Royal Agricultural College, Cirencester, and representatives of several county authorities in 1911.

Flax, hemp, tobacco, and beet are cited as crops requiring full investigation in order to determine whether they can be made a commercial success in this country.

The existing voluntary societies are to be utilised in organising cooperation, largely because "cooperation is particularly the kind of movement to which it is essential to retain the enthusiasm of voluntary workers." Considering the enormous amount of dairy and other farm produce imported, it is distressing to learn that "the question of agricultural cooperation in Ireland is unfortunately complicated by political differences." Other directions of activity include the continuance of light horse breeding schemes, the establishment of a cattle-testing station, and of a national poultry institute.

II. *Forestry.*—One guiding principle is here adopted, *i.e.* that "education and the provision of technical advice are the best lines of advance for the immediate present." This general idea is given effect by the recognition of five centres in England and Wales (Oxford, Cambridge, Cirencester, Bangor, and Newcastle), with suitable provision for Scotland and Ireland. Why the Commissioners consider that Oxford and Cambridge should be equipped for "higher education in forestry," and the other three centres for "forestry education of a simpler kind," is a mystery, without some reason for believing that the education so far given at Oxford and Cambridge has been

superior to that obtainable elsewhere. The two older universities are also to be the chief centres for research.

The Commissioners further approve of loans to local authorities for afforestation of suitable land, *e.g.* water catchment areas.

Some advance has been made in matters comprised under the remaining headings of the report, namely :—

III. *Land Drainage and Reclamation.*—One Irish scheme (Owenmore) approved.

IV. *Rural Transport.*—Considering the vital importance to small holders and others of this matter it is astonishing to find that only a very few applications, all Irish, have been received. No grants were recommended.

V. *Harbours.*—The Commissioners make a number of important recommendations, on the lines indicated in an earlier part of this review.

VI. *Inland Navigations.*—Technical difficulties retard this direction of advance, but loans are recommended for improvement of the Stort and Upper Medway.

VII. *Fisheries.*—Substantial grants to various authorities are recommended, partly for scientific research, and partly for improvement of harbours, and other purposes. Concessions to Irish fishermen by way of loans are also recommended.

VIII. *Miscellaneous.*—An application by the Meteorological Office was not entertained.

IX. *Compulsory Orders for the Acquisition of Land.*—Only one small and unimportant order has been made.

Within the limits of our space it is impossible to deal with the last part of the report, which is devoted to finance, but it is stated that in all cases the Commissioners "have tried to follow sound principles of finance and administration, to take a broad view of the questions involved, and to avoid any haphazard and spasmodic distribution of public money."

The Commissioners may be congratulated on having made very considerable progress during the year, and the principles of their action appear to be fairly sound, though they are somewhat handicapped by the unusually small proportion of scientific experts to be found among them. It is, however, very gratifying to know that the whole time of Mr. A. D. Hall is in future to be given to development work. Now and then we find that a sound principle advocated is not worked out satisfactorily in practice by the responsible authority. For example, on p. 11 of the report we read that the grants available from various resources "will provide for utilising to the full the energies of the Agricultural Colleges in teaching, in research, and in giving technical advice to farmers on practical difficulties involving problems which are beyond the scope of either an experienced agriculturist or even a member of the County Staff." Yet a grant of 1000*l.* per annum for advisory work in horticulture and agriculture has been made to the University of Bristol, none of which has been allocated to the associated Royal Agricultural College at Cirencester, the pioneer institution, accustomed to give the kind of advice contemplated for nearly seventy years. The progress made as regards cooperation and rural transport is disappointingly slow, considering the great importance of these for enabling farmers to cope with foreign competition, but the Commissioners can scarcely be blamed for the delay. Ultimately, we may hope to see a substantial reduction in the enormous sums paid to foreign countries for agricultural products.

RECENT PUBLICATIONS ON THE FERTILITY OF THE SOIL.

RECENT inquiries have shown that the fertility of agricultural land in Europe has very materially increased owing to the use of commercial fertilisers and green manuring, but it has often been stated that this increase is effected at the expense of virgin lands. Mr. Coventry therefore instituted an inquiry in India to see if there is any evidence of a progressive decline in fertility there. The results are published in vol. vii. of *The Agricultural Journal of India*, and show that the average of productivity may have become lower, but this can be entirely explained by the fact that inferior lands have been taken into cultivation on account of the great agricultural prosperity and expansion brought about under British rule. When allowance is made for this it is seen that the fertility is not declining, but rather tends to increase.

It is, however, undeniable that phosphoric acid and potash are removed from the soil in the crop and transferred to the centres of population. Impoverishment of the virgin soils necessarily takes place, although the productiveness is not affected until lack of these particular nutrients becomes the limiting factor in crop production. This position has been reached in parts of the United States, and has induced Prof. Whitson and his colleagues at the Wisconsin Experiment Station to undertake a valuable set of investigations on the effect on the soil of rock phosphate, which fortunately is readily obtainable. In the admirable surveys of Wisconsin now being made by Dr. Weidman it is shown that continued cropping has caused phosphate exhaustion, which can be remedied by dressings of rock phosphate.

The other side of the question, the increased phosphorus supply to land near cities, is very well seen in many parts of England, and has recently been strikingly illustrated by Messrs. Hughes and Aladjem in a paper in *The Agricultural Journal of Egypt* (vol. i., part ii.). Analysis of soils taken from various places in the Delta showed that certain spots were much richer in phosphates than usual, although in other respects the soils were fairly uniform. Detailed examination of one of these cases showed that the authors were working on the site of an ancient city where a considerable population had existed for a period of at least four thousand years before the Arab domination. To supply such a population and the animals belonging to it with food must have required the produce of a large area, while the refuse of the city would be used as manure only on the nearer land. The city and its population have long since vanished, but the concentration of phosphoric acid in the soil remains an indelible record of the past :—

Distance from the centre of Kom, kilometres ...	0-1	1-2	2-3	3-4	4-5
Total phosphoric acid, per cent.	0·34	0·29	0·26	0·22	0·22
Easily soluble phosphoric acid, per cent.	0·086	0·069	0·065	0·051	0·036

Nitrogen compounds are also transferred, like phosphorus compounds, but they take part in a perpetual cycle in which the nitrogen of the air plays a part, so that the accumulation and depletion processes are both limited. Much work is being done on this cycle; in particular, investigators in all countries are finding that addition to the soil of easily oxidisable organic substances, such as sugar,

conditions a notable fixation of atmospheric nitrogen. Indeed, in tropical countries where sugar-cane is cultivated, molasses are sometimes actually added to the soil for this purpose. The action of the sugar is not entirely simple, however, and Peck has shown that in Hawaii it may actually do harm by bringing about a marked decomposition of the nitrates (Bull. No. 39, Hawaiian Sugar Planters' Association).

It is, however, now realised that soil fertility is not wholly a matter of plant food, but may be limited by the presence of harmful substances in the soil. This phase of the problem is being investigated by Schreiner and Skinner, who have recently published (Bull. No. 77, Bureau of Soils, U.S. Dept. of Agriculture) a detailed account of the action of coumarin, vanillin, and quinone on plant growth. The general research of which this forms part consists in isolating from the soil such organic compounds as can be identified, and then trying their effect on plant growth.

