THURSDAY, JUNE 7, 1906.

## THE ROTHAMSTED EXPERIMENTS.

*The Book of the Rothamsted Experiments.* By A. D. Hall. Pp. xl+294. (London: John Murray, 1905.) Price 10*s.* 6*d.* net.

ALTHOUGH the Rothamsted experiments have formed the subject of over 200 papers and reports, no book describing them has hitherto been published in this country. The present volume, by Dr. Gilbert's successor, is therefore a welcome addition to agricultural literature. We do not forget that two works entitled "The Rothamsted Experiments" were published respectively in 1888 and in 1897, but the former was an account of a few experiments only, and the latter discussed the practical results rather than the experiments themselves.

Mr. Hall's book has been written chiefly for the general reader who may be interested in agricultural experiments, but it is also intended for the student and the teacher. It opens with biographical notices of the two remarkable men who have made the name of Rothamsted familiar. Then follow three introductory chapters—the first mainly historical, the second dealing with meteorological observations, and the third describing the soils of the experimental fields. At the end of the book there are three appendices, the most important being a list of Rothamsted publications. These sections of the work, with the index, occupy some 90 out of a total of 334 pages. The remainder of the book consists of ten chapters, each dealing with one experiment, or with groups of similar experiments. The text is illustrated by fourteen full-page plates, and by a large number of diagrams, while figures obtained in the experiments occupy ninety-two tables.

Those who conduct field experiments will read with some surprise the account given of the soil of Rothamsted. The estate was recently surveyed by Mr. H. B. Woodward, of the Geological Survey, and he described the experimental fields as resting on a very mixed deposit of clay-with-flints overlying chalk. The chalk is extensively piped, and appears occasionally in irregular pinnacles near the surface. The soil is a grey, flinty, or pebbly loam, ten inches or more in thickness, and varying in character according to the number of stones in it. From this description the soil would appear to be anything but an ideal one for agricultural experiments, but we know that on the whole it has been satisfactory. It would seem, therefore, that where the soil is of moderate depth, variations in the subsoil may not interfere seriously with field plots.

Lawes and Gilbert had wide interests, and at one time or another they touched upon almost every important subject dealt with by the agriculturist. Their main work was on what may be described as the balance-sheet of the soil, and most of the crop and feeding experiments were planned to throw light upon the soil's losses and gains; but they found time for investigations on many other subjects, such as the source of fat in the animal body, the economic feeding of live-stock, ensilage and sewage farming.

The experiments upon field crops at Rothamsted were chiefly of one type. The land was divided up into plots, usually of from one-eighth to one-half of an acre in size; the plots received different manures such as farmyard manure, superphosphate, nitrate of soda, and the sulphates of ammonia, potash, soda, and magnesia. The artificial manures were employed in various combinations. With few exceptions, plots received the same manures year after year, and the field was occupied by the same crop either permanently, as in the case of the wheat and barley experiments, or so long as the crop could be got to grow, as in the case of clover and potatoes. The primary object of these experiments was to ascertain how crops grow, and more especially to discover what capacity the important farm crops have of obtaining nourishment from unmanured soil, and what class of manure is most necessary for the healthy development of each. As the work progressed, other points were brought to light—thus, for example, in connection with the wheat experiments it was shown (1) that the fertility of ordinary soils was of two types—one quickly exhausted (condition), the other of a very enduring character (inherent fertility); (2) that high farming is not a remedy for low prices in the case of wheat; (3) that superphosphate and the sulphates of potash and ammonia do not occur in appreciable quantities in the drainage waters from corn-fields, but that nitrates readily pass through the soil and are lost. In the experiments on meadow herbage, as with wheat, it was soon shown what classes of manure were required, but after a time it became apparent that different species in the meadow were differently affected by the treatment the plots received, and for many years the interest has centred in the varying fortunes of the combatants in this "battle of the meadow." There is an excellent account of these changes, and the diagrams in this section of the book are particularly striking—not so striking, however, as the plots themselves now are. There are no field experiments so full of interest to the naturalist as the plots in the park at Rothamsted.

Mr. Hall gives a very good summary of the Rothamsted work, and his book forms a complete guide to the experiments. It contains just the information which the visitor wants, and it is also well adapted for the agricultural student. But in the interests of the visitor and the student we hope that a new edition of smaller size may be published before long. A royal octavo page, "English" type, and thick paper make the book in its present form an admirable library edition, but the student wants something more compact and less expensive.

We venture to make a further suggestion. It is that in subsequent editions the "Practical Conclusions" which are appended to most of the chapters should be omitted. They do not harmonise with the rest of the work—in a good many cases, indeed, they seem to be based on general agricultural principles rather than on results obtained in the Rothamsted

experiments—and in their present form they are more likely to cause readers to underestimate than to appreciate the great value of the work of Lawes and Gilbert. Take, for example, the "Practical Conclusions" which follow Chapter IV.—"Experiments upon Wheat." The chapter extends to thirty-eight pages, and deals with some of the most important work done at Rothamsted. The conclusions are three in number, and in effect are as follow:—(1) Wheat is in less need of direct manuring than most other crops of the farm, and "can usually be grown with the residues in the soil, especially if it follows a clover crop." (2) Manures for wheat should be mainly nitrogenous, and nitrate of soda is generally better than sulphate of ammonia. (3) "When wheat is grown two or three times in succession, about 1 cwt. per acre of some slow-acting nitrogenous manure and 2 cwt. of superphosphate should be ploughed before seeding, and a top-dressing of 1 to 2 cwt. per acre of nitrate of soda should be applied in February. Only on the lightest sandy and gravelly soils will any return be obtained for the use of kainit and other potash salts with wheat."

These conclusions do not represent the "practical" teaching of Lawes and Gilbert, and although it is admitted that they are conclusions which may be fairly drawn from the Rothamsted experiments on wheat, we think the book would be improved by their absence.

Rothamsted has exercised a great influence on practical agriculture, but in perusing Mr. Hall's book we have been impressed by the fact that the experiments, important as they are, do not in themselves account for the estimation in which Rothamsted has been held by agriculturists. If, however, the reader turns to the list of papers in appendix i. he will there find the explanation of much of Lawes and Gilbert's influence. They began their experiments as students of nature, and with the one object of adding to the existing knowledge of agriculturists. As their work progressed they not only came to possess an unrivalled acquaintance with the general facts of agricultural science, but they gained a very close knowledge of the business of the practical farmer. They were thus able to find in their experiments much that explained the farmer's difficulties, and, as they were always careful to place their results before farmers, their papers in the agricultural journals soon attracted the notice of practical men. As long ago as 1856 a writer on Rothamsted says: "These lessons the English farmers have learnt from Mr. Lawes. They have accepted them with becoming gratitude. They are practising them with increasing confidence day by day to their great and proved advantage."

It was not the habit of Lawes and Gilbert to confine themselves to Rothamsted data; they drew freely on other sources of information in compiling their papers; and they wrote upon subjects rather than upon experiments; to quote Mr. Hall, "The papers on specific investigations often tend to be less accounts of the experiment as a whole than discussion of such of its results as bear upon the dominant idea with which Lawes and Gilbert were then engrossed." This habit, possibly undesirable in a scientific report, was most valuable to the readers of their general papers. To the agriculturist, Lawes and Gilbert were known as teachers rather than as experimenters, and while the accuracy and extent of their experiments brought them scientific fame, it was as interpreters of science, as men who thoroughly appreciated both the scientific and the practical aspects of their subject, that they became leaders in the agricultural world, and for close on two generations continued to be the trusted advisers of the British farmer.

T. H. MIDDLETON.

## EVOLUTION AND PHILOSOPHY.

*Evolution the Master-key.* By Dr. C. W. Saleeby. Pp. viii+364. (London: Harper and Brothers, 1906.) Price 7*s.* 6*d.*

DR. SALEEBY has written a very interesting book. The grand range and sweep of his reasoning is remarkable. He deals, and generally very ably though very briefly, with most of the profoundest problems of science and philosophy. As the title of his book proclaims, his object is to apply the doctrine of evolution to all problems and to show that, though some entirely baffle human thought and reasoning, yet to most there is a key, and one key only. They must be studied from the evolutionary standpoint. Each train of thought is pursued till its logical conclusion is reached. There is no stopping half-way. When great principles are expounded, Dr. Saleeby does not leave them in barren solitude, but boldly faces the inferences that inevitably follow. He is, in fact, very thoroughgoing. Dr. Saleeby's science and philosophy are always alive and human, for he always traces new thoughts and new discoveries to their originators. In his admirations he is very hearty and genuine. His heroes are the men who have advanced human knowledge and helped to emancipate the human intellect. Occasionally he rises to eloquence.

After part i., which is preliminary and general, our author proceeds to inorganic evolution. The evolution of sun and planets from a nebula, the gradual dissipation of the sun's heat, and the possible return to the nebula state through collision with another celestial body—all this is excellently described. After this, radium and the architecture of the atom come up for investigation. Part iii. deals with organic evolution, beginning with a discussion of the origin of life, and not omitting the practical question of eugenics. The subject of part iv. is superorganic evolution—the evolution of mind, the human will, the origin of ideas, the evolution of religion, evolution and marriage, evolution and education, and so forth. In part v. we have evolution and optimism. In part vi. Dr. Saleeby tackles the difficult subject of dissolution. Though energy never disappears, yet it is dissipated, and so becomes unavailable. Is the death of the whole universe in prospect? Are there alternate periods of evolution and dissolution? Part vii. is occupied with evolution and the religion of the future.

In a book covering so wide a field it is inevitable

that there should be a good deal to criticise. Part i., which deals with preliminary questions, is too long. The chapter on the philosophic temper is quite unnecessary. Dr. Saleeby's overpowering admiration for Herbert Spencer occasionally leads him astray. Herbert Spencer attributed organic evolution mainly to the inheritance of acquired characters, tracing even the stag's antlers to this principle. Though a large majority of biologists think otherwise, our author maintains that time has vindicated Spencer. The evidence he himself produces is worth little or nothing. Pathogenic bacteria, he says, quoting Haeckel, when they "are passed through the body of a highly susceptible animal become possessed of a much greater degree of virulence than formerly." "The progeny of such bacteria, often after tens and hundreds of generations, are possessed of a character which was acquired by their ancestors during their passage through the body of the susceptible animal." Grant that this is so, still the unicellular organisms are in quite a different category from the higher animals.

Dr. Saleeby's optimism sometimes affects his judgment. Natural selection, he maintains, is still making for the improvement of the human breed. Is this really so among civilised races? And, if so, what need of Mr. Galton's eugenics, which he highly commends? Again, Dr. Saleeby denies the freedom of the will. Like nearly all modern psychologists, he is a determinist. Like a true optimist, he finds a satisfaction in the fact that we cannot act without motive—in other words, that we are automata. He tells us that we have will, but this turns out only to mean that the brain can inhibit the working of the lower nerve-ganglia. If a slave is allowed to keep a slave, he does not thereby cease to be a slave himself. After all, what we want is a working belief in free will, and this is the inalienable property of every healthy man. When it comes to action a healthy determinist throws aside his theories and his philosophic temper, and has as strong a sense of freedom as any barbarian. In conclusion, we must congratulate Dr. Saleeby on having produced so readable and so able a book. F. W. H.

## THE UNIVERSITY IDEA.

*The Launching of a University, and Other Papers.* A Sheaf of Remembrances. By Dr. J. D. C. Gilman. Pp. 386. (New York: Dodd, Mead and Co., 1906.) Price 2.50 dollars net.

THE launching of the Johns Hopkins University could not be more fitly or more intimately described than by one who has "the advantage of knowing more than anyone else of an unwritten chapter of history." Such a record could hardly fail to throw interesting sidelights on the growth of the idea of the University in its modern conception. It is interesting to notice that the launchers of the Johns Hopkins University were largely influenced, not only by the evidence of University Commissions in Great Britain, but also by the writings of Newman and Matthew Arnold, of Pattison and Appleton. The actual founder was as liberal in his ideas as he was in his gifts, and the administrators of his gift made the fullest use of their discretion. President Gilman himself had a roving commission to pick the brains of the older Universities in England, France, and Germany. The main problem was to disengage the University from the college idea, and to give to the University point of view all the distinctness of which it was capable. The selection of the original faculty was sufficient to secure this result. It included such men as Sylvester, Martin, Rowland, Morris (from Oriel College), Gildersleeve, and Remsen, who succeeded Dr. Gilman as president in 1902. We are given interesting glimpses of these and other noteworthy teachers, as also of other famous English and American savants who were at different times and in different degrees associated with the Johns Hopkins University—such as Freeman and Huxley, Cayley and Kelvin—and of such celebrities as Dean Stanley, Lowell, Child, and Lanier, the poet. The interest of these chapters is, in fact, largely personal and local, interspersed with general reflections on the advancement of science, the conflict of studies, and the idea of research. Brief notices are also given of what are perhaps the two most distinguished features of the Johns Hopkins University—its publications and its medical school.

The "addresses on various occasions, historical and educational," are of somewhat unequal interest. For the most part they are too occasional, as well as too topical in character, to be of very general interest. Some of them are fitly characterised as "a sheaf of remembrances"; some touch, without going very deeply into, University problems; while others, again, are of the nature of social and ethical homilies. Here, as elsewhere, the author dwells on the progress which has been made towards the recognition of "the true significance of University work, as distinguished from collegiate discipline," and at the same time indicates that the development of graduate study has not been without its influence upon the organisation of collegiate work. "Two gains are doubtless permanent"—elective courses or an option between "groups" of undergraduate studies, and the "rapidly increasing" recognition of the value of "liberal education"—not only as the preliminary antecedent to higher and special studies, but also as a preparation for business and politics. We are not sure, however, how far Dr. Gilman's estimate of the value of the "elective" system is representative of opinion among home or foreign observers. In another place he describes the system as "a triumph of the last thirty years." With regard to liberal culture, Dr. Gilman observes that "a liberal education is not now complete unless it includes a knowledge of French and German." Both these points deserve the consideration of University reformers in other places.

Perhaps the most striking note of Dr. Gilman's addresses on University subjects is his strenuous plea for "research." To the term itself he takes not unreasonable exception; for the thing he has nothing but enthusiasm; and in this connection what he has to say about the magnificent promise of the Carnegie Institution, with which he has been prominently associated, will be read with interest. Among the ...

velopments of University activity in America which Dr. Gilman selects for commendation are the growth of scientific laboratories (including observatories and surveys), the expansion of libraries, the adjustment of the claims of science and letters, the "clarification" of the idea of the University, the admission of women to the advantages of higher education, and the advancement of professional schools, especially schools of medicine and law. Dr. Gilman also notes with satisfaction the mutual growth of "sweet reasonableness" among the leaders of religious and of scientific thought. The remaining addresses on such miscellaneous subjects as "Hand-craft and Rede-craft," "Greek Art in a Manufacturing Town," "Civil Service Reform and Education in Philanthropy," do not seem to call for special notice. They are all, however, animated by the same lofty enthusiasm and the same large outlook that characterise the author's "idea of the University," and of the future which it has before it in the general life of the nation.

## A RAMBLE IN THE WEST.

*Highways and Byways in Oxford and the Cotswolds.* By Herbert A. Evans. Illustrated by Frederick L. Griggs. Pp. viii+407. (London: Macmillan and Co., Ltd., 1905.) Price 6*s*.

OXFORD and its colleges are always before the world. Early Oxford, Mediæval Oxford, Stuart Oxford, Modern Oxford, it has been described over and over again in all its phases and all its moods. It has furnished the artist with unfailing inspiration, it has been the excuse for endless reminiscences, we have seen it approach "the cross-roads," and recently it has been held to account in the columns of *The Westminster Gazette*.