It would be a mistake to suppose that the medium on which the soil organisms live and which is in contact with the plant roots is the inert mineral matter that constitutes the bulk of the soil. Recent investigations have brought into prominence the colloidal constituents that occur in notable quantity and appear to be distributed over the surfaces of the particles, and apparently impart to the soil many of its characteristic properties. On general grounds, it might be expected that these colloids would be much altered by the addition of small quantities of soluble salts, and the experiments of R. O. E. Davis (Bull. No. 82, Bureau of Soils) have justified this view, and have shown in what way the changes affect the physical properties.

The re-establishment of vegetation on devastated areas presents many important problems, and much interest attaches to a paper by W. N. Sands on the return of vegetation and the revival of agriculture in the area devastated by the Soufrière eruption in St. Vincent, 1902–3. The paper is published in the West Indian Bulletin, vol. xii., No. 1, and is well illustrated. Vegetation now flourishes wherever the old soil remains, even when a considerable admixture of ash has taken place. The ash itself, however, is unsuited to vegetation, and where no soil is present vegetation is very scanty. Once, however, plants begin to get a footing improvement speedily takes place, as the substances formed on their decay furnish supplies of plant food. In dealing with the agriculture, it is noted that yields are now in some cases higher than formerly; this result is attributed to the heating of the soil by the lava, and is discussed in the light of recent work at Rothamsted.

E. J. R.

UPPER AIR INVESTIGATIONS.

WITH the beginning of this year the Meteorological Service of Belgium completed its hundredth international balloon ascent, and the director, M. Vincent, considered this to be a suitable occasion for communicating, to the Royal Academy (*Bulletin de la Classe des Sciences*, 1912, No. 6) some of the data deduced therefrom. The complete results are included with those obtained in other countries in a special publication compiled by the president of the International Commission for Scientific Aëronautics and elsewhere.

The recording apparatus used is the Bosch-Hergesell baro-thermo-hygrograph, and this is suspended to the smaller of two rubber balloons, coupled in tandem and inflated with hydrogen gas. The larger balloon bursts at a variable height, and the rapidity of the fall of the apparatus is slackened by the smaller balloon. This remains floating as soon as the apparatus reaches the ground, and serves as a signal to its whereabouts. After making allowance for accidents, ninety-two of the records obtained remained available for examination. The highest altitude reached was 32,430 metres (determined from the pressure and temperature curves by means of Laplace's formula) on June 9, 1911. The lowest level of the principal inversion was recorded at 6890 m. on November 3, 1910, and the highest at 13,760 m. on August 2, 1906. The lowest temperature, −73·5° C., was registered on February 2, 1911, at 10,390 m., at the level of the inversion.

M. Vincent distinguishes three regions in the atmosphere accessible to instrumental observation :—(1) An upper one, which has been called the stratosphere, where the decrease of temperature is nil, or replaced by an increase; (2) an intermediate zone, where the decrease is at the rate of 0·7° C. per 100 metres, whether the conditions be cyclonic or anticyclonic; (3) a lower stratum of variable depth, where the decrease is less than 0·7°, and is frequently negative; some remarkable inversions are quoted in this portion of the atmosphere. These two lower zones are known as the troposphere. The conditions obtaining in the stratosphere are essentially different from those in the lower regions; the strata are nearly in statical equilibrium, the wind velocity usually weakens, and the direction is uncertain, but the author shows that there are important exceptions to this rule. The trajectories of some of the highest ascents determined by means of a special theodolite designed by M. de Quervain have been discussed.

The Royal Observatory of Batavia has recently published an important contribution to our knowledge of the upper air, including observations made (1) with kites and captive balloon at Batavia between November, 1909, and September, 1910; (2) with kites in the Java and South China seas in January, 1910; and (3) with manned balloon in the years 1910 and 1911. It was during the descent of a balloon on August 5, 1911, that the leader, Lieut. A. E. Rambaldo, unfortunately lost his life. A preliminary report upon these investigations was published in the Proc. Amsterdam Acad., June 25, 1910, and referred to in NATURE of November 3 of that year. Among the results of the kite observations we note that the amount of aqueous vapour per cubic metre over Batavia decreases with height, even in the lowest strata. The decrease of temperature with height, up to 1000 metres, is less in the west than in the east monsoon; between 1000 and 2000 metres it is about equal. Over the ocean the decrease is considerable between 0 and 200 metres and exceeds 1° C. in the first 100 metres; above 500 metres it is less than at Batavia. Above 1400 m. the temperature is higher than at Batavia, and the difference probably increases at heights beyond 3000 m. The diurnal change of the vertical temperature gradient differs over land and sea.

THE Supplement to the Monthly Weather Review of the Canadian Meteorological Service for 1911 contains a preliminary account of the results of the investigation of the upper air over Ontario by means of balloons and kites commenced during that year; a full description of the apparatus and methods employed, together with a more complete discussion, is reserved until a longer series of observations has been obtained. Registering balloons were liberated on the evenings preceding the "international" days, and the results are given for each 0·5 km. of height, with intermediate points if there were any noteworthy

features. The greatest height reached was 20·2 km. on September 9; pressure 43 mm.; temperature −59° C. The lowest temperature, −62°, was recorded at 14·1 km. All the balloons travelled easterly, but as several were lost owing to the proximity of lake or forest, the station had to be moved from Toronto to Woodstock, about eighty miles to the westward. The kite station is at Agincourt, about fourteen miles from Toronto; Dines's kite and meteorographs were used, and good records of pressure, temperature, humidity, and wind direction have been obtained; the highest flight was 7900 ft. above sea-level.

BIRD NOTES.

IN the November number of *The Zoologist* Mr. Harvie-Brown, in completing his account of the southern extension of the breeding range of the fulmar which has been in progress for many years, points out that these essentially Arctic birds had established themselves in St. Kilda at least 250 years ago. In 1838 or 1837 they were observed for the first time in the Faröes, nesting on the cliffs of Qualboe in Suderoe, and by 1849 they had colonised Skuor and Great Dimon. From these islands the fumar has invaded, as a breeding species, the Shetlands, the Scottish mainland, and the west coast of Ireland.

To Notes from the Leyden Museum, vol. xxxiv., Nos. 3 and 4, Dr. Van Oort contributes further records of the recapture of birds marked in Holland during 1911 and 1912. Among the species mentioned is the spoonbill, of which one example was taken at Reculvers, Kent, while four others were killed in north-western France. The total number of birds ringed in 1912 is considerably in excess of those marked in 1911.

An article on the haunts of the spotted bower-bird (*Chlamydodera maculata*), contributed by Mr. S. W. Jackson to the October number of *The Emu*, is illustrated by excellent photographs of the "runs," nests, and eggs of these birds. In addition to certain implements purloined from the writer's camp, the objects in one of the bowers included ribs and vertebræ of sheep, toe-bones of emus, fragments of coloured glass, stoppers of sauce-bottles, metal clippings, screws, metal bottle-capsules, a cartridge-case, and numerous pods and seeds. The birds nest high up in leafy trees, but select as look-out stations leafless branches or trees.