The author of this volume may well be pardoned if he does not write of the city at length. The few pages which he spares to it are given up for the most part to the archæology of the less visited portion to the west of the north and south artery, the quarter which centred round the castle still in existence, and the magnificent foundations of Osney and Rewley long since levelled with the dust. He does not attempt anything in the nature of a general survey. If Oxford has a place in his book it is mainly because, situated as it is, at a point where the hills from east and west most nearly meet, it is, as it were, the gate into the country whither he would lead us, the country that is bounded by the fringe of the Cotswold on the west and the Cherwell on the east, in other words the northern half of the basin of the Upper Thames. He does not claim to have described this exhaustively—he has merely tried to point out what struck him as attractive in its history and scenery, in the hope of making it seem attractive to others. That he has succeeded in so doing is certain. Whether he takes us in thought to the Cotswolds proper, to Painswick or Winchcombe or Stow on the Wold, whether he writes of the escarpment of Edgehill, or the Vale of Evesham, of the Forest of Wychwood, or of regions still nearer the city, he inspires us with the same feeling of interest, the same desire to set out and see for ourselves.

If we have any complaint to make it is that the author has not told us more about the natural features of the district. To the fauna and flora we find only scattered allusions, *e.g.*, to the Arion and the Acis on the hills near Barton, or the Salvia Pratensis in the Forest of Wychwood. Of the geology and hydrography he writes as little as possible. Like most other nations, the British are surprisingly ill acquainted with the land in which they live, but it does not follow that they are past educating.

For our own part we should have liked more than a mention of the botany of Tadmarton Heath, we should have been glad to have a general idea of the course of the Upper Thames, or the formation and lie of the Cotswolds, the more westerly portion of the great oolite sheet, which starts from the borders of Dorset and runs north-east across England to find its termination in the Yorkshire moors. On the other hand the author is generous with historical and antiquarian details. His pages are full of memories of the Civil War, of which this region was one of the chief theatres; the battles, Edgehill, Cropredy, &c., are brought clearly before our minds. He is a good raconteur, and his notes on the old families and local worthies are very good reading. The great houses (Broughton, Sudeley, Compton Wynyatts, &c.) receive full justice at his hands, while his descriptions of the churches, not only of the great wool-churches of Cirencester, Chipping Campden, &c., but of the humbler village types, are instructive, and all things considered wonderfully free from monotony.

We have no hesitation in recommending the book. It is not only attractive, but taking it as a whole it is accurate and valuable; between its covers is store both of pleasure and of profit. Like others of this series it has been illustrated by Mr. Frederick L. Griggs.

## OUR BOOK SHELF.

*A Manual of Geometry.* By W. D. Eggar. Pp. xxiii+325. (London: Macmillan and Co., Ltd., 1906.) Price 3*s*. 6*d*.

A NEW text-book of elementary geometry by the author of the well-known "Practical Exercises in Geometry" will be eagerly welcomed. The "Manual of Geometry" is based on the earlier treatise, but the subject has been extended by the introduction of theorems side by side with the practical work. In deciding on the ground to be covered the author has been largely guided by the revised syllabuses of various examining bodies, and the manual will be found specially suited to students preparing for the Oxford and Cambridge Locals, London Matriculation, Littlego, Army and Navy Qualifying, and similar examinations.

After a short preliminary course of practical and experimental work, practice and theory proceed together. The experimental method is always prominent, being continually used in leading up inductively to the theorems. As each theorem is reached a strict deductive proof is informally and partially outlined, and the student keeps a note-book in which the theorems are entered, accompanied by a complete formal proof written out in his own words. Sets of

problems and exercises are likewise provided. The style of the author is attractive, and the course as a whole has great educational value; in fact, we know of no text-book which presents the subject in a way more suited to the natural capacities of the youthful reader, or which is better adapted to impart a thorough knowledge of concrete geometry, and at the same time to develop the reasoning faculties in a legitimate manner.

There is a chapter describing the vernier, spherometer, callipers, and the micrometer screw gauge, and also treating briefly of the mensuration of the simpler geometrical solids. There are selections of recent examination papers, four-figure logarithms and trigonometrical ratios, answers to numerical problems, and a very useful general index.

If a draughtsman were to criticise the book he would probably say that in measuring and setting off lengths the scale should be directly applied without the intervention of dividers; that a line to be accurately measured should have its ends clearly defined by short cross-lines; and that diagonal scales, being of little or no practical use, are made rather too much of in the chapter devoted to them. But these are very minor matters, and do not detract from the general excellence of the work. We know of no text-book of elementary geometry which can be more confidently recommended to teachers, and none from which students are likely to derive more profit.

*Les Procédés de Commande à Distance au Moyen de l'Électricité.* By Captain Régis Frilley. Pp. vii+190. (Paris: Gauthier-Villars, 1906.) Price 3.50 francs.

THE problem considered in this volume is that of communicating to a distant mechanism a movement the magnitude, direction, and sense of which are definite functions of those of a transmitting mechanism. The character of the movements which it is desired to transmit varies very much in degree from the simplest of all (traction), in which the three "commands"—*forwards, backwards, stop*—are alone the orders to be obeyed. The author classifies the different mechanisms employed, not according to their complication, but according to the methods that are characteristic of them. These form seven groups—(1) direct action apparatus, (2) apparatus using relays, (3) apparatus employing rotating fields, (4) Wheatstone's bridge devices, (5) apparatus based on the use of induction sparks, (6) escapements, (7) Hertzian waves. The various devices that have been used from time to time are very clearly described under these headings with the aid of diagrams. In chapter viii. an account is given of the commutating device of Lieutenant-Colonel Rivals, by which the sending and receiving instruments can be used as either in turn. Altogether the book forms a very useful and suggestive summary of this very important branch of modern military practice.

*Das Radium und die radioactiven Stoffe.* By Karl Frhr. von Papius. Pp. viii+90. (Berlin: Gustav Schmidt.) Price 2 marks.

THIS book contains a semi-popular account of radioactive phenomena. The leading experimental facts and the conclusions of their discoverers are described clearly enough, but with little in the way of suggestive comment. The printing and illustrations are good, but we notice a serious error in Fig. 10, which suggests that the $\beta$-rays of radium, when deflected by magnetic force, lie in the same plane as the poles of the deflecting magnet. The contrary is, of course, the fact, and such a mistake cannot but suggest serious doubts as to the competence of the author's general scientific knowledge. R. J. S.

## 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.*]

### Ionisation and Temperature.

THE discourse by Prof. J. J. Thomson, published in NATURE of March 22 (vol. lxxiii., p. 495), was of importance from several points of view. The explanation of the method of ionisation which he suggests was of especial interest to myself, and I should be pleased if I might be allowed to raise one query concerning it.

Prof. Thomson does not regard the temperature of the gas as having any effect upon the ionisation. It has, indeed, never been shown that high temperature alone would produce ionisation. On the other hand, is there any reason for supposing that ionisation by impact may not take place much more easily at high temperature than at low, and that this is the explanation of the discharge observed by Prof. Thomson? That the gas in this case must have a very high temperature would seem exceedingly probable, for the amount of electrical energy lost in the discharge is very great when compared with the thermal capacity of the gas through which the discharge occurs. Thus in one case when the discharge became luminous the current was 0·045 ampere, the potential difference 50 volts, the distance between the electrodes 5 mm., and the pressure of the gas 0·01 mm. The dimensions of the tube are not given, but if we assume the volume of the gas to be 2 c.c., the residual gas to be atmospheric gas, and that the whole electrical energy is used in heating the gas, we should conclude that it would raise it $7{\cdot}4\times10^{7}$ degrees. It is, of course, not to be supposed that the temperature does reach any such value, but we have reason to believe that it reaches a very high temperature, and may it not be that this has a very great effect upon the production of the ions? C. D. CHILD.

Colgate University, Hamilton, N.Y., May 11.

THE average temperature of the gas when the discharge first became luminous was comparatively low; for example, a fine platinum wire immersed in it did not become hot enough to be visible. The figures quoted by Prof. Child refer to the current after the luminous discharge had been well established; the current when the transition from dark to luminous discharge took place was very much smaller, generally less than $10^{-5}$ ampere.

J. J. THOMSON.

### A Horizontal Rainbow.

J'AI étudié récemment un arc-en-ciel horizontal qui se montrait à la surface d'un petit étang dans les premières heures de la matinée. On l'observait, comme celui dont Mr. W. R. M. Church a envoyé la description à NATURE (April 26, p. 608), en tournant le dos au soleil; et il disparaissait quand la hauteur du soleil était de 44° environ. Il avait la forme d'un arc d'ellipse dont un foyer se serait trouvé à peu près dans l'ombre de la tête de l'observateur. Ses caractéristiques étaient les mêmes que celles de l'arc-en-ciel ordinaire: ouverture angulaire de 42° sur le bord rouge, largeur de 2°, apparition à 53° (plus rare) d'un second arc plus faible et plus large avec les couleurs disposées dans l'ordre inverse, obscurité de l'espace compris entre les deux arcs.

Tout invitait donc à chercher l'origine du phénomène dans des sphérules d'eau, qui ne pouvaient être que répandues sur la surface calme. C'est effectivement ce qu'une étude attentive m'a fait découvrir. Les sphérules en question ont généralement quelques dixièmes de millimètre de diamètre. Elles sont très nettement visibles quand on se penche sur l'étang, mais la moindre agitation les fait disparaître. Je les attribue à la rosée déposée à la surface de la nappe tranquille, laquelle est un peu grasse par suite de l'existence de nombreuses colonies d'animalcules et de végétaux dans ses eaux stagnantes. L'arc-en-ciel observé par Mr. Church me semble dû à la même cause: dépôt du brouillard à l'état sphéroïdal sur la surface calme du lac. V. SCHAFFERS.

Louvain (Belgium), rue des Récollets, 11.

## NOTES ON SOME CORNISH CIRCLES.[1]

### III.

*Boscawen-un, N. lat. 50° 5′ 20″.*

MY wife and I visited Boscawen-un on a pouring day, when it was impossible to make any observations. Mr. Horton Bolitho, who was with us, introduced us to the tenant of Boscawen-noon—Mr. Hannibal Rowe—who very kindly, in spite of the bad weather, took us to the circle and the stone cross to the N.E. of it.

Lukis thus described this monument[2]:—

"The enclosed ground on which this circle stands is uncultivated and heathy, and slopes gently to the south. Twenty years ago a hedge ran across it and bisected the circle.

"This monument is composed of nineteen standing stones, and is of an oval form, the longer diameter being 80 feet and the shorter 71 feet 6 inches. One of the stones is a block of quartz 4 feet high, and the rest, which are of granite, vary from 2 feet 9 inches to 4 feet 7 inches in height. On the west side there is a gap, whence it is probable that a stone has been removed. Within the area, 9 feet to the south-west from the centre, is a tall monolith, 8 feet out of the ground, which inclines to the north-east, and is 3 feet 3 inches out of the perpendicular.

"In 1594 Camden describes this monument as consisting of nineteen stones, 12 feet from each other, with one much larger than the rest in the centre. It must have been much in the same condition then as now. As he does not say that the monolith enclosed within it was inclined, it is possible that it was upright at that time.

"Dr. Stukeley's supposition was that it originally stood upright, and that 'somebody digging by it to find treasure disturbed it.'

"On the north-east side there are two fallen stones which Dr. Borlase, in 1749, imagined to have formed part of a cromlech. It is more probable that they are the fragments of a second pillar which was placed to the north-east of the centre, and as far from it as the existing one is. There are instances, I believe, of two pillars occupying similar positions within a circle. One of the stones, that marked C in my plan, on the eastern side of the ring was prostrate in the doctor's time.

"At a short distance to the south-east and south-west there are cairns, which have been explored."

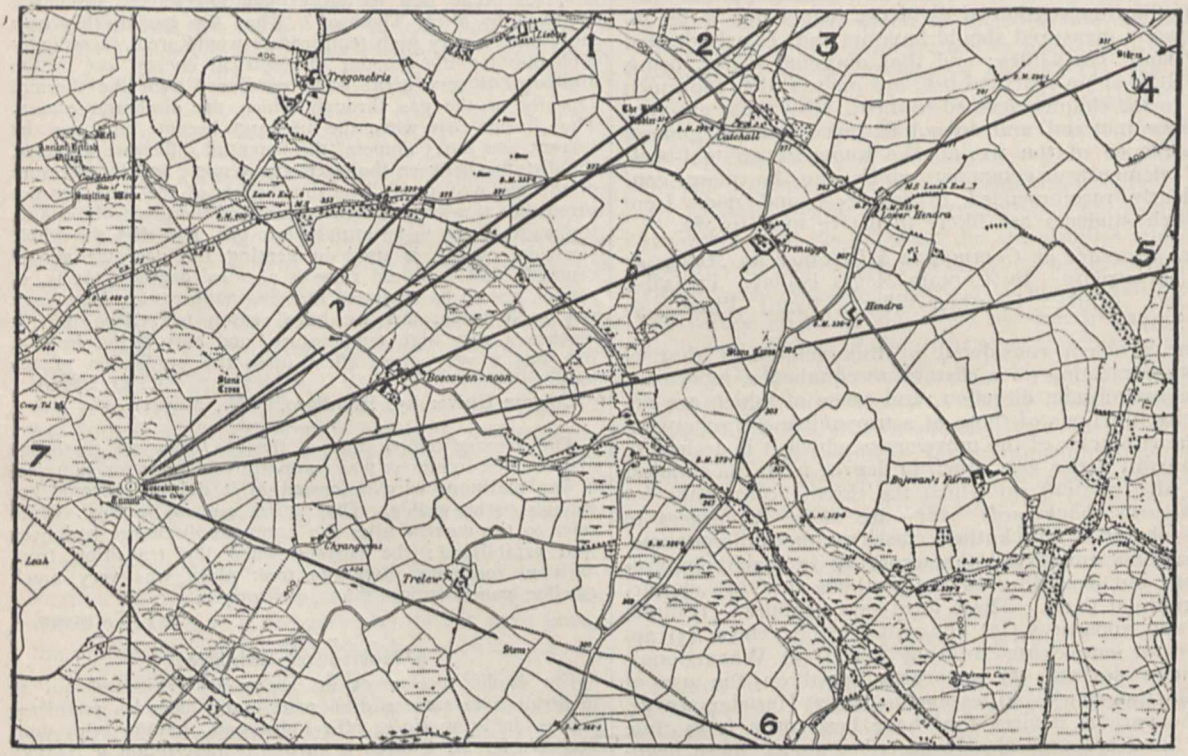


FIG. 8.—Photograph of the Ordnance Map showing sight-lines.

For this monument I have used the 6-inch map, as the circle lies nearly at the centre, and all the outstanding stones are within its limits. The heights of the sky-line were measured by Mr. H. Bolitho at a subsequent visit with a miner's dial; the resulting declinations have been calculated by Mr. Rolston. A theodolite survey will doubtless revise some of them:—

| Marks | Az. | Hills | Dec. | Star | Date |
|---|---|---|---|---|---|
| | ° ′ | ° ′ | ° ′ | | |
| 1. F. Stone cross | N. 43 15 E. | 2 7 | +29 26 | Capella | 2250 |
| 2. P. fine menhir | N. 53 30 E. | 2 23 | 23 59 | Solstitial Sun | |
| 3. B. Blind Fiddler | N. 54 30 E. | 2 23 | 23 25 | ,, | |
| 4. 2 Large menhirs | N. 66 50 E. | 1 0 | 14 55 | May sun | |
| 5. Stone cross | N. 78 0 E. | 1 0 (?) | + 8 8 | Pleiades (May) | 1480 |
| 6. Stone | S. 66 30 E. | 1 0 (?) | −14 32 | November sun | |
| 7. Stone | N. 83 30 W. | 1 0 (?) | + 4 36 | Pleiades (September) | 2120 |

I gather from a report which Mr. H. Bolitho has been good enough to send me that modern hedges

[1] Continued from vol. lxxiii., p. 563.

[2] "Prehistoric Stone Monuments of the British Isles: Cornwall," W. C. Lukis, p. 1.

and farming operations have changed the conditions of the sight-lines, so that 1 and 3 are just invisible from the circle. This is by no means the only case in which the sighting stone has just been hidden over the brow of a hill and in which signals from an observer on the brow itself have been suggested, or a *via sacra* to the brow from the circle; there are many monoliths in this direction which certainly never belonged to the circle. From menhir P (No. 2) a fine view is obtained from N. to S. through E., so that the Blind Fiddler and the two large menhirs, and almost the circle, are visible. The curious shapes of 1 and 2 are noted, the east face vertical and the west boundary curved, like several sighting stones on Dartmoor.