In vol. ii., No. 1, of the University of California Publications in Zoology Mr. H. C. Bryant bears testimony to the utility of birds as destroyers of grasshoppers. In July last it appears that grasshoppers were doing considerable damage to alfalfa and vegetables at Los Banos, Merced County, California. An average of about fifteen grasshoppers to a square yard is harmful, but in this instance there were from twenty to thirty. Several kinds of birds were observed to be feeding on the insects, and it was noticed that the local contingent of the former was reinforced from the neighbourhood. The author is led to conclude that although birds cannot be regarded as a trustworthy means for controlling all infestations of grasshoppers, yet they are efficient in preventing many. They can be depended on to protect crops by their war against the grasshoppers. "The failure of birds to check an insect outbreak is evident to all. Their success in preventing insects from becoming abnormally abundant is not so apparent but is no less real." Many birds in this particular case changed their normal feeding habits, and took to preying on grasshoppers, and species usually considered harmful to the agriculturist were commended for their utility.

The food of the pheasant in the Scottish grouse moors forms the subject of a note by Mr. P. H. Grimshaw in *The Scottish Naturalist* for November. Examination of the contents of the crop of a bird killed in Argyllshire, where the heather-beetle (*Lochmoea suturalis*) was unusually abundant during the summer, showed that these consisted chiefly of insects. These included 2286 flies (*Bibio lepidus*), 508 heather-beetles, and six other insects. This leads to the conclusion that the pheasant, like the blackcock, may be reckoned of importance in checking the ravages of the heather-beetle.

Another paper on the food of birds is published as Bulletin No. 44 of the Biological Survey of the U.S. Department of Agriculture. This report, which is drawn up by Mr. F. E. L. Beal, relates to the fly-catching species of North America, referable to the genera Sayornis, Empidonax, Muscivora, Myiarchus, Tyrannus, &c. The contents of the stomachs, or crops, of seventeen species were examined, and it was found that "of thirteen of these species Hymenoptera are the largest element in the diet. Of one species Orthoptera (grasshoppers and crickets) are the leading food; in another Lepidoptera (moths and caterpillars) are the favourites; and in two others Diptera (flies) stand at the head. Hemiptera (bugs) are eaten extensively by some, but naturally the ones taken are the larger flying species. Plant-lice and scales [Coccidæ] have not yet been found in the stomach of any fly-catcher, though one bird was shot on a plant covered with lice, with which its bill was filled."

Several of these birds have been charged with devouring honey-bees, but the accusation is not sustained by the examination of their food; comparatively few of these insects being devoured, and those chiefly drones. The real harm done by these birds is the destruction of predaceous and parasitic Hymenoptera which wage war on injurious insects. R. L.

STOCK DISEASES AND THEIR SUPPRESSION IN SOUTH AFRICA.[1]

MODERN knowledge of trypanosome disease and others of a similar nature can be usefully applied to some of the problems which are in my particular line of research, viz. to diseases of our domesticated animals. I shall mention but two, known probably to you all, and which are of great economical importance—horse-sickness in equines, and blue-tongue in sheep. Long before any expert came in contact with him, the observant farmer quite rightly classed these two diseases in one group. He even went so far as to say they were identical, but here is an opinion which we are not able to support. There are, nevertheless, more similarities than differences in the two; they resemble each other in nature of the cause, both being due to micro-organisms of infinitesimal minuteness, so small that none of our modern microscopes can detect them.

The theory of our modern microscope teaches us that there is a limit to visibility beyond which objects can no longer be recognised. The so-called ultra-microscope, which makes use of a different principle of illumination, and allows the detection of objects varying in the magnitude of a molecule, has in these two diseases failed to enable us to demonstrate an organism so far. It must be there, nevertheless, and we conclude this from the experiment that we are able to transmit the disease by inoculation with blood from a sick to a healthy animal, in which latter, after a definite incubation time, it appears, thus showing

[1] From the Presidential Address delivered before the South African Association for the Advancement of Science, at Port Elizabeth, on July 2, by Dr. Arnold Theiler, C.M.G.

that a development must have followed. It having been demonstrated that the malady was inoculable, it formed the subject of much speculation to explain the observations which the farmers had been collecting ever since they knew it, and which principally apply to the climatic and tellurical conditions under which it appears. You have probably all heard that the farmer interpreted his observations to the effect that the dew is the cause. There is nothing ridiculous in this theory. Remember that our knowledge of micro-organisms as causes of disease is practically only a science of yesterday; remember that the English translation of the name "malaria" for the disease of that name means "bad air," and it is only a few years back that science admitted of such a theory as the probable cause; that is just as our farmers have done and are still doing for horse-sickness.

The observations of the farmer are correct in details. We give them the right interpretation when we substitute for the name "dew" the name "blood-sucking night insect." Under the conditions under which dew is formed horse-sickness and blue-tongue appear most frequently, and these conditions are most favourable for the breeding of mosquitoes and other blood-sucking insects. This being so, the question might be put to us, "But are there any direct proofs to this effect?" If we had all the proofs, we would no longer speak of a theory, and we must speak of a theory until the actual blood-sucking insect has been demonstrated and until the experiments have been made under such conditions that no doubts are left any longer. Indirectly, the theory has been so well founded that the only missing link is the insect itself. The reason why this link has not been demonstrated yet is the fact that we do not know sufficient of all the nocturnal blood-sucking insects of South Africa, of which various genera and many species exist; we do not yet know how to breed and handle them for such delicate experiments as are required to bring the proofs with horse-sickness and blue-tongue. Notwithstanding this, the theory has its practical value, inasmuch as it shows in which way protective measures can be adopted, and what has been said about the destruction of mosquitoes in connection with human malaria applies equally well to the diseases under discussion.

The theory goes still further. Seeing that flying insects must be accepted as being the transmitting agencies, we conclude that there also must be a reservoir somewhere from which these insects obtain the virus. This is perhaps the most interesting point. The horse alone in the case of horse-sickness, and the sheep in the case of blue-tongue, are not sufficient to represent that reservoir. When recovered, the blood of these animals no longer contains any virus. Furthermore, horses, when introduced into a wild country where before there had never been any equines, are liable to contract the disease. Again, the almost "explosion-like" expansion when climatic conditions are suitable does not allow us to conclude that the sick animal alone is responsible, and we naturally ask, "Where does the virus come from?" By analogy with tsetse and human malaria we accept the existence of a reservoir in the shape of a different species of animal, harbouring the parasite of the disease in its blood. Such an animal may be cold-blooded or warm-blooded, a bird or a mammal.

Here, again, we have not yet been able to make further progress. We enter on a different branch of research. It will be interesting work for our zoologists to point out to us the geographical distribution of any such animals, coinciding with the distribution of the disease. Then we might have more hope of proving the theory than there is at present, where we have to work more or less in the dark. It is this theory which justifies the hope that within the districts of the reservoir those diseases will be suppressed one day. Recently an assistant of mine, Mr. Walker, found a parasite in the blood of young ostrich chicks known under the name of *leucocytozoon* and related to the trypanosomes. Whatever the practical outcome of this discovery will be, one conclusion we are entitled to make now, and that is the parasite is transmitted by insects; and should it prove to be the cause of the mortality observed in chicks, the way to combat it is indicated by this conclusion.

Whilst on the subject of suppressing disease, I wish to refer to some other well-known observations made by farmers, the correct interpretation of which has led to important applications. They are in connection with immunity. When horses or sheep recover, they are said to be salted against the disease, viz. to be immune. We expected this to be so by comparison with other diseases of a similar nature, but caused by visible organisms. To this latter group belong those against which modern science introduced methods of preventive inoculation, and by analogy we were entitled to anticipate that a similar possibility would exist in connection with those under discussion. It proved to be the case, and on recognised principles, methods of inoculation for mules as well as for sheep were worked out, which proved to be successful. In the case of horses, however, great difficulties were experienced, inasmuch as these animals showed a much higher susceptibility than mules, a fact which can only be explained by inherited immunity from their sires, which, although susceptible to the disease, have, at least in my experience, never been found to die. The methods in use for mules proved useless for horses. Here the observation of the farmers came to the rescue; they led to deductions which proved to be applicable in the practice.

Long ago farmers had the experience that the so-called salted horses may break down in immunity. They called these relapses, or "*aanmanings*." Subsequently our experience proved the same observations to be correct. Some of the mules and horses which were undoubtedly immune broke down when exposed to natural infection. The virus from such cases was collected, and in several instances it was shown that breakdown in immunity could be produced in almost any salted animals. The experiments showed that there was no actual loss of immunity in the animal affected, but the relapse was due to the different nature of the virus. This means from a biological point of view, the ultravisible micro-organism will also follow the laws of other organisms, viz. that of variability or mutability, but which can show itself to our eyes only by a different virulency in the animal it attacks.

Accordingly more than one variety of horse-sickness organisms exist, and although from a pathological point of view we only recognise one disease, yet there are as many diseases as there are varieties of ultravisible organisms. At one time we thought that the variation was simply due to the influence of environment, but, based on a number of experiments, we came to the conclusion that the cause of the variability of a particular strain lies in the horse from which it is collected. The host represents, so to say, its environments. The passage through a horse determines whether there will be a decrease or an increase in virulency. This fact established, the further conclusion was made that there must be certain strains or varieties of which the virulency would not be so pronounced, and accordingly that a greater number of animals would recover when infected. This, indeed, proved to be the case. The variability of the organism has now been made use of for the inoculation of horses in connection with the method as applied to mules. The

method was introduced into practice last year, and only in the experimental manner; it has not yet stood the brunt of the severe tests of the practice.

The experience just now alluded to teaches us that under the conditions of the practice breakdown in immunity will occur. It remains to be seen to what extent they do occur, or, in other words, what percentage of inoculated horses will be protected against the naturally acquired disease. The same principle was made use of in the preparation of the blue-tongue vaccine, and again recently in the method of inoculation against anaplasmosis of cattle, a disease generally known as gall-sickness. This latter was found to be caused by parasites attacking the red corpuscles of the blood. The remarkable observation was made that two different varieties of organisms could be distinguished under the microscope, and the tests proved that whereas one species was very virulent, the other one was very much less so, and this latter protected an animal to a great extent against the former. The vaccines used against the various diseases therefore represent by no means anything artificial; they are specially selected germs producing the disease in a milder form, which give a great amount of immunity, but by no means a complete one, owing to the existence alongside of still stronger varieties of the same species or genus.

A cure or an inoculation against a disease always appeals to the mind of a layman, and more credit is attached to such an inoculation than to other methods of prevention or controlling the disease which perhaps are more rational but more tedious and cumbersome. A good illustration of this is afforded by red-water, which, as many of you will remember, was introduced into the Cape Colony many years ago. In those days measures were taken to stop its spread, but they were of no use, because the cause of the plague was not then known. Only in the beginning of the 'nineties of the last century was it found in America that it was due to a parasite which lived in the red corpuscles; the parasite developed in the body of a tick, and was transmitted by these to new cattle.

This was as much an epoch-making discovery as Bruce's that the trypanosoma disease was carried by winged insects. The statements of the American men of science were subsequently verified in Cape Colony, and when the attention of South African workers was directed to the presence of similar parasites in the blood of South African stock suffering from various other ailments, then it was only natural to conclude that in their propagation ticks also must be responsible. The conclusion proved to be correct. It was further proved that there also existed the theoretical reservoir; it was found that it was the recovered animal itself which remained infected. This fact, so paradoxical as it appears for healthy animals to spread a disease, explains the permanency of infection on our pasture; although they are immune, they maintain the contamination.

The investigations by Lounsbury into heart-water, a disease caused by an invisible organism which at one time rendered the rearing of cattle and small stock almost an impossibility, more particularly in this neighbourhood, proved definitely that also here ticks were responsible. Once these facts were well established, it was a natural conclusion to expect that the destruction of the ticks would mean the eradication of the disease, just as the destruction of mosquitoes meant the disappearance of malaria. This conclusion at one time had only appealed to a limited number of farmers, and it is even at the present time not sufficiently appreciated. Perhaps it is not scientific enough, or there is not enough mystery about it.

When the terrible disease, East Coast fever, was introduced into South Africa, the presence of a parasite found in the blood corpuscles was soon recognised, and the conclusion had to be drawn that here again ticks were responsible. This also proved correct. After the species of tick which transmitted the disease had been traced, and their life-history was fully understood, and once it had been realised that in this disease, unlike the other caused by intracellular parasite, the immune animal did not represent the reservoir for the virus, it became possible successfully to combat it. In the course of time the most powerful remedy proved to be the dipping tank, which was decidedly the salvation of the Natal farmer, all other methods of stopping the spread in that Colony having failed. For the destruction of the ticks as the root of many evils in stock, the dipping tank must be considered to be the best and most practical means, and its introduction into South Africa is a great scientific attainment.

Not only in the world of micro-organisms, but also in that of higher developed parasites, we shall find our example for demonstrating the utility of the adoption of biological research. I refer to one of the most important farming industries, viz. the breeding of ostriches. We know that one of the main drawbacks are internal parasites, and although the farmer is able to help himself temporarily in a rough and ready way, yet he feels that, in order to combat these pests more successfully, more scientific knowledge is required about the life-history of these worms. As soon as this is established—and I can tell you that good progress has already been made in this connection—practical deduction will be possible in order to build up a rational hygiene for the rearing of the chicks.

So far I have selected my examples in scientific research and practical application out of a group of diseases due to parasites visible to the naked eye, by microscope, or those that can be traced by means of inoculation experiments. We have, so to say, the cause of the diseases in our hands, and can produce and reproduce them at will. This is the one and perhaps the main reason why in the past, in a considerably short time, good progress was made; we were dealing with problems similar to many others already solved. I will now have to mention a subject where the use of the microscope and all transmission experiments into animals failed. It is the disease "Lamziekte" in cattle, to which, in recent years, so much attention has been given by the public, the Press, and Parliament. It has caused terrible destruction, and even threatened to ruin the newly-developed north-western districts.

The investigations carried out so far in conjunction with Mr. Burtt-Davy, the Government agrostologist and botanist, show that we have to deal with toxins which are present in grasses of certain areas. This is at least our theory, and it is well founded; it is, however, by no means new, as it has its analogies in other parts of the world, and explains the observations made by farmers in various parts of South Africa; indeed, it represents the views of many farmers, although not precisely expressed. It is that grasses on certain soils and under certain climatic conditions develop a poison of an accumulative character which only shows its effects on cattle after they have partaken of such grasses for a prolonged period. Actual feeding experiments which have been started on various experimental stations will bring the proof one of these days. The influence of climate and soil has also recently been brought home by experiments undertaken in Natal. Some of you will remember that Mr. Robertson, of Grahamstown, proved in an unmistakable way that the plant *Senecio latifolia*, collected in that part of the country, was found to be very fatal when

fed to horses and cattle. The experiments in Natal, carried out on the same class of animals with the same plant, proved harmless.