The circle itself has several peculiarities. In the first place, as shown by Lukis, it is not circular, the diameters being about 85 and 65 feet; the minor axis runs through the pillar stone in the centre and the "fallen stones" of Dr. Borlase towards the "stone cross" (which is no cross but a fine menhir) in Az. N. 43° 15′ E. This would suggest that this was the original alignment in 2250 B.C., but against this is the fact that the two stones of the circle between which the "fallen stones" lie are more carefully squared than the rest. It is true, however, that this might have been done afterwards, and this seems probable, for they are closer together than the other circle stones.

The one quartz stone occupies an azimuth S. 66° W. It was obviously placed in a post of honour. As a matter of fact, from it the May sun was seen to rise over the centre of the circle.

As there are both at Tregaseal and Boscawen-un alignments suggesting the observation of the summer solstice sunrise, it is desirable here to refer to the azimuths as calculated. For this purpose Fig. 9 has been prepared, which shows these for lat. 50° both at the present day and at the date of the restoration at Stonehenge.

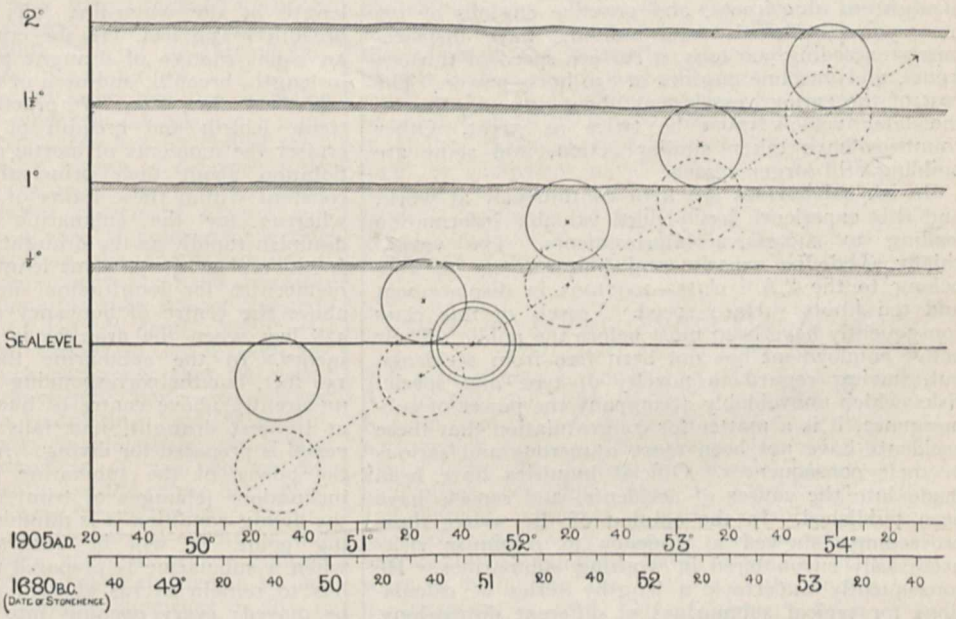


FIG. 9.—Showing the azimuths at the present time and in 1680 B.C. at which the sun rose in Cornwall at the solstice, with different elevations of the sky-line. These are shown at the side.

My readers should compare this with the table on p. 33, vol. lxxii., which gives the solstice sunrise conditions of Stenness in lat. N. 59°. Such a comparison will show how useless it is to pursue these inquiries without taking the latitude and the height of the sky-line into account.

*The "Stripple Stones" (lat. 50° 32′ 50″ N., long. 4° 37′ W.)*

This is a very remarkable circle consisting of 5 erect and 11 prostrate stones situated on a circular level platform 175 feet in diameter on the boggy south slope of Hawk's Tor on Hawkstor Downs in the parish of Blisland. The circle itself is about 148 feet in diameter, and the whole monument is, in Lukis's opinion, the most interesting and remarkable in the country. Surrounding the platform there is a ditch 11 feet wide, and beyond that a penannular vallum about 10 feet in width. The peculiarity of the vallum is that it has three bastions situate on the north-east, north-west, and east sides. It is to the north-east bastion that I wish to refer.

Sighting from the huge monolith, which is now prostrate but originally marked the centre of the circle along a line bisecting the arc of this bastion, we find that the azimuth of the sight-line is N. 25° E.; the angular elevation of the horizon from the 1-inch Ordnance map appears to be about 0° 22′. Thus we get in the same form as before:—

| Alignment | Dec. | Star | Date |
|---|---|---|---|
| Centre of circle to centre of bastion ... | 35° 1′ N. ... | Capella | 1250 B.C. |

indicating that this alignment was formed for the same purpose as that which dominated the erection of "The Pipers."

*The "Nine Maidens" (lat. 50° 28′ 20″ N., long. 4° 54′ 35″ W.)*

In this monument we find a very different type from those considered previously.

The Nine Maidens are simply 9 stones in a straight line 262 feet in length at the present day; possibly, as suggested by Lukis, it may have extended originally to the monolith known as "The Fiddler," situated some 800 yards away in a north-easterly direction. Measuring the azimuth of the alignment on Lukis's plan, and finding the horizon elevations from the 1-inch Ordnance map, we have the following:—

| Az | Hills | Dec. | Star | Date |
|---|---|---|---|---|
| N. 28° E. | ...0° 0′ ... | 33° 47′ N. ... | Capella ... | 1480 B.C. |

It may be remarked that here we have a date for the use of Capella intermediate between those obtained for "The Pipers" and the "Stripple Stones" respectively.

NORMAN LOCKYER.

## THE STABILITY OF SUBMARINES.

THE construction of submarines for the Royal Navy began about five years ago. On March 31, twenty-five vessels of the class had been completed, fifteen were building, and twelve more were projected in the Navy Estimates for 1906–7. France at the same date had thirty-nine submarines completed, and fifty building or projected. Russia had thirteen vessels completed and fifteen building. The United States had eight vessels completed and four building, while Congress has recently sanctioned a special vote of 200,000*l.* for further work on submarines. Germany, Italy, and Japan as yet have done but little, but they are moving in the same direction. An American engineer, Mr. Holland, has exercised the greatest influence on recent submarine design, having worked at the problem for thirty years, and proved himself a worthy successor of his fellow-countrymen Bushnell and Fulton, who were pioneers in submarine construction in the closing years of the eighteenth century and the commencement of the nineteenth. The first five British submarines, ordered in 1900, were repetitions of a type designed by Mr. Holland, tried and approved by the United States Navy Department. Great developments have taken place in later British submarines. Those first built had displacements of 120 tons, surface speeds of eight to nine knots, and gasoline engines of 160 horse-power. Vessels now building have displacements exceeding 300 tons, a surface speed of thirteen knots, and gasoline engines of 850 horse-power. The cost of the earlier vessels was about 35,000*l.*; that of the later vessels must be twice as great. Other countries have taken similar action, and some are building still larger vessels.

British submarines are kept continuously at work, and this experience has yielded valuable information leading to successive improvements. The vessels chiefly used for experimental purposes up to date belong to the "A" class—200 tons in displacement and ten knots surface speed. Vessels of this class consequently have been most before the public. Their active employment has not been free from accidents, but, having regard to novelty of type and special risks which unavoidably accompany the power of submergence, it is a matter for congratulation that these accidents have not been more numerous and serious in their consequences. Official inquiries have been made into the causes of accidents, and reports have been published. In the opinion of the writer these proceedings showed a tendency to minimise risks necessarily encountered in working submarines. He consequently undertook a lengthy series of calculations for typical submarines of different dimensions, in order to ascertain their conditions of stability in various conditions which occur on service. The results for one class are embodied in a paper presented to the Royal Society on May 3, which paper contains also the results of similar calculations made for a cruiser of ordinary form. The distinctive conditions of submarines were emphasised by comparing these results, and the editor of NATURE has suggested that an explanation in popular language of the principal conclusions, based on the investigations, may be of general interest.

Submarines are generally "cigar-shaped," with circular or nearly circular cross-sections. This form is adopted in order to provide, with a minimum expenditure of weight, structural strength sufficient to meet severe external fluid pressures which may come upon the hulls if submarines sink to considerable depths. Such depths are not reached intentionally, but experience shows that they may be attained accidentally, and that very quickly.

In ordinary vessels the freeboard is considerable, and the sides are approximately vertical between the lightest draught reached on service and the deepest (load) draught; consequently, within these limits of draught, horizontal sections of the vessels coincident with the water-surface—known as *planes of flotation*—remain practically constant in form, area, and moments of inertia. In cigar-shaped submarines, with circular cross-sections, the freeboard is small, and the lightest draught of water bears a large proportion to the diameter of the largest circular cross-section. For the typical submarine dealt with in the Royal Society paper, the extreme breadth (diameter of largest cross-section) is a little more than twelve feet, and the lightest draught of water is about ten feet. The circular form of cross-section involves rapid diminution in lengths, breadths, areas, and moments of inertia of successive planes of flotation as the draught of water is increased from light to load. These changes are accompanied by rapid and considerable losses in the stability, and the conditions differ radically from those of ordinary ships. For the typical submarine the extreme length is 150 feet, and breadth extreme 12.2 feet; but the length of water-line at the lightest draught is only 94 feet, and breadth 8.2 feet. When the draught of water is increased eighteen inches (by admitting water-ballast) and the vessel is prepared for diving, the length at the water-line falls to 41 feet, and the breadth to 3.6 feet. In the cruiser of ordinary form an equal change of draught produces small change in length, breadth, and area of the planes of flotation, and these dimensions are practically equal to the extreme length and breadth of the vessel. For the cruiser the moments of inertia of successive planes of flotation about their principal axes remain nearly constant within these limits of variation in draught; whereas for the submarine moments of inertia diminish rapidly as the draught of water is increased. In the cruiser the extreme length is 260 feet, and the metacentre for longitudinal inclinations is 352 feet above the centre of buoyancy at light draught, and 328 feet when the draught is increased by eighteen inches. In the submarine the extreme length is 150 feet, but the corresponding height of longitudinal metacentre above centre of buoyancy is only 37 feet at lightest draught, and falls to 1¼ feet when the vessel is prepared for diving. At the lightest draught the power of the submarine to resist longitudinal inclinations (changes of trim) is relatively small; in the diving condition it is diminished almost to vanishing point. It will be understood, therefore, that when a submarine is prepared for diving every man has to remain at his station, and no weights must be moved; every opening into the interior must be closed hermetically. The reserve of buoyancy is extremely small in the diving condition. A submarine of more than 200 tons weight may have only 400 to 800 pounds reserve—representing 40 to 80 gallons of water.

Even at their lightest draughts the reserve of buoyancy of submarines is very small as compared with that in other vessels. In good examples it is 6 per cent. of the corresponding displacement—little more than half the lowest percentage accepted for low-freeboard monitors when fully laden, and about one-fourth the corresponding percentage for the deepest laden cargo steamers. Openings into the interior are placed at the tops of conning towers at a considerable height above water, and Admiralty regulations provide that all openings shall be closed before water-ballast is admitted to bring a vessel into the diving condition. Further, it is now provided that before proceeding at full speed at the surface, the maximum reserve of buoyancy shall be secured by emptying ballast tanks. One of the most serious acci-

dents that have occurred to British submarines—that to A 8—was unquestionably due in great measure to proceeding at full speed with about half the maximum reserve of buoyancy, certain tanks containing water-ballast. The vessel was driven under water as she gathered speed, dipped her bow suddenly, brought the open top of the conning tower to the water-level, was partly filled, and foundered.

Maintenance of the full reserve of buoyancy and lightest draught of water when proceeding at the surface increases safety in two directions. It secures much greater longitudinal stability, and diminishes the tendency to plunge produced by the relative motions of the water surrounding the vessel, especially at the bow. These motions are largely discontinuous, broken water being piled upon the bow, and the phenomena being of such a character that only direct experiment on models or vessels can give accurate information. Such experiments have been made both in this country and abroad, and they indicate the occurrence of a tendency to plunge at certain critical speeds. The problems are still only partially solved, but it is certain that the maximum reserve of buoyancy should be maintained. It also appears desirable to keep the vessels on an even keel, since a cigar-shaped form has then its maximum longitudinal stability for a given mean-draught of water. In the Royal Society paper calculations are recorded showing the diminution of stability accompanying changes of trim in submarines.

In modern submarines of large size the operation of diving is performed when the vessels have headway. Horizontal rudders, controlled by skilled men, are employed as the active means of depressing the bow. The pressures on the upper surface of the vessel resulting from the relative movement of the surrounding water develop a vertical component acting downwards which overcomes the small reserve of buoyancy and the vertical component of the pressures on the rudder. The submarine then moves obliquely downwards. When the desired depth below the surface has been reached the steersman operates the horizontal rudders in such a manner that the vessel shall advance on a practically horizontal course, although it really is an undulating one. Watchfulness and skill are necessary to achieve this result, and there must be no movements of men or weights which would vary the position of the centre of gravity. If such movements become necessary—as, for example, when torpedoes are discharged—compensation must be arranged to take effect at once. Failures to comply with these conditions may involve serious consequences, and have caused submarines to dive to great depths. With trained and disciplined crews such accidents are rare. Plans for automatic maintenance of any desired depth—similar to those used in locomotive torpedoes—have been brought forward and tried; but for large submarines manual control has been found preferable. In small submarines it has been found possible to dive without headway by varying the volume of displacement, admitting water into suitable chambers from which it can be readily expelled when the desired depth has been reached, and a balance restored between weight and buoyancy. Such methods involve the necessity for minute and rapid adjustments, which can be secured on a small scale much more readily and certainly than on a large scale. As a consequence, horizontal rudders and headway have been generally adopted for large submarines, and have answered well on the whole. One great advantage of the plan is that when headway ceases the horizontal rudders become inoperative, the small reserve of buoyancy reasserts itself, and the submarine comes to the surface. The other system—varying the volume of displacement—especially when applied to large vessels, involves risks of reaching great depths in a short time before buoyancy can be restored. This is recognised in vessels which work on that system, and detachable external weights are fitted, so as to restore buoyancy in cases of emergency.

There has been a considerable increase in the speed of submarines, both at the surface and when submerged. Our latest types are said to have surface speeds of thirteen knots and a radius of action of 500 miles with their gasoline engines, while the under-water speed is nine knots and radius of action 90 miles. These higher speeds are attainable, no doubt, but they necessarily involve greater risks, especially in the diving condition. Pressures on horizontal rudders increase as the *squares* of the speeds, and the extreme sensitiveness of submarines when submerged to the action of external forces tending to produce changes of trim must demand much greater watchfulness, skill, and promptness of action on the part of steersmen than are now required, if greater speeds are to be attained under water. The risks of attaining rapidly excessive depths of submergence must increase as speeds are raised, and they are now far from negligible. At the lightest draughts increase of speed would also involve greater risks of accidental plunging. Exhaustive experiments are necessary, therefore, before designers of submarines commit themselves to the production of vessels having much greater surface speeds, and still more of vessels having much greater under-water speeds. Submarine design is not a task to be lightly undertaken by amateurs; it requires thorough experimental and scientific treatment by competent naval architects, who should be furnished by naval officers with the strategical and tactical conditions to be fulfilled in the completed vessels, and should ascertain what is involved in the fulfilment of these conditions. W. H. WHITE.

## *THE RISE AND PROGRESS OF THE ZOOLOGICAL SOCIETY.*[1]

IT was a happy thought on Mr. Scherren's part to tell the story of the Zoological Society of London, and he is to be congratulated on the success with which he has accomplished his evidently congenial task. The history of a development is always interesting, especially when it is still progressing, and there is, moreover, a strong personal interest in the book, since many eminent workers, whose names and deeds are familiar, have cooperated in various ways in furthering the welfare of the society since its inception in 1826. Mr. Scherren's book is not only a careful contribution to the history of zoology in Britain during the last eighty years, but is at the same time good reading for its revelation of what goes on behind the scenes in a scientific society, and for its record of many interesting events in what is familiarly called the "Zoo."

On November 29, 1822, John Ray's birthday, a bud from the Linnean Society formed itself into a "Zoological Club," which four years afterwards took shape as the Zoological Society. There were 342 members at the close of the year, and there are now ten times as many. In 1828, when the gardens were opened to the public, there were about 600 specimens, and there is now a specimen for each F.Z.S. A farm for breeding purposes and experimental work (from which nothing very noteworthy ever resulted) was established in 1829 at Kingston Hill, and scientific meetings began to be held in 1830. Such were the

1 "The Zoological Society of London: a Sketch of its Foundation and Development, and the Story of its Farm, Museum, Gardens, Menagerie and Library." By Henry Scherren, F.Z.S. Pp. xii+252; 12 coloured plates, 50 uncoloured plates, 9 plans. (London: Cassell and Co., Ltd., 1906.) Price 30s. net.

beginnings of the Zoological Society. How it grew from more to more Mr. Scherren tells us with no lack of circumstantial detail. We see the long procession into the scientific ark, we hear the quaint comments made when conspicuously new creatures arrived, we can realise from the abundant plates how the "houses" increased in number, size, and efficiency, and we are reminded how men like Owen, Yarrell, Waterhouse, Gould, Huxley, Flower, Sclater, Murie, and Wolf helped the Society forwards in varied ways. From time to time there were new departures, such as the publication of Proceedings and Transactions, the institution of aquarium and insect-house, the formation of a library, the experiment of the Davis lectures. As in many a development there were periods of rapid growth and of temporary arrest, of crisis and metamorphosis, and there was quite recently a general reorganisation. The author gives expression to the view forced upon him by the history "that before the Zoological Society was half a century old its bionomical work practically ceased owing to the increasing influence of morphographers and systematists in its councils. The election of the Duke of Bedford as president, the recommendations of the Reorganisation Committee, and subsequent changes, mark a return to lines laid down by the charter." We fervently hope that this policy will be adhered to, and that the "Zoo" will gradually become a recognised centre of bionomical research and evolutionist experiment.

*Photo.*] [*Cassell & Co., Ltd.*

FIG. 1.—Rocky Mountain Goat. From "The Zoological Society of London."

No naturalist can read this well-told history without having his gratitude to the Zoological Society revived, not only for what it has directly accomplished through the gardens and the workers there, through the scientific meetings and the publication of what has been submitted there, but also for the way in which the society has given aid and encouragement to bibliography (notably through the Zoological Record), to institutions such as the biological stations of Naples and Plymouth, as also to travellers, collectors, and, indeed, zoologists at large. The excellence of the plates which adorn Mr. Scherren's volume reminds us also of the important part the society has played in sustaining and raising the standard of zoological illustration.

## THE INTERNATIONAL FISHERIES INVESTIGATIONS.

THE latest publications of the International Fisheries Organisation consist of the part of the *Bulletin des Resultats* containing the results of the quarterly cruises carried out in May, 1905, the fourth volume of *Rapports et Procès-Verbaux*, and Nos. 28 to 32 of the *Publications de Circonstance*. The bulletin contains the usual data—hydrographical and plankton observations obtained in the course of the obligatory voyages made by the exploring vessels. At first the west coast of England and the coasts of Ireland were not included in the area to be investigated, but for the last year the Irish Board of Agriculture and Technical Instruction have allowed their steamer to make the necessary quarterly cruises, and a report on these is now made to the International Council by Mr. E. Holt.

The *Publications de Circonstance* include an account of an investigation of the fisheries for salmon and sea-trout in the rivers and neighbouring waters of the Baltic, with special reference to measures of artificial culture, being the report of an international commission appointed by the International Council for Fishery Investigations, and two papers by Dr. R. J. Witting, of a very technical nature, dealing with the measurement of ocean currents, one of them describing a new electrically registering current meter. The two remaining reports are by Dr. C. Kofoid and Dr. L. Gough, the former dealing with a means of studying plankton from deep water layers, and the latter describing the migrations of an oceanic species of Siphonophore.

In the former paper Dr. Kofoid describes the construction of a bucket for obtaining samples of water from considerable depths. Plankton from deep water has hitherto been obtained chiefly by means of self-closing nets, or by bringing up water from the requisite depth by a pump and hose-pipe, both methods of some uncertainty in their results. The apparatus described consists of a bucket of considerable dimensions which is lowered down to the depth required, where it fills with water, and is then closed by means of a specially constructed catch and "messenger." The samples of sea-water obtained by making a number of hauls with this apparatus are then filtered in the ordinary way, and the organisms present are so obtained. It is claimed that the apparatus is simple and certain in its results, and that it can also be used for obtaining temperatures from the depths to which it is lowered.

Dr. Gough describes the distribution of the Monophyidan genus *Muggiaea atlantica*, Cunn., in the waters of the English Channel, the Irish Sea, and off the south and west coasts of Ireland during the year 1904. It is shown that a shoal of Muggiæa entered the Channel in May, and that the shoal was introduced into this area by the current of Atlantic water which, just before this time, had set into the Channel as a stream flowing north past Ushant from the Bay of Biscay. The shoal entered the English Channel and reached as far as Plymouth, from which region it disappeared at the end of the year. After entering the Channel the shoal divided, and, rounding Land's

End, one portion entered the Irish Sea, and by September had reached as far north as the Cardigan Bay and south Arklow light-ships. The other part of the shoal passed along the south coast of Ireland, and was observed in November as far along the west coast of Ireland as Galway Bay. The disappearance of the shoal from the Irish Sea in September is attributed to the southerly flow of water from that area into the Channel blocking its further northerly migration. It is shown that the shoal must have entered the Irish Sea from the south, for plankton collections taken from the Bahama light-ship in the north of that area did not contain the organism, which could not, therefore, have passed through the north channel. The paper is illustrated by charts which show the distribution of Muggiæa from month to month during the year 1904.

The volume of *Rapports* is noteworthy only because of a statement made by Mr. Archer, the English Chief Inspector of Fisheries, at one of the "reunions," that it is the wish of the British Government "that no tasks should be undertaken or interests created the conclusion of which could not be reasonably looked for by July, 1907," since it is not the intention of the Government to continue the large expenditure involved beyond the five years originally contemplated. It is very probable, then, that the British share of the work will cease in the course of another year, and that with the withdrawal of this country the international investigations will come to a close.

It has, indeed, been apparent for some time past that the International Organisation, as at present constituted, could not continue on a permanent basis. For the last five years it has been necessary to maintain, at a very great expense, the Bureau at Copenhagen, the Central Laboratory at Christiania; and a complex system of "reunions" of the council, the "commissions," the "special commissions," and "sections." All this organisation was no doubt necessary, in the first instance, to bring together those engaged in the work, and to secure the necessary coordination in the hydrographical investigations. But since this preliminary organisation must now have been completed, it is desirable in any case that some simpler and less expensive means of coordination should have been evolved. It should be remembered that the international scheme of investigations originally included fishery research proper, hydrographical investigations, and, though this has never been stated in so many words, the promotion of international agreement with respect to the observance of "closed areas," such as the Moray Firth, and the regulation of fishing on the high seas. With regard to the latter point one cannot speak at present, but it may be pointed out that fishery legislation on an international scale has been notoriously difficult to obtain in the past, and that the chances of securing this at the present time ought not to be jeopardised by the unconditional withdrawal of Great Britain from the scheme of international work. Purely fishery investigations need not be imperilled by any such action. There does not appear to be any real advantage in the prosecution of these on an international scale. No amount of research carried out in another area than our own will relieve us of the necessity of investigating fishery questions locally with respect to the special economic and legislative problems involved. Fishery research with regard to such issues as the protection of immature fishes, closed areas and closed seasons, the regulation of fishing methods, and the like, must be carried on if fishery restrictions are ever to be more than an expensive and vexatious interference with the legitimate operations of our fishermen. If a fair proportion of the annual grant at present made to the International Organisation is in the future made to supplement the efforts of existing fishery research institutions, with, of course, proper Government inspection, then the withdrawal of our Government from the international scheme need cause no apprehensions.

It is different with regard to the hydrographical investigations. If these are to be carried on at all it must be on an international scale, and with proper coordination as regards methods and publication of results. Quite apart from the assistance which such research is likely to afford meteorological science, it seems now to be certain that it is sure to throw light on the ultimate causes which affect the shoaling movements and migrations of food fishes. There is really no good reason why, even if the fishery investigations of the International Organisation be dropped, the hydrographical work should not go on. The present hydrographical cruises could be continued by the national staffs; and methods having already been worked out, the coordination of the work and the publication, in a uniform style, of the results need entail no great expense. The international conferences which have become so marked a feature of fishery affairs, both on the administrative and scientific sides, might be dispensed with, and no really useful object would be sacrificed.

## NOTES.

THE council of the Society of Arts has awarded the Albert medal for the present year to Sir Joseph W. Swan, F.R.S., "for the important part he took in the invention of the incandescent electric lamp, and for his invention of the carbon process of photographic printing."

A LARGE physical laboratory is, the *Pioneer Mail* states, to be built by the Punjab Education Department in Lahore on the present camping-ground of the Public Works Department, as soon as the new Public Works offices are constructed.

THE *British Medical Journal* states that a general institute of psychology specially intended for the study of the phenomena of subconsciousness, the investigation of the causes of criminality, and the discovery of means of curing social evils will shortly be formally constituted in Paris. Among those to whom the initiation of the scheme is mainly due are Profs. Brouardel, d'Arsonval, and Gariel, and MM. Boutroux, Giard, and A. Picard.

WE notice with regret the announcement of the death, at eighty-three years of age, of M. Raphael Bischoffsheim, honorary member of the Paris Academy of Sciences. M. Bischoffsheim was a generous benefactor to science. He contributed largely to the Pic du Midi Observatory, bore the expense of the great equatorial at Paris Observatory, gave largely to the Montsouris Observatory, and founded the fine observatory at Nice. He was elected a member of the Institut de France in 1890 in succession to M. Cosson.

A COMMITTEE has been formed with the object of establishing a memorial of the late Sir William Wharton, K.C.B., F.R.S., whose death at Cape Town in September last was a sad incident of the British Association meeting in South Africa. For a long period Sir William Wharton filled with distinguished ability the important post of hydrographer to the Navy, and the committee has decided that the most appropriate testimonial would be such as would follow the same lines and exist for the same purpose as the Beaufort testimonial, which is awarded as a prize to the officer who has distinguished himself as having passed the best ex-

amination in mathematics and nautical astronomy for lieutenant in his year. This Sir William Wharton won in the year 1865. By the proposed arrangement two awards for the same object would be given under the names of "The Beaufort Testimonial" and "The Wharton Testimonial," thus associating the names of the two eminent hydrographers who have served for the longest periods in that capacity. It is proposed in addition, if the funds admit, to present a medal, having on the obverse a bust of the late Sir William Wharton, and on the reverse a suitable inscription. The committee includes Vice-Admiral Sir Charles Drury, K.C.B., K.C.S.I.; Captain A. Mostyn Field, F.R.S.; Vice-Admiral Swinton C. Holland; Admiral of the Fleet Sir F. Richards, G.C.B.; and Captain T. H. Tizzard, C.B., F.R.S. Messrs. Coutts and Company, Bankers, 440 Strand, London, have arranged to receive contributions to the fund.

ON May 25 Lord Avebury presided at the annual conversazione of the Selborne Society and delivered his presidential address. He spoke of the coming of age of the society, of the interest which many members were taking in the forthcoming "Country in Town" Exhibition, and of the bird sanctuary maintained by the Ealing branch. He also alluded to the destruction of roadside beauty, to the way in which ladies prefer the authority of shopkeepers to that of ornithologists with regard to "artificial ospreys" so called, and to the injury to birds, which gamekeepers still continue to do. In the latter part of his remarks Lord Avebury dwelt upon the manner in which the study of nature adds to the happiness of life. Nearly 700 guests were present, and there was a large number of interesting exhibits, including some fifty microscopes exhibited by members of the Royal Microscopical Society, the Quekett Club, and other institutions.

MESSRS. R. B. Woosnam, D. Carruthers, and A. F. R. Wollaston, three members of the zoological expedition sent to Africa under the auspices of the Natural History Museum, South Kensington, have made the following ascents in the Ruwenzori range. On April 1 they ascended Duwoni, the peak rising to the north-east of the Mubuku Glacier. This peak has two tops of apparently equal altitude; the southern top, which was reached, was found to be 15,893 feet. On April 3 they ascended Kiyanja, the peak at the western end of the Mubuku group of peaks. The altitude was found to be 16,379 feet. (The altitudes were taken by aneroid and by the boiling-point thermometer.) Both these peaks have been thought by different explorers to be the highest points in Ruwenzori, but from the summit of Kiyanja a still higher peak with two tops was seen in a north-westerly direction. The weather at this season of the year is very unfavourable, the mountains being almost constantly buried in clouds with frequent snowstorms, which prevented the party from making further explorations.

ON Friday last, June 1, the Secretary for Scotland received a deputation of the Royal Scottish Geographical Society, laying before him the claims of the society in connection with the proposed National Galleries Bill (see p. 137). The deputation was introduced by Mr. C. E. Price, M.P., and the society's position and claims were explained by Prof. Geikie (president), Mr. W. B. Blaikie, Dr. George Smith, Mr. W. C. Smith, K.C., and Mr. Ralph Richardson. The national character of the society was touched upon, as also the important work it did in fostering the study of geography, in providing lectures by eminent travellers in the four great centres of population, and in giving facilities for the inspection of maps and valuable geographical works. It was claimed that the society should be recognised officially as one of the scientific societies of Scotland, to be provided with premises free of rent (at present 120*l.* is paid in rent), to have a grant from State funds, and to be represented on the new Board of Trustees. Reference was also made to the present endeavour to found a chair of geography in the University of Edinburgh. The Secretary for Scotland in reply thanked the members of the deputation for their presence, and pointed out that their memorial went further than the recommendation of the departmental committee which recommended the remission of the rent of 120*l.* which the society pays for its accommodation in the National Portrait Gallery. He was not sure that this was a convenient time to urge the Government to further expenditure, but he would not fail to take into serious consideration all that had been urged in the interests of the society.

WE regret to announce the death on May 29 of Dr. William Fream, who since 1894 acted as the agricultural correspondent of the *Times*, and was formerly a frequent contributor to our columns. Born in 1854, Dr. Fream was educated at the Royal College of Science, Dublin, and became professor of natural history at the Royal Agricultural College at Cirencester. After lecturing for a time on botany at the Guy's Hospital Medical School he became professor at the Downton College of Agriculture. Later he was chiefly engaged in writing, and for ten years acted as editor of the Journal of the Royal Agricultural Society. His best-known books were one on the Rothamsted experiments and his "Elements of Agriculture," written for the Royal Agricultural Society, which reached its seventh edition last year. Dr. Fream will be remembered for the part he took in a controversy as to the merits of perennial rye grass in pastures, a controversy which cannot yet be regarded as settled. Mr. Faunce de Laune, and with him Mr. Carruthers, maintained that rye grass was neglected by stock, and should be excluded from any mixture used for sowing down land to grass. Dr. Fream, however, by growing pieces of turf selected from the most famous pastures in the country, demonstrated that rye grass was a large constituent of such good grass land, and in consequence argued strongly in favour of the high opinion in which this grass has always been held by practical farmers.