You will grasp the complexity of these subjects when you remember that, in order to understand and explain them fully, a combination of a number of sciences is necessary, viz. pathology, geology, botany, chemistry, climatology, meteorology, and physiology. Better subjects could scarcely have been found to illustrate how comprehensive investigations may become in a matter which at first sight seems purely and simply a problem for the veterinarian. This point brings me back to some remarks raised before. It is only possible for an applied science, such as that for investigating into the cause of the disease, to progress when the other sciences on which the applied one is based are advancing at the same time or, still better, are ahead of it. This applies strikingly to the case in point. Of the physiological effect of grasses and plants under the various conditions of climate and soil in South Africa we know nothing as yet. I am glad to state that the Minister of Agriculture, to whom I have explained the necessity of such investigations, has promised to add a branch of physiological research on to the laboratory under my control. But an investigation of this nature must be thoroughly undertaken, and in order to be fruitful it must go hand in hand with chemical and biological investigations of the nature of the soil as well.

The necessity for such investigations has frequently been pointed out. Prof. Pearson some years ago advocated the erection of botanical gardens in South Africa in areas representing the various conditions of climate and soil, and one of his strong arguments was the economical importance such establishments would have. Our recent investigations bear him out, and should bring home the value of such institutions. For many years Dr. Juritz preached the necessity of a systematic and thorough chemical survey of the soil of this subcontinent. The conclusions I put before you in connection with the disease caused by plants show you the necessity in the first instance of scientific research into soil and vegetation. But a good deal is required if we intend to make further progress in the understanding of the disease as already described, and of many more not touched at all. The necessity for a general biological survey of all South Africa becomes obvious. Particularly the geographical distribution and seasonal occurrences of plants and animals, the connection of climate and soil with flora and fauna, will have to be thoroughly studied. Hand in hand with this will go the interpretation of the presence and absence of the cause of certain stock diseases.

Fortunately, in the past a great deal has been done by a good many enthusiastic workers. More has yet to be done. Dr. Muir, in his presidential address in Cape Town two years ago, touched on this question, and he pointed out the necessity of a systematic co-operation in which the museums of South Africa could perform the leading duties. I fully agree to this, and I am of the idea that these institutes, similar to the one under my charge, should be centralised, and the work should be undertaken in a definite and well-planned manner, preventing overlapping, and securing complete specialisation in the various branches. We require more: we want a centre for scientific investigation, a central university for South Africa, where research is the leading idea. I speak with emphasis, that South Africa should not wait any longer before establishing such an institute. We men engaged in the application of science feel the want of it in all our undertakings; we require it for advice or assistance in the many problems the solution of which is entirely outside the scope of a single man, who is not always able to keep in line with the new discoveries, and outside his own sphere of work. Nowadays, it is no longer a genius who will only be capable of solving knotty problems; I venture to say that the methods of investigation and research are so far developed that any scientifically trained man with the necessary critical mind, and endowed with patience and perseverance, can tackle these investigations with every prospect of solving them, provided the sciences he has to make use of are sufficiently far advanced to be of assistance to him.

In conclusion, I wish to come back to one of my remarks; that the South African tends to the practical side of scientific problems. If I can give him, after so many theoretical discussions, practical advice, it will be: foster by all means the pure sciences; they are, in the hands of experts, the medium of solving the many economical problems of South Africa.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

In the issue of NATURE of December 5 last attention was directed to the action which the general council of the University of Edinburgh had taken to bring before members of Parliament and others interested in higher education the serious danger with which the universities of Scotland are threatened by the recent interference of the Treasury with their freedom of internal administration. From further information which has reached us, we find that the question of whether or not Scottish universities are to establish composite or inclusive fees is regarded by the council as relatively unimportant. The vital question is whether the Scottish universities, which have hitherto been free so far as their internal administration is concerned, are now to be subject to a State department. The council is not asking that the universities of Scotland should be freed from the responsibility of accounting for their use of public money, but it is desired that the autonomy which has hitherto been a greatly valued characteristic of the Scottish university system should not now be withdrawn.

THE Bulletin of the Massachusetts Institute of Technology for December, 1912, takes the form of "a catalogue of the officers and students, with a statement of the requirements for admission, and a description of the courses of instruction." One of the most interesting of the very complete arrangements of the institute is the opportunity for research afforded in all the laboratories devoted to the more advanced branches of instruction, as well as in the three separately organised research laboratories for physical chemistry, applied chemistry, and sanitary science. We notice also that by a gift in 1909 special research in seismology and other branches of geophysics was provided for. On January 1, 1912, the Hawaiian Volcano Research Association cooperated with the institute to establish an observatory and laboratory at the volcano Kilauea. Work was begun at once, and a suitable building has been constructed with laboratories, a seismograph cellar, water supply, and facilities for physico-chemical investigation of volcanic process. Investigations are carried on by a resident staff, and properly qualified investigators will be received at the observatory for special studies.

IT is announced that a group of some of the largest coal owners of South Wales has decided to start a mining school for the training of colliery officials. Treforest House, Treforest, has been acquired for the purposes of the school, and the post of director of

mining instruction is being advertised. It is proposed to make a levy of one-tenth of a penny per ton on the output of the collieries concerned, which will provide upwards of 5000*l*. a year for the maintenance of the school. The scheme is really part of a larger scheme recommended by Prof. Louis, of Newcastle-on-Tyne, on the lines of the mining school at Bochum in connection with the Westphalian coalfield, whereby elementary instruction in mining, given at preparatory schools spread over the whole district, leads up to the higher work in the central mining school. The portion of the general scheme which it is now proposed to develop does not embrace the all-round training necessary for mining engineers, such as that provided for in some of the English universities and at University College, Cardiff. It is much to be hoped that the mining courses now being arranged will not overlap the higher work that comes more strictly within the province of the University College at Cardiff, and that the development of the mining department at that college will not suffer in the future from any want of sympathy and financial support from the wealthy colliery proprietors of our richest coalfield.

THE report for the session 1911–12 on the work of the department of technology of the City and Guilds of London Institute has been published by Mr. John Murray. The number of subjects in which examinations were held by the department was 75, the same number as in the previous year, the number of separate classes increased from 4495 to 4552, the largest on record, and the number of students in attendance rose from 52,680 to 53,999. These figures represent the numbers of students of registered classes, receiving instruction mainly with a view to the institute's examinations, but they are only a proportion of the total number of students in applied science and technology, who are in attendance at courses of instruction largely influenced by the work of the department. There can be no doubt, the report states, that the teaching of technology has improved greatly during the past few years; but it is noted that the examiners have still to direct attention to the insufficient knowledge that some candidates possess of the principles of their subjects, and to the lack of practical knowledge shown by others. As regards the preliminary training of the students, the examiners in several subjects comment on the inability of the candidates to write good English, the poor handwriting and spelling, and the unsatisfactory answers to questions involving calculations. The report urges that it is desirable, before commencing the distinctly technical part of their course of training, that the attendance of pupils at day or evening continuation schools in which special provision is made for manual instruction, the teaching of English, and practical science should be further encouraged.