PRELIMINARY arrangements have been made for the establishment of a great marine museum in New York with an astronomical museum as an adjunct to it. The New York Observatory and Nautical Museum will, according to *Science*, have an endowment of not less than 100,000*l.*, and, in addition to this, it is expected that the city of New York will provide a site in Bronx Park adjacent to the botanical garden and zoological park, and will also erect the museum building and the domes and smaller buildings for the observatory. In the nautical museum will be collected and exhibited models of all types of vessels, safety and signal devices, nautical instruments and methods of determining position, charts, marine engines and motors, and historic instruments and relics. The museum and collections will be arranged so that properly qualified persons can avail themselves of the facilities there offered for investigation and research. The observatory will be provided with a great telescope, for photographic and visual work, astrophysical instruments for the investigation of solar problems, magnetometers, seismographs, and other necessary instruments. A time service will be instituted so that chronometers may be rated, marine instruments will be tested, and tidal investigations will be inaugurated.

COMMENTING upon Mr. Southerden's letter on "Carbon Dioxide in the Breath," published in NATURE for May 24 (p. 21), Mr. E. A. Parkyn writes to direct attention to the well-recognised fact that the presence of 0·06 per cent. of carbon dioxide in the atmosphere need not be injurious, but that the gas is generally found in bad company, for an increase of carbon dioxide is almost invariably accompanied by a corresponding increase of organic impurity. In other words, the importance attaching to the rise of carbon dioxide to 0·06 per cent. is a true indication of the vitiation of the air by organic matter given out during respiration.

A COMMUNICATION from the Zi-ka-wei Observatory, near Shanghai, informs us that the great San Francisco earthquake was registered by the seismographs there. The shocks were fairly strong, and they lasted a little more than 1h. 34m. The first preliminary tremors, transmitted through the mass of the globe, began at 9h. 35m. 0s. p.m. Chinese coast time. The first large waves, travelling along the crust, on an arc of a great circle, were felt at 9h. 55m. 54s. The last waves of decreasing amplitude left their trace at 10h. 31m. 35s. p.m., and the last slight movements of the ground died away at 11h. 9m. 44s. p.m. April 18. These records should be of service in determining the velocity of propagation of the seismic undulations by connecting them with observations of the exact minute and second of the occurrence at San Francisco.

MR. CHARLES VAN NORDEN, writing from East Auburn, California, U.S.A., says that he was on the fourth floor of the Palace Hotel, San Francisco, on April 18, when the disastrous earthquake occurred. The movement seemed from south to north, and the rocking of the massive walls of the hotel was so violent that its continuance even for a few seconds seemed impossible. To Mr. Norden, who was in bed, the motion seemed like that of a small rowing boat on a choppy sea. The shock occurred at 5.13 a.m., and at 6 a.m. Mr. Norden had left San Francisco by the ferry boat for Oakland. While sitting on the deck of the ferry boat, looking at the many fires gathering together in a great conflagration, he noticed a thunder-cloud—a white, cumulous mass, dark at the bottom—hanging over the city. The morning was clear and mild for San Francisco, and no other cloud was in sight. None of the descriptions of the catastrophe mentions this feature, and Mr. Norden is curious to know if other observations were made of it.

AN excellent little *résumé*, by Mr. D. J. Scourfield, of the leading features and possible developments of Mendel's law of heredity appears in the Proceedings of the South London Entomological and Natural History Society for 1905–6. Other articles are devoted to the British plume-moths, the lengthened pupa-stage of certain Lepidoptera, and notes on Hawaiian entomology.

THE contents of the *Sitzungsberichte und Abhandlungen* of the Dresden Isis for the second half of 1905 include an article by Prof. O. Drude on the meaning and scope of the term œcology (ökologie), or the manifestations of plant and animal life in regard to the struggle for space (or existence) in connection with climate and other external influences. Mr. H. Engelhardt contributes an illustrated article on the Tertiary flora of Chili.

A STRIKING instance of increased patronage due to the adoption of "popular prices" is recorded by Captain Stanley Flower in his report of the Giza Zoological Gardens for the past year. By the reduction of the gate-money the number of visitors to the garden leaped up from 64,711 in the previous year to 177,587, an excess of 112,876 over any other year. The receipts showed, however, but a comparatively small increase—£E.1402 against £E.1388 in 1904. The stock of animals has been largely increased, and a notable new feature in the gardens is the formation of an extensive enclosure, where a number of the larger birds of the Nile Valley are allowed to roam at comparative liberty.

OLD churchwardens' accounts of various Bedfordshire parishes have been utilised by Mr. J. Steele-Elliott, for an article which appears in the May number of the *Zoologist*, to afford information with regard to the fauna of the county during the last two and a half centuries. The entries cited refer to sums paid for the destruction of "vermin." The absence of mention of birds of prey is noticeable, as is the infrequent occurrence of rats, but special interest attaches to certain entries referring to martens. Polecats were evidently once abundant, and it is curious to note the persistent war waged against the hedgehog—probably on account of its supposed milk-sucking propensities. Mr. Heneage Cocks refers, in the same issue, to an artificial cave at Park Place, Remenham, Berks, which forms the abode of a number of bats, some belonging to rare species, including *Myotis bechsteini*.

WE have received seven parts (Nos. 1448, 1449, and 1452 to 1456) of the Proceedings of the U.S. National Museum, which include descriptions of Japanese Hymenoptera and of South American geometrid moths and grasshoppers, as well as of two American river-mussels; fully illustrated notes on molluscs of the family Pyramidellidæ from Japan, America, and the intermediate areas; a synopsis of Japanese sturgeons; and an account of the osteology of the creodont carnivorous mammals of the genus Sinopa. The latter genus, which occurs in the Lower and Middle Eocene of North America, according to Mr. W. D. Matthew, may be regarded as an extremely primitive form, with cheek-teeth of the opossum-type, from which have been evolved the more specialised Cynohyænodon, Pterodon, and Hyænodon of the Oligocene. Japanese sturgeons are, it appears, represented only by two species. Of the Pyramidellidæ, Messrs. Dall and Bartsch name a number of new species, and also figure others.

THE application of De Vries's mutation-theory to molluscs forms the subject of an article by Mr. F. C. Baker in the May number of the *American Naturalist*. The shells selected for observation are fresh-water snails, more especially Limnæa and Valvata, the former of which is well known to be an exceedingly variable or "unstable" type. Series of specimens of Limnæa from particular localities are figured to exhibit the range of variation, which is so great that the extreme forms, if isolated, would be allowed specific rank. Special attention is directed to the sudden development of an apparently new species in a newly-formed pond in the United States. While the mutation-theory seems to account more satisfactorily than any other for these variations, the author deprecates haste in applying a hypothesis founded upon plant-variation to animal life. In the same issue Dr. E. A. Andrews discusses the mode in which American crayfish of the genus Cambarus lay their eggs. The first process is the careful cleansing of the lower surface of the body preparatory to the extrusion of a glairy substance from the "cement-glands" in which the eggs are afterwards laid. During oviposition the female lies supine and externally inert, but after this occurs a long, rhythmic alternation of poses connected with the fastening of the eggs to the abdominal appendages.

THE *Haslemere Museum Gazette* is the title of a new serial published by the institution the name of which it bears, and to be issued in monthly parts at the price of sixpence. The Haslemere Museum specially devotes itself to education at first-hand, that is to say, by inculcating familiarity with actual specimens rather than the cultivation of mere book-knowledge. One of the objects of the new journal is to assist and amplify this excellent conception. It is proposed to refer in turn to the chief museums in London (including those devoted to art), the Zoological Society's Gardens, &c., and to direct the attention of readers to some of the most noteworthy objects in each. By this means—without in any way usurping the function of a "guide"—it is urged that the educational value of such establishments will be largely increased. Nor will nature itself be neglected, as is demonstrated by the frontispiece, representing two oaks growing under similar conditions, but one with and the other without leaves. Excellent "lecturettes" on prehistoric times and the severance of Britain form part of the contents of the first number. Giraffes in the British Museum, with a (not absolutely accurate) transcript of the accompanying label, form the subject of another section.

IN connection with the study of the occurrence of glycogen and paraglycogen in fungi, the late Prof. Errera compiled a bibliography of the subject. The list of papers with his abstracts on their contents is published in *Recueil de l'Institut botanique*, Brussels, vol. i., 1905.

IN the *Bulletin du Jardin impérial botanique*, vol. vi., part ii., Madame O. Fedtschenko writes a note on species of Eremurus in which she refers the species *Eremurus Aucherianus* and *Eremurus Korolkowi* from Turkestan to *Eremurus anisopterus* and other species. Mr. V. Arcichovskij discusses the size of plants as a specific character.

TO replace the list of ferns and fern-allies cultivated in the Royal Gardens, Kew, issued in 1895 and now out of print, a second edition compiled by Mr. C. H. Wright has been published. The plants are enumerated under the three groups of ferns, fern-allies, and cultivated forms of British ferns. The table of fern-distribution throughout the world, drawn up by Mr. J. G. Baker for the previous edition, has been revised, showing a considerably increased percentage for temperate Asia.

A DETAILED account of the distribution of the forest flora of the Bombay Presidency and Sind has been contributed by Mr. W. A. Talbot to the *Indian Forester* (January to March). Mr. Talbot distinguishes an evergreen forest flora of Malabar showing a decided Malayan affinity, a Deccan dry deciduous flora in which African elements predominate, and the flora of the Western Ghats and Konkan, in which there is a mixture of high deciduous and evergreen forests. The dry Deccan flora includes such typical species as *Zizyphus jujuba*, *Acacia catechu*, *Sterculia ureus*, and *Bombax malabaricum*. Myristicas, Dipterocarpeæ, laurels, and palms are characteristic of the tropical evergreens.

THE Bulletin of the Johns Hopkins Hospital for May (xvii., No. 182) is mainly devoted to medical subjects. Dr. Cushing contributes an interesting article on a course of instruction in operative medicine, and Dr. Pratt one on the home sanatorium treatment of consumption, in which the problem of applying the open-air treatment of tuberculosis in the homes of the poor is dealt with. The proceedings of the Johns Hopkins Historical Club are devoted to a "symposium" of the "gold-headed" cane, a stick or cane, now in the possession of the Royal College of Physicians of London, which made its appearance in medical circles about the year 1689, and for one hundred and thirty-six years was carried by a leading London practitioner, including John Radcliffe, Richard Mead, Anthony Askew, William Pitcairn, and Matthew Baillie, all well-known names in medical history.

WE have received from Mr. Herbert Kynaston, director of the Transvaal Geological Survey, a copy of his memoir on the geology of the Komati Poort coalfield (Pretoria, 1906, price 7*s*. 6*d*.). It covers 55 pages, and constitutes the second of the series of descriptive memoirs which it is the intention of the Geological Survey to issue from time to time. It is an admirable piece of work, giving a connected account of the character, behaviour, and distribution of the coal-bearing strata of the Komati Poort district. A description is also given of the associated sedimentary and igneous rocks. Apart from the prevalence of intrusive sheets and dykes of igneous rock throughout the coal-bearing strata, the conditions are favourable, and no evidence was observed of the beds having been disturbed by faulting in a manner that would be discouraging to mining operations. The actual Coal-measure series occupy 150 square miles, and the great thickness of the coal-bearing strata, and the favourable situation of the better portion of the field, render the prospects eminently satisfactory. The memoir is accompanied by two coloured geological maps and six sections, and six photographic views giving an excellent idea of the character of the scenery on the Crocodile and Komati rivers.

SOME valuable results of an experimental investigation on the effect of fire on building stones were described by Mr. W. R. Baldwin-Wiseman at a meeting of the Surveyors' Institution on May 14. The purpose of the research was not so much to determine the design of a building for fire resistance as to estimate the ultimate stability of an edifice after subjection to a severe conflagration, and to afford some small assistance to those who may be called upon to decide whether demolition or reconstruction shall succeed the wrecking influences of a big conflagration. The points of primary importance in determining the most efficient design for fire resistance are summarised as follows:—(1) That the edifice should in no wise be flimsy; (2) that it should be constructed of stone possessing a uniform or fairly uniform coefficient of expansion, and retaining a considerable strength after subjection to high temperatures; (3) that all combinations of different stones should be avoided as much as possible; (4) that combinations of stone and metal should be avoided, especially when the former rests directly upon the latter, even when the metal is entirely enshrouded in stone, for stone acts as a fairly good conductor of heat; (5) that stair wells and lift wells should open as little as possible on to the main building, and should preferably be enclosed and glazed with wired glass from basement to roof; (6) that floor areas should not be unduly large or corridors unduly long.

THE first parts of two serial publications, issued by Messrs. Cassell and Co., Ltd., have been received. A new edition of Prof. G. S. Boulger's "Familiar Trees" is to be completed in twenty-nine fortnightly parts, and will contain 114 coloured plates and 114 illustrations from photographs. Mr. W. F. Kirby's "Butterflies and Moths of Europe" will be published in thirty-two instalments at fortnightly intervals; and the completed volume, with its large pages and fifty-four coloured plates, will form an attractive addition to the naturalist's reference library.

MR. T. FISHER UNWIN has published a second edition of "Methods in Plant Histology," by Dr. C. J. Chamberlain, of the University of Chicago. The first edition of the book appeared in 1901, and was reviewed in our issue of November 28, 1901 (vol. lxv., p. 75). It is only necessary to say of the present edition that more attention has been given to the collection of materials. Prof. Kleb's methods for securing various reproductive phases in the algæ and fungi have been outlined, and methods for growing other laboratory material are more complete. New chapters dealing with microchemical tests, free-hand sections, special methods, and the use of the microscope are included.

## OUR ASTRONOMICAL COLUMN.

SUN-SPOT AND CHROMOSPHERIC SPECTRA.—A paper of exceptional interest to workers in solar physics was read by Prof. A. Fowler at the April meeting of the Royal Astronomical Society.

Whilst observing the bright lines in the spectra of metallic prominences on the sun's limb, Prof. Fowler has been able to classify them into "long" and "short" lines, a fact which points to their origin being in the higher and the lower chromosphere respectively; he also states the fact that the lines emitted by the upper chromosphere, the "long" lines, are those which, speaking generally, are enhanced when passing from the arc to the spark in terrestrial spectroscopy.

Further, Prof. Fowler found that these long lines are generally *weakened* in sun-spot spectra, whilst the short lines are generally widened, or *strengthened*. The evidence for this differential treatment of "enhanced" and "arc" lines in the solar atmosphere is most conclusive for the elements iron, titanium, and chromium (the *Observatory*, No. 370).

PROPOSED DAILY PHOTOGRAPHS OF CHROMOSPHERIC RADIATIONS.—A paper by M. Deslandres, which is published in the *Comptes rendus* for May 7, discusses in detail the possibility of obtaining daily photographs of the radiations emitted by the solid and liquid particles of the chromosphere, without waiting for the rare occasions afforded by total eclipses of the sun.

In order to do this M. Deslandres proposes to employ an apparatus similar to that used by him for the same purpose during the last eclipse, and to obtain a concentrated image of the chromosphere, without the photosphere, by a special arrangement of mirrors and lenses.

If the coloured screens are insufficient, it is suggested that the spectroheliograph might be employed. By obtaining the ordinary spectroheliograms with $K_1$ and $K_2$, and then another in which the bright interspaces, *i.e.* the continuous spectrum, were projected on to the primary slit, it would be possible to separate the parts due to the particles from those parts of the chromospheric radiations due to permanent gases.

M. Deslandres further suggests that the same methods, if successful in this instance, might be employed for the analysis of the structure of other celestial bodies such as nebulæ and comets.

STARS WITH VARIABLE RADIAL VELOCITIES.—A list of four stars the radial velocities of which have been found to be variable is published by Mr. J. H. Moore in No. 3, vol. xxiii., of the *Astrophysical Journal*.

The radial velocity of $\tau$ Ursæ Majoris has been found to vary between $-1$ km. and $-10$ km., that of $\lambda$ Hydræ between $+15$ km. and $+24$ km., and that of $\mu$ Ursæ Majoris between $-16$ km. and $+27{\cdot}4$ km. In the case of Y Ophiuchi, discovered to be a spectroscopic binary by Mr. S. Albrecht, the variation of the velocity is found to agree, in point of time, with the light variation, both having the period 17·12 days.

Four other spectroscopic binaries with variable velocities are announced by Prof. Frost in the same journal. The first two, B.D. $-1°{\cdot}1004$ and 29 Canis Majoris, are remarkable for the long range of their velocities and their short periods. In the former of these two, the radial velocity changed from $+132$ km. on February 12 to $-34$ km. on February 16, whilst that of the second star changed as follows:—1906 January 26, $-164$ km.; January 29, $-3$ km.; February 12, $-243$ km.; February 16, $-92$ km. Owing to under-exposure, these results are, however, slightly uncertain.

The stars $\mu$ Orionis and T Monocerotis have also been shown to have variable velocities in the line of sight.

OBSERVATIONS OF NOVA PERSEI NO. 2.—No. 96 of the Lick Observatory Bulletins is devoted to the publication of the results obtained by Messrs. Townley and Maddrill from magnitude observations of Nova Persei No. 2.

The observations extended over the period February 24, 1901, to July 5, 1902, the magnitude on the latter date being 9·4.

The table given contains the weighted, mean magnitudes of the Nova on more than one hundred nights, with notes on the observing conditions and the comparison stars and instruments employed.

OBSERVATIONS OF SHADOW BANDS.—In No. 4086 of the *Astronomische Nachrichten* Dr. M. Roso de Luna, of Madrid, briefly describes a new arrangement of screens for the observation of the shadow bands during total eclipses of the sun. Altogether he proposes to employ six screens, one horizontal, two vertical (N. and S. and E. and W.), one oriented to the azimuth of the sun at the moment of totality and another perpendicular to it, and one placed in the direction of the wind.

Such an arrangement was employed at Soria (Spain) during the last eclipse, and the following results obtained:—breadth of bands, 2 cm.; distance from one band to the next, 6 cm.; velocity of the movement of the bands, 30 metres per minute.

THE RADIAL MOTION OF $\beta$ ARIETIS.—In No. 4090 of the *Astronomische Nachrichten* Herr H. Ludendorff publishes the results obtained from an investigation of the radial velocities of $\beta$ Arietis during the period October 21, 1902, to December 16, 1904.

Thirty-seven spectrograms were obtained with the spectrograph No. iv. (three prisms) of the Potsdam Observatory attached to the 32·5 cm. refractor, and the range of the velocities determined was from $+60$ km. (on January 19, 1903) to $-17$ km. (on December 25, 1903).

From an analysis of the results, Herr Ludendorff concludes that the period of $\beta$ Arietis is $321/n$ days, where $n$ is equal to or less than 5.

PUBLICATIONS OF THE NICOLAS OBSERVATORY, ST. PETERSBURG.—We have just received vols. iii. and xiv. (series ii.) of the "Publications de l'Observatoire central Nicolas, St. Petersburg."

The former contains a catalogue of right-ascensions of the principal stars contained in the Pulkowa catalogue for the epoch 1885·0, the results being based on observations made between September, 1880, and November, 1887, with the meridian telescope. The catalogue is published in the same form as those which appeared in 1845 and 1865.

Vol. xiv. contains a part of the results of the observations made with the vertical circle of the observatory between May 1, 1896, and May 19, 1899. The remaining part of the results and the discussion of the whole are reserved for the next volume (xv.) of the publications.

## THE ROYAL OBSERVATORY, GREENWICH.

THE annual inspection of the Royal Observatory, Greenwich by the Board of Visitors took place on Wednesday, May 30, when the Astronomer Royal submitted a report of the work accomplished during the twelve months May 11, 1905, to May 10, 1906. A brief summary of this report is given below.

The new working catalogue of stars of the ninth magnitude and brighter, situated between declinations $+24°$ and $+32°$, is now complete, and includes more than 12,000 stars; the star-places have all been accurately brought up to 1910 from the Astronomische Gesellschaft catalogues.

A new determination of the pivot errors of the transit instrument, made during November, showed that the errors in the form of the pivots are insensible. The determination of the co-latitude for 1905 has been delayed by the necessity

of applying the corrections to the star-places due to the variation of latitude. The value found for 1904, with Bessel's refractions, is 38° 31′ 21″·74.

The second nine-year catalogue, for epoch 1900, which was completed last year, will be divided into two sections, one containing the fundamental and zodiacal stars, the other the astrographic reference stars. For the second section the places (for 1900) of the stars within 10° of the pole have already been determined, and a comparison of these with the places given in Carrington's Redhill catalogue should discover a number of proper motions hitherto undetermined, thereby providing new material for the discussion of the solar motion.

Mr. Cowell has completed the discussion of the Greenwich meridian observations of the moon from 1750 to the present time, and has found the necessity of introducing three empirical terms, of which the third has a period of about 300 years. Because the introduction of this term renders the determination of the secular acceleration of the moon from modern observations impossible, Mr. Cowell has worked up the conditions for six ancient eclipses of which the historical records seem to be fairly authentic. By introducing accelerations of eleven seconds per century for the moon and four seconds for the sun, he found it possible to bring the conditions of every one of these eclipses into agreement with the historical records of the phenomena attending them. By treating ten of the lunar eclipses recorded in the Almagest in the same way, additional evidence for the existence of these accelerations was obtained. At first glance the acceleration for the sun was difficult to account for, and Mr. Cowell hypothecated a resisting medium through which the earth travels; but more recently he has found that a lengthening of the day by the two-hundredth part of a second per century would account for the quantity required for this acceleration. As one of the principal features of Mr. Cowell's discussion was the employment of the day as the unit of time, the lengthening of that unit would produce the apparent acceleration.

Owing to the re-mounting and re-polishing of the object glass the altazimuth was out of use from July 12 to August 30, but for the remainder of the year it was employed for observations of the sun, moon, planets, and fundamental stars. The lunar crater Mösting A was observed whenever the conditions were favourable, and, as the same kind of observations are being made at the Cape Observatory, the results will serve to determine anew the parallax of our satellite. The value obtained from the discussion of the two sets of observations should be more trustworthy than that previously obtained, which depended solely upon observations of the moon's limb, a much more difficult feature to "set on" than the crater. Mösting A was also observed with the transit circle whenever possible, and the mutual agreement of the two sets of results was very satisfactory.

Eight hundred and twenty-three double and twenty-four single observations of various stars were made with the reflex zenith tube, and the results have been reduced up to March 31.

The weather was not favourable during the year for observations of difficult double stars with the 28-inch refractor, but the time was utilised in completing the measures of neglected doubles in Struve's "Mensuræ Micrometricæ"; the total number observed was 606, of which 158 have their components separated by less than 1″·0, and seventy by less than 0″·5. The diameters of Jupiter and his satellites were also measured with this instrument. Both the polar and equatorial diameters of Jupiter were observed, first with the filar micrometer and then with the double-image micrometer, on each night, and it was found that the mean of the results of the two methods produced a very good value for the diameter. The error caused by irradiation in the filar micrometer observation is apparently exactly corrected by the error introduced in the second method by the fact that when the two images are apparently in contact they actually overlap to a slight extent.

The 26-inch refractor was employed on twenty-eight nights in obtaining seventy-two photographs of Neptune and its satellite, using the occulting shutter as in previous years. These photographs are now being measured.

A number of photographs of Jupiter's newly-discovered satellites vi. and vii. were obtained with the 30-inch reflector. This success is remarkable because it was the expressed opinion of the discoverer of the satellites that vii. was too faint to be photographed through our British atmosphere. Yet nineteen photographs of this object were secured at Greenwich on fifteen nights, and eighty-six negatives of satellite vi. were taken on thirty-six nights. The 30-inch reflector was also employed for obtaining photographs of twenty-three minor planets, five comets Nova Aquilæ, and several nebulæ.

The reduction of the Eros plates is complete, and the results have been communicated to M. Lœwy.

At the date of last year's report the measurement of the Greenwich plates for the Astrographic Catalogue was complete, but a number of the measures have been repeated, and the press copy has been prepared for the seven zones 80° to 86°. The measures of the eight zones 77° to 84° have been printed during the year, and include 46,329 separate stars covering an area of 450 square degrees of sky. The remaining 78·5 square degrees between 85° and the pole will include about 6000 stars. An interesting table given in the report shows the number of stars which have been measured, and will be contained in the Greenwich section of the catalogue, and compares it with the number shown in each of the corresponding zones of the Bonn Durchmusterung and the Astronomische Gesellschaft catalogues. Thus it is shown that the total in the Greenwich section will be about 178,380, whilst for the same region the B.D. contains only 25,184 stars. A similar table compares the number of stars shown on the Greenwich chart plates in several zones with those contained in the corresponding zones of the B.D. In the total area of 558·3 square degrees the latter contains 2259 stars of magnitude 9·0 and brighter, and 6542 altogether, whilst for the different exposures given for the Greenwich plates the following numbers are shown:—

| | | | | |
|---|---|---|---|---|
| Exposure ... ... | 20 secs. ... | 3m. ... | 6m. ... | 40m. |
| Number of stars... | 12,019 ... | 56,921 ... | 58,393 ... | 170,180 |

Thus on the plates taken at Greenwich with forty minutes' exposure there are 304·8 stars per square degree, and about twenty-six times as many stars as are given in the corresponding region in the B.D. The second Greenwich volume of the Astrographic Catalogue is printed up to the end of 84°, and will soon be ready for publication. Twelve thousand photographic prints, reproducing on double scale 191 plates in zones 65° to 70°, have been made during the year, bringing the total number of plates reproduced since the work began up to 401, or rather more than one-third of those contained in the Greenwich section. During the year under report the astrographic telescope has been used to obtain duplicate plates for the chart to replace previous ones which are not entirely satisfactory for reproduction purposes.

Heliographic observations were carried out as usual, the sun being photographed on 210 days. The solar activity was very pronounced during 1905, the record for that year being about double that for 1904.

The magnetic observations were made as in former years, and the principal results for the magnetic elements for 1905 were as follow:—

| | |
|---|---|
| Mean declination ... ... ... | 16° 9′·9 West |
| Mean horizontal force ... ... | 4·0173 (in British units)<br>1·8523 (in metric units) |
| Mean dip (with 3-inch needle)... | 66° 55′ 55″ |

There were no days of "great" magnetic disturbance, and only twelve days of lesser disturbance in 1905.

The various meteorological observations were continuously maintained throughout the year, the mean temperature being 0°·2 above, and the rainfall 1·21 inches below, their respective averages for the fifty years 1841–1890.

In the chronometer and time-service department the report follows the usual lines, but the Astronomer Royal remarks on the inferiority of the box chronometers and the superiority of the watches submitted for tests during the period covered by the report. Of fifty-nine chronometers sent in, thirty-three were rejected because they failed to attain the minimum standard of constancy. This

is a larger number of rejections than in any previous year, although the number submitted was smaller than usual.

In concluding the report, the Astronomer Royal directs attention to the serious menace to the continued efficiency of the observatory on its present site involved in the establishment in the immediate neighbourhood of large generating stations for the supply of electric power to distant districts. The most serious danger at present arises from the new power station erected by the London County Council, which is situated directly north of the observatory. Not only will the high chimneys actually prevent stars from being seen when near the northern horizon, but the heated gases arising from the buildings may seriously affect the accuracy of any results obtained. Again, the new station is but half a mile from the observatory, and the running of the engines, although their number is not yet complete, produces serious tremors on the mercury reflecting surface, on the steadiness of which the accuracy of the astronomical results is critically dependent. At present the instruments employed in the magnetic pavilion have shown no disturbance, but it is greatly to be feared that the contemplated increase of the electrical plant will also have a serious effect on the work of this department.

## THE ROYAL SOCIETY OF EDINBURGH AND THE NATIONAL GALLERIES OF SCOTLAND BILL.

ON Friday last, June 1, the Secretary for Scotland received an important deputation of the Royal Society of Edinburgh regarding the claims of science in the readjustment of grants in aid and allocation of national buildings as contemplated in the National Galleries of Scotland Bill recently introduced in Parliament.

The chief point discussed was the position of the society in regard to its present occupancy of part of the Royal Institution, Princes Street. The deputation, which was very representative of science in Scotland, was introduced by Sir J. Batty Tuke, M.P. The claims of the society were presented by Lord M'Laren, vice-president; Mr. J. W. Gulland, M.P.; Principal Sir William Turner, of Edinburgh University; Principal Mackay, Dundee; Prof. Cash, Aberdeen; Prof. Gray, Glasgow; and Prof. Chrystal, secretary of the society. It was pointed out that in the National Galleries Bill, which contemplates devoting the Royal Institution, as well as the present National Gallery building, entirely to art, no provision is made for the Royal Society, which has occupied the west wing of the Royal Institution since that building was constructed seventy years ago, and for which, indeed, the building was originally designed. The deputation suggested the introduction of a clause safeguarding the position of the society, so that it shall not be dispossessed until equally good and convenient rooms have been obtained elsewhere out of public money. It will be impossible to carry on the important work of the society, especially as regards the publication of valuable and expensive memoirs, without this guarantee. Not only so, but it was urged that the Royal Society of Edinburgh should be placed on the same footing as the Royal Society of London and the Royal Irish Academy, both of which sit rent free in Government buildings, and receive grants to the extent of 1000*l.* and 1600*l.* respectively. The Royal Society of Edinburgh receives a grant of 300*l.*, which, however, is nearly all paid back to the Board of Manufactures in the form of rent. The Royal Society of London and five other scientific societies are accommodated in Burlington House next door to the Royal Academy, and it is hoped that a similar principle will be applied in Edinburgh.

The Secretary for Scotland expressed his hearty sympathy with all that had been said as to the importance of scientific work and the national character of the work done by the Royal Society. The National Galleries Bill introduced by the present Government is practically the Bill of last session with some minor alterations. The whole question has been gone into very carefully, and the conclusion is to put the National Gallery into the south building, and give to the Royal Academy the Royal Institution, part of which is at present occupied by the Royal Society. The accommodation for the National Gallery and for the Academy will thus be doubled, and ample scope will be given for future development. It is not possible to house the Royal Society and the Royal Academy in the same building. The decision has been come to after review of all the circumstances, and it carries with it the obligation to find accommodation consistent with the necessities and prestige of the Royal Society. It is the desire and intention of the Government to meet the reasonable demands of the Royal Society in a liberal spirit; and the Secretary for Scotland suggested that the Royal Society should consider the new situation which has been created, and should formulate some scheme for the consideration of the Government.

## THE DISCOVERY OF MAGNETIC DECLINATION.

THE *Meteorologische Zeitschrift* for April contains an interesting article by Prof. G. Hellmann on the knowledge of the magnetic declination before the time of Christopher Columbus. Some years ago Prof. Hellmann pointed out that, independently of the discovery by Columbus, the variation must have been known on the Continent, from the construction of many pocket sundials provided with magnetic needles for adjusting the instruments to the astronomical meridian, and showing the declination by a line on the floor of the compass-box.

Dr. A. Wolkenhauer recently discovered three such sundials dating from before the time of Columbus. One of these, which is in the Ferdinand Museum at Innsbruck, and

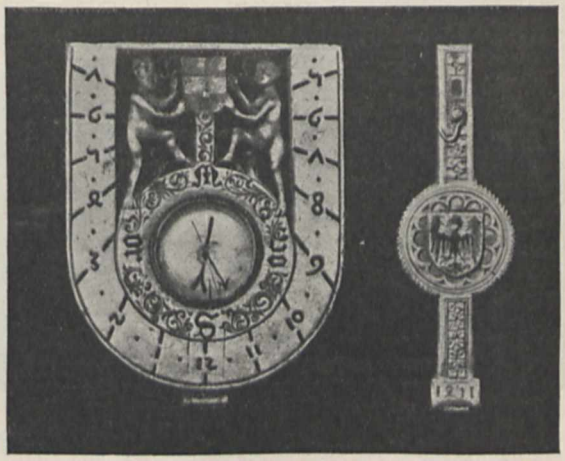

FIG. 1.—Pocket sun-dial with compass and variation line. Date, about A.D. 1451.

was probably made at Nuremberg, is shown in the accompanying photographs by Hofrath von Wieser. The glass shade and magnetic needle have been removed so that the lines on the bottom of the box might be more plainly shown. The lid or flap, which has also been removed, and which adjusts the gnomon when opened, shows the date of construction, viz. 1451, the figures 4 and 5 being in the old form (see also the hour numbers of the dial).