THE Department of Agriculture and Technical Instruction for Ireland has issued its programme of technical school examinations for 1912. Both in day secondary schools and in evening technical schools the department has adopted a system of inspection, to the exclusion of written examinations, as a test of efficiency, and has never prescribed written examinations for the purpose of assessing grants for educational purposes. It is not proposed to depart from this policy, which has been attended by excellent results. In past years students requiring some certificate of efficiency have entered for certain English public examinations in science and technology. The recent changes made by the Board of Education in its science examinations, together with other considerations, have led the department to inaugurate the examinations dealt with in the programme. The scheme of examinations is designed to follow courses of instruction extending over four years in the following branches of technical knowledge: commerce, building trades, applied chemistry, electrical engineering, mechanical engineering, domestic economy, art. There will be, in general, two examinations in each course in each of the four years, and the examinations in each course must be taken in the order prescribed. The department will not be concerned with the examination of students other than those intending to take out a course certificate. The syllabuses of examination are based upon the knowledge which may be acquired in following a definite course of instruction in a technical school, though the department will not for the present require attendance at a technical school as a qualification for admission to the examinations.

THE Imperial University of Tokyo, the calendar of which for the current session has been received, consists of six colleges of law, medicine, engineering, literature, science, and agriculture. In each college complete arrangements have been made for higher education in accordance with the most modern standards. It is possible here to refer to one or two examples only. Attached to the College of Agriculture are five forests, two in Tokyo Fu, one in Chiba Prefecture, one in Hokkaidō, and one in Formosa. That in Chiba Prefecture, to take one instance, covers an area of about 5358 acres, and is divided into the Kiyosumi and the Okuzan forests, and it is intended for use in practical instruction in forestry, for the investigations undertaken by the professors and students, and to serve as a model of scientific forest management in Japan. The system of scholarships, too, is of special interest. Research and loan scholarships are awarded. The former are intended for graduates of "high scholarship and of sound and strong character" who wish to devote themselves continuously to study and research. Loan scholarships are of two kinds—college scholarships and donation scholarships. A college loan scholarship has a value not exceeding 120 yen per annum, and is for students unable to meet college expenses from their private means. When the holder of a loan scholarship has graduated, he is bound to refund the sum he has received by monthly instalments, so as to complete the repayment within the same number of months as that during which he had been in receipt of the scholarship; and he also pays interest at the rate of 6 per cent. per annum. A donation loan scholarship differs chiefly in being allotted according to the wishes of the donor.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, December 5.—Sir Archibald Geikie, K.C.B., president, in the chair.—Dr. J. H. **Ashworth** and Dr. T. **Rettie**: A Gregarine—*Steinina rotundata*, nov. sp.—present in the mid-gut of bird-fleas of the genus Ceratophyllus. This cephaline Gregarine was first observed in the mid-gut of adult examples of *Ceratophyllus styx*, and its life-history has been traced in larvæ and adults of this species, in which it has been found to be common. Examples of *C. farreni* and *C. gallinae* have also proved to be infected, but only sparingly.—G. **Dreyer**, W. **Ray**, and E. W. A. **Walker**: The size of the aorta in warm-blooded animals, and its relationship to the body-weight and to the surface-area expressed in a formula. The conclusion reached is that in any given species of warm-blooded animal the sectional area of the lumen of the aorta (A) is proportional to the body-surface, and can be calculated from the body-weight by means of the

formula $A=W^n/k$, where n has the value 0·70 to 0·72, and k is a constant to be ascertained for each particular species.—G. **Dreyer**, W. **Ray**, and E. W. A. **Walker**: The size of the trachea in warm-blooded animals, and its relationship to the body-weight, the surface-area, the blood-volume, and the size of the aorta. Measurements have been carried out on rabbit, guinea-pig, and ptarmigan. These show that within a wide range of weight in any given species of warm-blooded animal, the sectional area of the lumen (T) of the trachea is proportional to the body-surface, and can be calculated from the body-weight by means of the formula $T=W^n/k$, where n has the value 0·70 to 0·72, and k is a constant to be ascertained for each particular species. Since n has now been shown to be 0·70 to 0·72, not only in the case of the blood-volume, the aortic area, and the tracheal area, but also in calculating the surface-area from the body-weight, it follows that the three former measurements are all proportional to the body-surface, and that the formula put forward ($W^n/a=k$) is a rational formula. —Studies of the processes operative in solutions:—(i) E. E. **Walker**: The conversion of ammonia cyanate into urea, especially as influenced by alcohols.—(ii) F. P. **Worley**: (1) The hydrolysis of cane sugar by dilute acids. (2) The hydrolysis of cane sugar by sulphuric acid, with a note on improvements in polarimetric apparatus. (3) The hydrolysis of methylic acetate by acids.—(iii) Dr. H. E. **Armstrong** and F. P. **Worley**: The nature of hydrolytic process.—Dr. R. T. **Beatty**: The direct production of characteristic Röntgen radiations by kathode particles.—A. S. **Russell**: The penetrating power of the γ rays from radium C. Attempts have been made to detect a radiation from radium C possessing a greater penetrating power than ordinary γ rays. A source of 300 millicuries of radium emanation was immersed in a tank of mercury at a distance of 20 cm. below the testing instrument, and sunk in the mercury until the leak in the testing instrument was no greater than the natural ionisation. It was found that the ionisation due to any radiation penetrating 25 cm. of mercury is less than 2×10^{-6} of that due to the unabsorbed γ-ray beam. The absorption of the γ rays was measured also for a great range of thickness of mercury. From 1 cm. to 22·5 cm. absorption took place strictly according to an exponential law. Over this range the intensity is diminished in the ratio of 360,000 to 1. The value of the absorption coefficient (cm.$^{-1}$ divided by the density) was found to be 0·0438, which is very nearly the same as that found by Soddy and Russell for lead, namely 0·0437.—Dr. H. S. **Allen**: The photo-electric behaviour of iron in the active and passive state.—H. B. **Keene**: A determination of the radiation constant. The mean value obtained for the radiation constant equals $5·89\times10^{-5}$ erg. cm.^{2} sec. deg.^{4}. The paper contains the calculation of an exact expression for the energy exchange between two radiating coaxial circular apertures; the ordinary approximate expression which applies when the distance between the apertures is great being insufficiently exact in the present case.—C. G. **Douglas**, Dr. J. S. **Haldane**, Y. **Henderson**, and E. C. **Schneider**: Physiological observations made on Pike's Peak, Colorado, with special reference to adaptation to low barometric pressures.—Muriel **Robertson**: Notes on the life-history of *Trypanosoma gambiense*, with a brief reference to the cycles of *T. nanum* and *T. pecorum* in *Glossina palpalis*.