The rim of the compass-box shows the four cardinal points:—M. (Meridies), Oc. (Occidens), S. (Septentrio), Or. (Oriens). On the floor of the compass-box is cut the northerly-pointing bifurcated line of deviation of the magnet, showing about 11° easterly variation. This line is of the same depth and thickness as the hour lines, and a careful examination of the instrument shows that it must have been originally done by the maker. It can easily be recognised, however, that the three other marks west of the original line (two of which have arrow-heads) were roughly inserted at a later time, when probably the declination had become westerly. The short, thick stroke lying 4°–5° west of the N.-S. direction has been scratched the deepest. The magnetic variation was apparently probably known before the beginning of the fifteenth century, but by whom and where it was discovered still remain an open question.

## IRISH CAVE EXPLORATIONS.

OUR knowledge of the Irish fauna in Neolithic and early historic times has been greatly extended by recent researches into the cave remains of Ireland. These have been carried out during the past few years by a committee, under the auspices of the British Association and of the Royal Irish Academy. Two reports on these investigations have been published in the Transactions of the latter. The first dealt with the exploration of the caves of Kesh, in the county Sligo, and the second, which has just been issued, with that of the county Clare caves. The committee is now at work further south, in the county Cork.

The Clare caves, which are situated about thirty miles from the sea coast, among beautiful surroundings, in a district of crags and lakes, lie in the lands of Edenvale and Newhall. Our illustration shows the entrance to two of these caves (marked A and B) in a steep ridge of rock overlooking an ancient track, known as the Pilgrims' Road, which leads from Ennis to Killone Abbey and the Holy Well. The others lie barely a mile to the west of these. All the caves have been formed by the solvent action of water on the limestone in which they occur. Several of them are of great extent, with complicated ramifications. They are mostly about 100 feet above sea-level. They differ from many of the great English caves in the absence of a well-marked stalagmite floor, and of their early cave-fauna, including the rhinoceros, hippopotamus, cave-bear, hyæna, &c. The deposits are composed, as a rule, of two easily distinguishable strata. The upper one, generally consisting of brown earth, contains charcoal associated with the bones of domestic animals, while the second is often of a very tenacious nature, and includes many remains of the bear and reindeer, Irish elk, and Arctic lemming.


*Photo.*] [*R. Welch.*

FIG. 1.—View showing entrances of Bat's Cave (A) and Elder-Bush Cave (B), Newhall.

Of particular interest is the occurrence of the Arctic fox and of the wild cat. The former of these is exceedingly rare in England, and had not been known to occur in Ireland, while as to the latter, it has been held as doubtful whether it ever inhabited Ireland. Several jaws and teeth were found, however, which agreed, not with the Scottish wild cat, but with that commonly met with throughout the African continent, and popularly known as the Caffer cat.

More than 2000 bones of birds were obtained, comprising fifty-eight species, the most noteworthy of which is the crane. The Welsh traveller, Giraldus Cambrensis, stated that when he visited Ireland in the twelfth century cranes were to be met with in flocks, and it is of interest that this account of their presence has been verified by the discovery of these remains.

The occurrence of a shed antler of the Irish elk, and of long bones of this species and of the reindeer, which seemed to show signs of having been artificially fractured, indicate the possible contemporaneousness of man with these deer, but the evidence in this case is not conclusive. The bear, however, was clearly coexistent with man, and probably lingered on in Ireland long after the Irish elk and the reindeer had become extinct. A knee-cap of a large bear, showing the incisions of a knife, was found in one of the caves, and other bear bones were obtained from the upper layer along with charcoal and the remains of domestic animals. Unfortunately all the cave deposits had been greatly disturbed by burrowing animals, such as badgers and foxes, which inhabited them chiefly in recent times.

Some of the caves show traces of human occupation of long continuance in early times, while others may have been used as shelters for short periods. Scrapers and flint flakes, bone pins, and stone implements occurred, while a gold bracelet, and another, richly decorated, of bronze, were found. Of bronze, also, was a buckle engraved with an interlaced pattern and plated with silver. One of the most remarkable of the objects discovered was a lamp, the receptacle being hollowed out of a round stone, not carved in any pattern, but with deep grooves round the sides. Of these and other objects the plates illustrating the report give a good idea. Together with the implements, numbers of human bones were found, although there is no evidence that the caves had ever been used as places of burial. The bones revealed nothing which might lead us to suppose that they belonged to a different race from that inhabiting Ireland at the present time; but their study elicited the fact that some of them belonged to individuals who habitually assumed the squatting position common to all primitive peoples.

R. F. SCHARFF.

## NEW PILOT CHARTS.

IN these days of perpetual and feverish haste, which is characteristic of life at sea as well as on shore, the desirability has been realised of introducing modifications in the method of conveying practical information for the use of seamen. Formerly, men had more leisure to wade through the bulky volumes known as sailing directions when they wished to clear up any point in doubt. Now, with less time to spare, the demand is for the concentrated essence rather than the minute details of the facts, and this is one of the objects in view in the production of the several pilot charts originated on both sides of the Atlantic within recent years. Many subjects have to be dealt with, and the space is strictly limited, so that the mariner has before him on his chart-room table all the essential features of the particular subjects.

Two pilot charts are published by the Deutsche Seewarte at Hamburg, one for the North Atlantic and Mediterranean area, issued monthly, the other for the North Sea and Baltic region, issued quarterly. They are elaborately and excellently got up, and in the quality of their varied contents afford further evidence of that thoroughness characteristic of German investigators. The face of each Atlantic chart (36 inches by 27 inches) is covered with information of immediate concern in navigating a ship—the mean direction and force of the prevailing winds in every 5° square; the northern and southern limits of the trade winds; the paths and the intensity of storm systems; the regions of mist and fog; the dust atmosphere off Africa; the tropical rain area; the set and velocity of ocean currents; ice; derelicts; steamship and sailing-ship routes and great circle tracks; copious remarks bearing on all these subjects; variation curves; and illustrations of the storm-warning signals adopted by countries on both sides of the ocean. The whole of the back is devoted to articles, with or without illustrations, discussing subjects of general interest to

the navigator, and not necessarily limited to the North Atlantic area. A special investigation of the winds, currents, and air and sea temperatures experienced along the Mediterranean steamship routes is being carried out at the Seewarte, and the results are now appearing month by month on the pilot chart.

The issue for last February contains a very complete work on the handling of ships in tropical hurricanes—Atlantic, Indian and Pacific Oceans, the Arabian and China Seas. The April number gives an account of a very severe Atlantic storm, the maximum violence occurring on the rise of the barometer; a still longer article deals with water-spouts. The May chart gives the true bearing and the compass bearing at about three hundred positions round the coasts of the British Isles. The North Sea-Baltic publication is equally complete, each quarterly issue containing one general chart for the region and others for the several months of the quarter, together with an abundance of letterpress dealing with a great variety of subjects, such as the investigation of the fisheries and the physical condition of the waters of the region, the surface currents of the Kattegat and Sound, ice, and tidal streams.

With five years' experience in the preparation of the monthly North Atlantic pilot charts, our Meteorological Office has now commenced the publication of a similar series of "Monthly Meteorological Charts of the Indian Ocean North of 15° South Latitude, and Red Sea." The area covered by the map extends from 30° N. to 15° S., between the meridians of 30° and 100° E. The first number, issued in London on May 9, is for the month of May. Presumably future issues will be well in advance of the month to which they relate, so as to be in the hands of mariners navigating the Indian Ocean during the month. Generally, the chart presents the same features as the North Atlantic one. For each ocean space of 5° of latitude by 5° of longitude the frequency of winds of light, moderate, or gale force is shown for the sixteen even points of the compass, the observations upon which the results are based covering a period of fifty years. Apparently through inadvertence a pecked line intended to indicate the northern limit of the south-east trade has been omitted. Tracks of some cyclonic storms are given in red. It is left to the sailor to assume whether the date given is at the commencement or end of the tracks, there being no directing arrow heads. The set and velocity of the ocean currents are shown in blue, and in a lighter blue the variation curves for 1907. Use is made of the land spaces for supplying a variety of information by means of letterpress and inset charts.

A small chart of the whole area gives, for the month, the average distribution of barometric pressure over the sea, and the mean temperature of the air and of the water. An enlarged map of the Guardafui and Ras Hafún district shows the currents, sea temperatures, and misty weather in this dangerous locality, and suitable notes accompany the map. Over Arabia appear remarks on the various air and water elements of the Red Sea and Gulf of Aden. On the back of the sheet are given complete summaries of the elaborate storm and weather signals of the Bay of Bengal and of the Húgli River storm signals, which are far more precise than those in use in any other part of the world. A map of the southern Indian Ocean, from the equator to 40° S., and 30° to 120° E., is used for reproducing the late Dr. Meldrum's monthly tracks of cyclones between 1848 and 1885. There are notices to captains relating to the collection of meteorological observations, to the necessity for accurate determination of the errors of barometers in use, and to the compass adjustment marks at Kalpi anchorage.

Altogether the new publication gives promise of supplying a much-needed want in a simple and easily accessible form for a part of the ocean about which there has hitherto been but little information. The monthly variations in the circulation of the waters of the Arabian Sea and of the Bay of Bengal will alone well repay careful study, while a more accurate knowledge of the different winds of the region covered by the chart cannot fail to be of the greatest practical benefit to shipmasters and their officers.

## UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

OXFORD.—The electors to the Linacre professorship of comparative anatomy will proceed to an election next month. Candidates are desired to send in their names so as to reach the registrar's office not later than Saturday, July 7. The Linacre professor is by virtue of his office a fellow of Merton College. He is entitled to receive from the college a stipend of 700*l*. a year in addition to the emoluments of a fellowship, which amount at present to 200*l*. a year.

CAMBRIDGE.—Mr. E. S. Roberts, Master of Gonville and Caius College, has been elected Vice-Chancellor for the ensuing academical year.

Mr. L. Noon, Trinity College, has been elected to a John Lucas Walker studentship in pathology.

The assessment to be paid by the colleges to the University in the present year has been fixed at 30,038*l*., or 13*l*. per cent. on the college incomes.

The Chancellor, His Grace the Duke of Devonshire, has made a gift of 500*l*. to the special fund now being raised on behalf of the University library.

Mr. C. L. Boulenger, King's, has been nominated to the University table at the Naples Zoological Station; and Mr. K. Lucas, Trinity, to the table at the Plymouth Marine Biological Laboratory.

The special board for mathematics has made some minor alterations in the proposals for the re-modelling of the Mathematical Tripos, parts i. and ii., but it is proposed to submit unchanged to the Senate the principles of the original report.

Ten candidates have been successful in the special examination in agricultural science and the first examination for the University's diploma in agriculture.

Mr. W. A. Cunnington, Christ's, for a dissertation on "Tanganyika," and Mr. C. Shearer, Trinity, for a dissertation on "The Development of Larval Nephridia," have been approved as advanced students for the certificate of research.

Prof. Bradbury, Prof. Osler, Dr. S. West, and Prof. Rose Bradford have been appointed examiners in medicine; Dr. Rivers Pollock and Prof. Spencer, examiners in midwifery; and Dr. Kellock, Prof. Barling, Mr. Stanley Boyd, and Mr. Dunn, examiners in surgery for the ensuing academical year.

A sum of 6000*l*. from the benefaction fund, raised by the University Association, has, with the approval of the Chancellor, been contributed to the cost of the botany and medical school buildings.

The name of "Frederick James Quick, of Trinity Hall," founder of the Quick professorship of biology, has been added to the list of benefactors in the Commemoration Service.

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A ROYAL COMMISSION has been appointed for the purpose of holding an inquiry into Trinity College, Dublin, and the University of Dublin. The terms of reference of the commission are as follows:—"To inquire into and report upon the present state of Trinity College, Dublin, and of the University of Dublin, including the revenues of the College and of any of its officers and their application, the method of government of the University and of the College, the system of instruction in the College and the teachers by whom it is conducted, the system of University examinations, and the provision made for post-graduate study and the encouragement of research; and also to inquire and report upon the place which Trinity College, Dublin, and the University of Dublin now hold as organs of the higher education in Ireland, and the steps proper to be taken to increase their usefulness to the country." Among the commissioners are Sir Edward Fry (chairman), Sir A. W. Rücker, F.R.S., and Prof. D. J. Coffey.

ACCORDING to the *Reichsanzeiger*, the number of students who took the "Doktor-Ingenieur" degree of the technical Hochschulen at Berlin, Hanover, and Aachen during the last winter semester was seven in Berlin, five in Hanover, and four in Aachen, while the number who took this degree during the two semesters from March, 1905, to

March, 1906, at the Dresden Technische Hochschule was seventeen; of these thirty-three we find that eight passed the *viva voce* examination with distinction, whilst the ages of the candidates varied from twenty-three to thirty-nine years. As a reason for this small number of the students who eventually take the degree, it is said that the great majority of the students, after having passed through their eight semesters of stiff study and obtained the coveted diploma, qualifying them to style themselves "Dipl. Ing.," have frequently neither the desire nor the means for the extra semester's study and research necessary for the doctor's degree.

THERE is no diminution in the generosity shown by American citizens towards higher education. *Science* announces that Columbia University has received 1000*l.* for a mathematical prize, given by Mrs. Louise T. Hoyt. Mr. Edward S. Harkness has given 540*l.* to the morphological museum at the College of Physicians and Surgeons, and Mr. Archer M. Huntington 200*l.* to support a lectureship in geography. In April, 1905, Mr. Andrew Carnegie offered Morningside College, Sioux City, Iowa, 10,000*l.* on condition that they raised 30,000*l.* On April 3, 1906, his conditions for the gift were satisfied, and Mr. Carnegie's cheque has been received. Mr. Carnegie has also given the sum of 10,000*l.* to Drury College, at Springfield, Missouri, on condition that the college increases its resources by the sum of 40,000*l.* About one-third of this sum has been raised since January 1. Mr. R. Y. Cummings has given 4000*l.* to the Field Museum of Natural History to defray the expenses of an ethnological study of the native tribes of the Philippine Islands.

ALBION COLLEGE is now building a new biological laboratory, which is expected, we learn from *Science*, to be completed in time for the opening of the college year in September. Mr. Andrew Carnegie has promised 4000*l.* to the endowment fund of the college on condition that 16,000*l.* additional is raised for the purpose. Mr. Carnegie has also given Kenyon College 5000*l.* to aid poor students. A new scholarship of 1000*l.* has been given to Barnard College, Columbia University, by Mrs. George W. Collord in memory of her brother. By the will of Roland Hayward, of Milton, Mass., the museum of comparative zoology of Harvard University will receive the testator's collection of Coleoptera.

A CLAUSE in the Education Bill before Parliament will, if it eventually become part of the Act, abolish the Teachers' Register. There is a strong feeling among teachers in secondary schools and others that such a course would be very prejudicial to the progress of secondary and higher education, inasmuch as it would discourage the movement to secure adequate training for secondary-school teachers. A meeting of the heads of training colleges for secondary-school masters and mistresses in all parts of the country was held at Bedford College, London, on May 26, to consider the proposals of the Government, and after discussion numerous resolutions were adopted unanimously. These resolutions declared that, as a result of the proposal, public confidence in the stability of the Board of Education has been shaken seriously; that a part of the present register fulfils a purpose that is useful and not otherwise provided for; that grants and other administrative aids to the training of secondary-school teachers, as promised by the Board of Education, do not form a substitute for a register. The recognition of a profession, one resolution insists, with powers over entrance to its ranks, is an essential element in creating a respected and permanent profession; and another lays it down that in view of the difference of conditions at the various centres of training and of the necessity for experiments in the training of teachers, the Board of Education should give as much liberty as possible in the regulations under which the preparation for diplomas is conducted.