Royal Meteorological Society, December 18.—Dr. H. N. Dickson, president, in the chair.—Prof. H. **Bassett**: Probable utility of salinity observations in the Irish Sea for long-date weather forecasting. The cyclones which reach the British Isles nearly all arrive from the Atlantic, consequently any alteration in the distribution of temperature in the Atlantic may be expected to affect their number and character. The hydrographic investigations which have been carried out in the North Atlantic and in European waters during the past fifteen years have shown that they are affected by a periodic change in salinity and temperature, the period of which is about one year. This change is of such a nature that the water is salter and relatively warmer in the winter and spring months and fresher and relatively cooler in the summer and autumn, the time of maximum salinity depending somewhat on the geographical position. The author described the result of a series of salinity observations which he has carried out in the Irish Sea, and he has found that the salinity changes and the time of their occurrence preceded certain seasonal types of weather. He is therefore of opinion that if monthly observations of the salinities were made at certain stations on the line of the Calf of Man—Holyhead, these would enable forecasts of the general character of the weather over the British Isles and a considerable part of Europe to be given four or five months ahead.—J. E. **Clark**: Air currents at a height of fifty miles, as indicated by the Bolide, on February 22, 1909. This meteor, the brightness of which was at least four times that of Venus, was seen at 7.38 p.m. at a height of fifty-eight miles, and it left a remarkably bright streak in the sky, which was watched by observers in the southern counties for the long period of 104 minutes. The author collected the various observations, and after plotting them on charts came to the conclusion that between 49·5 and 51 miles the streak lay in a west wind of great velocity, and that at 51·5 miles the current was almost from the east with a velocity of about 100 miles an hour. Above this the current changed to south-east and ultimately to south-west, with an increased velocity.—C. **Anthony**: New form of standard barometer.

Royal Microscopical Society, December 18.—Mr. P. E. Radley, vice-president, in the chair.—F. **Enock**: Insect intelligence. Several instances were given from the life-history of spiders and insects which seem to show real reasoning power, and lead to the conclusion arrived at by Lord Avebury, who attributes to insects in degree a certain amount of conscious knowledge. When breeding the larvæ of dragonflies the author has repeatedly observed the nymph on leaving the water crawl up a leaf or stem or some twig, and when it has reached a certain point it rests and suddenly flings out its tail as far as it can, and should it come into contact with anything, it changes its position and again flings its tail out, and continues to do so so long as it comes into contact with a leaf or stem; it changes position until, on flinging out its tail, it does not come into contact—then, and not until then, does it affix its clasping limbs to the leaf or twig preparatory to going through its transformation. From this the author gathers that the nymph has conscious knowledge that it will require a certain amount of space so that its large wings do not come into contact with anything when fully developed.

CAMBRIDGE.

Philosophical Society, November 25.—Dr. Shipley, president, in the chair.—Prof. **Hughes**: The gravels of East Anglia. In introducing the subject of the gravels of East Anglia, Prof. Hughes pointed out that too much importance must not be attached to the absolute height and level of the river terraces, first, because of the rise of the valley from its mouth to its source, and, secondly, on account of the earth movements which have affected the area. He showed that

there had been considerable depressions in the valley of the Cam since the deposition of some of the existing river silt. Only a small proportion of the flints of which the gravels were chiefly composed were likely to have been derived directly from the Chalk, and very few from the London Tertiaries. They were probably produced on the Miocene land surface over which the Crag sea advanced rapidly, sweeping up the old surface soils, and forming the first deposits of angular flints from which so much of our stained gravel has been derived. The subsequent depression of this area, while adjoining mountain regions were uplifted, would account for the material of the Norfolk cliffs, which might be referred to the action of an ice-laden sea on the land.—Dr. **Marr**: The meres of Breckland. Attention was directed to the small meres of the sandy heaths north of Thetford, situated in chalk. The meres are probably explicable on the view that events happened similar to those observed in other limestone districts, such events occurring as the result of subterranean drainage.—Dr. **Arber**: The earlier Mesozoic floras of New Zealand. A preliminary survey has been made of the specimens of fossil plants collected in New Zealand by Mr. D. G. Lilley, now biologist to Captain Scott's Antarctic expedition, during the recent winterings of the *Terra Nova* in New Zealand waters. Those obtained from Mount Potts in the Rangitata Valley (Canterbury) are particularly important. For many years past it has been asserted that Glossopteris and other members of the Glossopteris flora of Gondwana-land occur in New Zealand at Mount Potts. Among the specimens examined, however, there is no trace of Glossopteris, though another somewhat similar plant is abundantly present, and this has no doubt been mistaken for Glossopteris hitherto. The age of the flora is further unmistakably either Rhætic or Liassic, and thus much younger than the Permo-Carboniferous flora of Gondwana-land.—R. H. **Rastall**: The mineral composition of some Cambridgeshire sands and gravels. Following on a previous and as yet unpublished research on the Neocomian rocks, the author was led to investigate the mineral composition of the Pleistocene deposits of Cambridgeshire, numerous specimens being collected from the Plateau Gravels, the sands of the ancient and of the present river-systems, and from certain surface deposits formed by wind-transport. The chief constituents are quartz, flint, and chalk, with a notable proportion of glauconite and heavy minerals, especially garnet, tourmaline, kyanite, staurolite, hornblende, augite, epidote, zircon, and iron ores. Muscovite was not found except in the plateau sands, a very remarkable fact, which cannot yet be fully explained.—Dr. F. H. **Hatch**: A remarkable instance of complete rock-disintegration by weathering. The material described comes from Diamantina, in the province of Minas Geraes, Brazil, where it is being worked for diamonds. It occurs as a loose sandy deposit in which there are a number of partially disintegrated pebbles, and is sufficiently soft to be dug out with a shovel at the lowest depth yet attained in the open-working. The pebbles consist of quartzite, vein-quartz, steatite, and tourmaline-quartz vein-stuff. The sand is a mixture of colourless quartz and of the fine powder produced by the pulverisation of the steatite fragments. The heavy minerals in the residue obtained by treatment with bromoform are the following:—Zircon, zinc blende, galena, iron pyrites, chalcopyrite, rutile, and tourmaline. The material has evidently resulted from the prolonged weathering of an ancient conglomerate formation.

MANCHESTER.

Literary and Philosophical Society, November 12.—Prof. F. E. Weiss, president, in the chair.—Dr. Henry **Wilde**: Searchlights and the *Titanic* disaster (see p. 471).—H. G. J. **Moseley**: Radium as a means of obtaining high potentials. A radio-active substance which emits β rays should, when insulated, continue to gain a positive charge until a potential of the order of a million volts is reached. Only the fastest β rays should then be able to escape. Experiments have been made to test this point. A small bulb containing radium emanation was supported by a quartz rod in the centre of an exhausted flask. A disc suspended from a quartz spring in the neck of the flask formed a simple attracted disc electrometer. It was found that a bulb of diameter 9 mm. reached a potential of 160,000 volts in the course of a few minutes. A sudden discharge then occurred through the residual gas in the flask, although great care had been taken in obtaining the vacuum. A bulb of diameter 5 cm. charged up much more slowly; no discharge took place, and the final potential, 140,000 volts, was limited by a leak of electricity along the quartz support. The cause of discharge in a high vacuum remains unknown.—C. G. **Darwin**: The interference-phenomena produced by passing X-rays through crystals.

NEW SOUTH WALES.

Linnean Society, October 30.—Mr. W. W. Froggatt, president, in the chair.—T. D. A. **Cockerell**: Australian bees. No. I. A new species of Crocisa, with a list of the Australian species of the genus. A new species from West Australia is described. Two species attributed to Australia are excluded, Amboina being their correct habitat.—T. D. A. **Cockerell**: A small collection of bees from Tasmania. Thirty-seven species are known from Tasmania, including two described as new in this paper. Tasmania is much richer in bees than New Zealand, and systematic collecting and observation are desirable.—W. L. **Distant**: Synonymical notes on some recently described Australian Cicadidæ.—A. M. **Lea**: Revision of the Australian Curculionidæ belonging to the subfamily Cryptorhynchides. Part xi. Deals with a group of small and highly polished weevils, sparsely represented in Australia, but abundantly in New Guinea and the Malay Archipelago. The abdomen and hind legs of some of the species are peculiar. Five genera (one new) are noted, and fourteen species (five new).—R. H. **Cambage**: (1) Notes on the native flora of New South Wales. Supplementary lists to part viii. Camden to Burragorang and Mount Werong. (2) Notes on the native flora of New South Wales. Part ix. Barraba to Nandewar Mountains and Boggabri. The Nandewar Mountains are of botanical interest. Their altitude is about 5000 ft., while they are situated about ninety miles west of the Main Divide. One Queensland plant, *Pultenaea setulosa*, was found there which had not previously been recorded from New South Wales; also several southern plants which had not been recorded as occurring north of the Hunter Valley. Amongst the latter is a Victorian species, *Asterolasia correifolia*, var. *Muelleri*, known in the Buffalo Mountains and in the Kiandra district, and its discovery on the summit of the Nandewara extends its known range 400 miles northerly. The question is discussed as to how it may have developed. To show the effect of climate on plant-distribution, it is pointed out that around Boggabri, at elevations ranging from 800 to 1200 ft., about 36 per cent. of the species noticed occur in Tasmania, while on the Nandewars, at altitudes ranging from 3000 to 5000 ft., in a distinctly mountain or cool climate, about 60 per cent. of the plants found are represented in Tasmania.

CALCUTTA.

Asiatic Society of Bengal, November 6.—W. **Kirkpatrick**: The marriage ceremony and marriage customs of the Gehara Kanjars. The marriage ceremonies and

marriage customs of the Gehara Kanjars, who are an endogamous section of an aggregate of tribes of a gipsy-like character scattered all over northern India, are remarkable for two or three survivals. The authors find a strict observance of the primintive exogamic law, a proper recognition of the occupational origin of the tribe, a reverence for the tribal token, beater ordeal by way of consulting the oracle, and mock combat between the bride's and bridegroom's respective parties.—Dr. P. C. **Ray** and Rasik Lal **Datta**: Isomeric allylamines.—Rasik Lal **Datta**: The preparation and decomposition of monochloro- and dichloro-benzylamines.—Jitendra Nath **Rakshit**: Action of stannic chloride on phenylhydrazine.

BOOKS RECEIVED.

Grundzüge der allgemeinen Phytopathologie. By Prof. H. Klebahn. Pp. ii+147. (Berlin: Gebrüder Borntraeger.) 4.80 marks.

Fortschritte der naturwissenschaftlichen Forschung. Edited by Dr. E. Abderhalden. Siebenter Band. Pp. ii+268. (Berlin and Vienna: Urban and Schwarzenberg.) 15 marks.

Abhandlungen über den mathematischen Unterricht in Deutschland veranlasst durch die Internationale Mathematische Unterrichtskommission. Edited by F. Klein. 25 parts. (Leipzig and Berlin: B. G. Teubner.) Various prices.

The Entomologist's Log-book and Dictionary of the Life-Histories and Food Plants of the British Macro-Lepidoptera. By A. G. Scorer. Pp. vii+374. (London: G. Routledge and Sons, Ltd.) 7*s*. 6*d*. net.

The History of the Collections contained in the Natural History Departments of the British Museum. Vol. ii., Appendix. By Dr. A. Günther. Pp. ix+109. (London: Longmans and Co., and others.) 5*s*.

Catalogue of the Mammals of Western Europe (Europe exclusive of Russia) in the Collection of the British Museum. By G. S. Miller. Pp. xv+1019. (London: Longmans and Co., and others.) 26*s*.

Catalogue of the Collection of Birds' Eggs in the British Museum (Natural History). Vol. v. By W. R. Ogilvie-Grant. Pp. xxiii+547+plates. (London: Longmans and Co., and others.) 2*l*. 7*s*. 6*d*.

Catalogue of the Chætopoda in the British Museum (Natural History). Part i. By Dr. J. H. Ashworth. Pp. xii+175+plates. (London: Longmans and Co., and others.) 27*s*. 6*d*.

The Genus Iris. By W. R. Dykes. With 47 coloured drawings by F. H. Round, 1 coloured plate of seeds by Miss R. M. Cardew, and 30 line drawings by C. W. Johnson. Pp. 245. (Cambridge University Press.) 6 guineas net.

Miners' Nystagmus: its Causes and Prevention. By Dr. T. L. Llewellyn. Pp. xix+158. (London: The Colliery Guardian Co., Ltd.)

The Centenary of a Nineteenth-century Geologist, Edward William Binney, F.R.S. Pp. 58. (Taunton: Barnicott and Pearce.) 2*s*. 6*d*. net.

Syllabus der Pflanzenfamilien. By Prof. A. Engler. Siebente, wesentlich umgearbeitete Auflage. By Prof. E. Gilg. Pp. xxxii+387. (Berlin: Gebrüder Borntraeger.) 6.80 marks.

Memoirs of the Geological Survey of Ireland. The Interbasaltic Rocks (Iron Ores and Bauxites) of North-East Ireland. By Prof. G. A. J. Cole and others. Pp. vi+129. (Dublin: H.M.S.O.; London: E. Stanford, Ltd., and others.) 3*s*.

The Lichens of the Swedish Antarctic Expedition. By O. V. Darbishire. Pp. 74+3 plates. (Stockholm: Lithographisches Institut des Generalstabs; London: Dulau and Co., Ltd.)

The Works of Aristotle. Translated into English under the Editorship of J. A. Smith and W. D. Ross. De Motu Animalium. De Incessu Animalium. By A. S. L. Farquharson. (Oxford: Clarendon Press.) 2*s*. net.

A History of Chemistry from the Earliest Times till the Present Day. By the late Prof. J. C. Brown. Pp. xxx+543. (London: J. and A. Churchill.) 10*s*. 6*d*. net.

Mathematische Instrumente. By Prof. A. Galle. Pp. vi+187. (Leipzig and Berlin: B. G. Teubner.) 4.40 marks.

Beobachtungen über Strandverschiebungen an der Küste des Samlands. II., Brüsterort. By Dr. R. Bruckmann. Pp. 15+plates. (Leipzig and Berlin: B. G. Teubner.) 1.20 marks.

Veröffentlichung des Königlich Preuszischen Geodätischen Institutes. Neue Folge. No. 54. Untersuchungen über die Gezeiten der festen Erde und die hypothetische Magmaschicht. By Dr. W. Schweydar. Pp. 58. (Potsdam; Leipzig: B. G. Teubner.) 3.50 marks.

The Problem of the Gasworks Pitch Industries and Cancer. The John Howard McFadden Researches. Pp. 48. (London: J. Murray.) 6*d*. net.

The Passing of Morbid Anatomy. The Harveian Oration for 1912. By Sir J. F. Goodhart, Bart. Pp. 32. (London: J. Murray.) 1*s*. 6*d*. net.

Heredity and Memory, being the Henry Sidgwick Memorial Lecture, 1912. By Prof. J. Ward. Pp. 56. (London: J. Murray.) 1*s*. 6*d*. net.

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