THE current number of the *University Review* contains a vigorous article by Mr. H. P. Biggar on the establishment of a graduate school at Oxford. One of the chief aims of a university should be, the article insists, the extension of the bounds of knowledge in each department of learning by masters who are capable of making fresh discoveries therein. This object is constantly before the minds of the authorities of German and French universities. In both these countries the graduation of students is dependent upon their success in prosecuting research, and from France and Germany instruction in research has spread to the United States. Since 1876, Princeton, Columbia, Chicago, Cornell, and other American universities have found themselves bound to establish graduate schools where training may be obtained in research, and from the United States post-graduate studies have spread to Canada. With us, however, graduate studies are practically unknown. At Oxford, for instance, which Mr. Biggar takes as an example, because it is there alone that Rhodes scholars may study, the University ceases to enforce any test of proficiency beyond the degree of Bachelor of Arts. The B.A. has but to continue to pay certain fees to his college for about three and a half years after taking his degree, when he may come up, pay some 20*l.*, receive the degree of Master of Arts, and become a member of Convocation. What is wanted, Mr. Biggar maintains, is to establish at Oxford a proper graduate school, that is merely the reinforcement of a thesis, either for the M.A. or for the doctor's degree. The important part is that the increase of knowledge should be looked upon as one of the main ends to be kept in view. Then, perhaps, the Rhodes scholars will discontinue to experience the disillusionment which awaits many of them, who come hoping to find themselves among *the makers of new knowledge*! and participating in the glorious work.

THE distinguished representatives of the University of Paris and the Collège de France, together with guests from nine other French universities, arrived in London on June 4, and have during the week been entertained by the University of London and the Modern Language Association. The visitors were met at Victoria Station by Sir Edward Busk, Vice-Chancellor of the University of London; Sir Arthur Rücker, principal of the University; and many members of different faculties of the University and of the Modern Language Association. In the evening of June 4 the French guests were entertained at an informal dinner. Sir Walter Palmer, chairman of the London University organisation committee, in proposing in French the toast of "Our Guests," said that the visit is a unique fact in the annals of university life, which will long remain imprinted on our hearts as a new phase in the scientific and literary development of the two nations represented. What could be of happier augury than so distinguished an assembly of men of letters and of science leaving their country and paying a visit to their colleagues in order to draw closer still the bonds existing between the arts and the sciences of the two countries? M. Bayet, director of higher education at the Ministry of Public Instruction, responding in French, remarked that if there is a domain in which the *entente cordiale* has its place it is the domain of letters, science, and art. It has long had its place there, for if we reascend the current of the centuries we find that this *entente cordiale* has existed almost always between England and France. We are creditors and debtors of each other. Frenchmen, he said, salute the profound influence which England has exerted upon them in the domain of letters, science, and art. They know the English writers, poets, and philosophers, they love them, they have drawn inspiration from them, and in their hearts they associate themselves with the cult of great writers and thinkers. M. Lippmann, who responded for the faculty of science of the University of Paris, spoke in English, and said science is not bounded by the Channel nor has it a local habitation. There is but one geometry throughout the world. The laws of nature reach beyond the stars. For that reason the guests feel at home in any place among the brotherhood of scientific men. He continued, it is a happy dispensation that a university should have been founded within the precincts of this huge city. London is gigantic in size, wealth, and might; its shipping is unrivalled, its commercial activity unexampled; but the greater the pressure of business, the heavier the load of accumulated wealth, the more needful it is to augment the power of the priceless element which is the soul of a university, the more so as the experimental work done in laboratories and in experimental research of any kind is the prime source of industrial progress, as well as an antidote to

fortune.—On Tuesday the visitors were received at the Foreign Office in order that Lord Fitzmaurice and Mr. Lough, M.P., might welcome them officially on behalf of the Government. At the conclusion of the reception they were driven to the University of London, where luncheon was served. Addresses were afterwards delivered by the Vice-Chancellor (Sir Edward Busk), M. Liard, Sir Arthur Rücker, and Prof. M. E. Sadler, and a visit was made to the new physical and chemical laboratories of the Royal College of Science. In the evening several receptions were held in honour of the guests.

## SOCIETIES AND ACADEMIES.

### LONDON.

**Geological Society**, May 9.—Mr. Aubrey Strahan, F.R.S., vice-president, in the chair.—The eruption of Vesuvius in April, 1906: Prof. Giuseppe **de Lorenzo.** After the great eruption of 1872 Vesuvius lapsed into repose, marked by merely solfataric phenomena, for three years. Strombolian activity followed, varied by lateral outpourings of lava in 1885, 1889, 1891, 1895, &c., and by outbursts from the principal crater in 1900 and 1904. Fissuring of the cone and slight outpourings of lava began in May, 1905, and continued until April 4, 1906, when the first great outburst from the principal crater occurred, accompanied by the formation of deeper and larger fissures in the southern wall of the cone, from which a great mass of fluid and scoriaceous lava was erupted. After a pause the maximum outburst took place during the night of April 7 and 8, and blew 3000 feet into the air scoriæ and lapilli of lava, as well as fragments derived from the wreckage of the cone. The south-westerly wind carried this ash to Ottajano and San Giuseppe, which were buried under 3 feet of it, and even swept it on to the Adriatic and Montenegro. At this time the lava which reached Torre Annunziata was erupted. The decrescent phase began on April 8, but the collapse of the cone of the principal crater was accompanied by the ejection of steam and dust to a height of from 22,000 feet to 26,000 feet. On April 9 and 10 the wind was north-easterly, and the dust was carried over Torre del Greco and as far as Spain; but on April 11 the cloud was again impelled northward. The ash in the earlier eruptions was dark in colour, and made of materials derived directly from the usual type of leucotephritic magma; but later it became greyer, and mixed with weathered clastic material from the cone. The great cone had an almost horizontal rim on April 13, very little higher than Monte Somma, and with a crater which possibly exceeds 1000 feet in diameter; this cone was almost snow-white from the deposit of sublimates. Many deaths were due to asphyxia, but the collapse of roofs weighted with dust was a source of much danger, as was the case at Pompeii in A.D. 79. The lava-streams surrounded trees, many of which still stood in the hot lava with their leaves and blossoms apparently uninjured. The sea-level during April 7 and 8 was lowered 6 inches near Pozzuoli and as much as 12 inches near Portici, and had not returned to its previous level on April 18. The maximum activity coincided almost exactly with the full moon, and at the time the volcanoes of the Phlegræan Fields and of the islands remained in their normal condition. The author believes that this eruption of Vesuvius is greater than any of those recorded in history, with two exceptions—those of A.D. 79 and of A.D. 1631.—The Ordovician rocks of western Caermarthenshire: D. C. **Evans.** The ground dealt with is practically identical with that examined by the late Thomas Roberts, whose notes were published in 1893. It extends from the River Cywyn on the east to the Tave on the west, and from the base of the Old Red Sandstone on the south to the top of the Dicranograptus-Shales on the north.

**Zoological Society**, May 15.—Dr. J. Rose Bradford, F.R.S., vice-president, in the chair.—Descriptions of the two species of water-mites (Hydrachnidæ) collected by Mr. W. A. Cunnington in Lake Nyasa during the third Tanganyika expedition, 1904–5: J. N. **Halbert.**—A collection of mammals made by Mr. W. Stalker in the northern territory of South Australia, and presented to the National Museum by Sir William Ingram, Bart., and the Hon. John Forrest: O. **Thomas.** The collection included sixteen species, of which the two following were of special interest:—*Mus forresti*, sp.n. Size, medium. Colour, drab-grey above, white below. Teeth with their laminæ peculiarly twisted, the first molars with large cingular ledges. Head and body, 104 mm.; tail, 72 mm.; hind foot, 19 mm. Type, B.M. No. 6.3.9.39. *Phascogale ingrami*, sp.n. Size, minute; the teeth and feet smaller than in any known Australian marsupial. Head peculiarly flattened. Head and body, 80 mm.; tail, 60 mm.; hind foot, 10 mm. Type, B.M. No. 6.3.9.77.—The skull of a young ribbon-fish (Regalecus): Prof. W. B. **Benham** and W. J. **Dunbar.**—Descriptions of two species—one of them new—of hair-worms of the family Gordiidæ: Dr. von **Linstow.** The specimens were obtained in Korea by Mr. Malcolm Anderson, who was making collections of the fauna of eastern Asia for the Duke of Bedford.—Descriptions of a new lizard, a new snake, and a new toad collected in Uganda by Mr. E. Degen: G. A. **Boulenger.**—The gestation and parturition of certain monkeys that had bred in the society's menagerie in the spring of the present year: R. I. **Pocock.**

**Faraday Society**, May 15.—Dr. F. Mollwo Perkin, treasurer, in the chair.—Behaviour of platinised electrodes: H. D. **Law.** The author desired to find an electrode on which the reduction of the aromatic aldehydes and similar easily reducible compounds could not be effected. Platinised platinum, as being the metal from which hydrogen is liberated at the lowest potential, was tried as the kathode in an acidified alcoholic solution of benzaldehyde. At first energetic reduction took place; the activity of this, however, diminished in successive experiments, and was extremely small after twelve hours' polarisation.—The electrolysis of fused zinc chloride in cells heated externally: Julius L. F. **Vogel.** The dehydration of zinc chloride by evaporating under reduced pressure, and the electrolysis of the salt in a fused state in externally heated cells were investigated by Dr. O. J. Steinhart and the author jointly on behalf of the Smelting Corporation, Ltd. Further investigations were made after the United Alkali Company had joined the Smelting Corporation in testing the process, and details are given in the paper of the work as carried out under the joint supervision of the author's firm and the chemical staff of the United Alkali Company. The author describes how the process was carried successfully to a stage when continuous electrolysis was carried on for eleven days and nights, and three cwt. of pure zinc was produced. On the failure of the Smelting Corporation the work was suspended, and finally abandoned, although further elaborate investigations were undertaken by the United Alkali Company utilising cells heated internally by the current.

**Royal Microscopical Society**, May 16.—Dr. D. H. Scott, F.R.S., president, in the chair.—Some observations recently made on the parasites of malaria and the phagocytic action of the polymorphonuclear leucocytes: Dr. **Bernstein.** The subject was illustrated by drawings showing the results of observations made during the examination of blood taken from a patient suffering from malarial fever. The observations were made at intervals of a few minutes during a period of five hours. A crescent form of the parasite was seen to become engulphed by a leucocyte, in which it was soon surrounded by vacuoles and was ultimately destroyed, only the pigment granules remaining; other leucocytes afterwards approached and absorbed some of the granules. The blood film was stained, and the preparation, showing the pigment granules in the polymorphonuclear leucocytes, was exhibited under a microscope at the meeting.

**Chemical Society**, May 17.—Prof. R. Meldola, F.R.S., president, in the chair.—The relation between absorption spectra and chemical constitution, part vi., the phenylhydrazones of simple aldehydes and ketones: E. C. C. **Baly** and W. B. **Tuck.** A spectroscopic investigation of the phenylhydrazones of formaldehyde, acetaldehyde, propylaldehyde, acetone, and diethylketone shows that these exist in two forms, an unstable true hydrazone and a stable azo-form. The absorption spectra of the hydrazones of the

three nitrobenzaldehydes show that the colour of these substances is not due to their existence in the azo-form.—The rusting of iron: J. T. **Nance.** The "rusting" of iron in solutions of ammonium chloride is probably due to the action of hydrogen ions formed by hydrolysis of the salt.—Aromatic compounds obtained from the hydroaromatic series, part ii., the action of phosphorus pentachloride on trimethyldihydroresorcin: A. W. **Crossley** and J. S. **Hills.**—Studies of dynamic isomerism, part v., isomeric sulphonic derivatives of camphor: T. M. **Lowry** and E. H. **Magson.**—The densities of liquid nitrogen and liquid oxygen and of their mixtures: J. K. H. **Inglis** and J. E. **Coates.** The results showed that a slight contraction took place on mixing the two liquids. It was found that the solubility of nitrogen in oxygen obeys Henry's law, but that the solubility of oxygen in nitrogen does not obey the simple form of that law, since oxygen dissolved in nitrogen is associated to the extent of about 9 per cent.—Glutaconic and aconitic acids: H. **Rogerson** and J. F. **Thorpe.**—The chemistry of organic acid "thiocyanates" and their derivatives: A. E. **Dixon.**—The molybdilactate and the tungstilactate of ammonium: G. G. **Henderson.** Molybdic and tungstic anhydrides are dissolved, the latter with some difficulty, when heated on the water-bath with solutions of ammonium lactate, the products being ammonium molybdilactate, $MoO_2(C_3H_4O_3NH_4)_2$, and ammonium tungstilactate, $WO_2(C_3H_4O_3NH_4)_2$, respectively. Descriptions of these salts are given.

**Society of Chemical Industry** (London Section), May 21.—Mr. A. Gordon Salamon in the chair.—The electrochemical problem of the fixation of nitrogen: Prof. Philippe A. **Guye.** Among the many investigations undertaken to solve this problem, two directions have led to industrial methods, the one, calcium cyanamide, the other, electrochemical nitric acid. The principal technical details of the manufacture of calcium cyanamide are given, and it is pointed out that its cost price depends upon that of calcium carbide. From this it is concluded that a kilogram of nitrogen fixed as calcium cyanamide will cost a little more than ammonia salts and Chili saltpetre, if the excess of calcium carbide obtained in carbide works not available for the development of acetylene is used. This conclusion seems confirmed by some agricultural tests made with this new compound of nitrogen of which the value, relative to Chili saltpetre, is not definitely fixed. Passing to electrochemical nitric acid, the author summarises the principles of its preparation, and although these are very simple, the application has presented serious difficulties, which, however, now appear to be solved by the experiments carried out in Norway. The absorption of the nitric acid by sulphuric acid is insisted on, as this allows concentrated nitric acid to be directly obtained, which is of greater commercial value than nitrate of lime, and consequently of more interest to a new industry. Analysis of the cost of electrochemical nitric acid leads to the conclusion that a kilogram of nitrogen is fixed slightly cheaper as nitric acid than as calcium cyanamide. In concluding, the author discusses the exterior economic factors which may hasten the development of the nitrogen industries. Among these the direct synthesis of ammonia from nitrogen and hydrogen, and the recovery of the nitrogen of coal in the ammoniacal form by the methods of L. Mond are mentioned. These processes, combined with the production of electrochemical nitric acid, will in all probability solve the problem of obtaining electric energy cheaply by motors utilising the power of coal.

## DUBLIN.

**Royal Dublin Society,** April 24.—Prof. J. A. McClelland in the chair.—Entoptic vision, part iv., Haidinger's brushes and other entoptic phenomena: Prof. W. F. **Barrett,** F.R.S. The term entoptic vision may be employed to include the observation of all those phenomena the cause of which is situated within the eyeball. In previous papers on this subject the author has shown how obscurities in the path of a homocentric pencil of rays within the eye may be self-detected, delineated, and measured with great ease by means of the entoptiscope, a simple instrument devised by the author. Obscurities due to incipient cataract can be detected, and its progress watched and the effect of any possible remedy examined. In the present paper the entoptic phenomena are studied, delineated, and submitted to exact measurement, such as (1) the so-called Haidinger's brushes, or coloured polarised fasciculi seen when a brightly illuminated surface is looked at through a Nicol's prism, and the seat of which has been the subject of considerable discussion; (2) the moving corpuscles, like darting fire-flies, seen when a bright sky is looked at through a cobalt blue glass. These are depicted and measured in the paper, and the result leaves little doubt that they are really due to the movement of blood corpuscles in the vessels of the retina, the curved streaks of light they leave behind being due to the retention of the image of a quickly-moving body. Other entoptic phenomena are also discussed.—The absorption of $\beta$ radiation by matter: Prof. J. A. **McClelland** and J. E. **Hackett.** It is important to know the true coefficient of absorption of $\beta$ rays for different substances. There are really no data on the subject, as the coefficient usually measured depends to a large extent upon the power of the substance to emit secondary $\beta$ rays. This coefficient gives, therefore, little information as to the actual stopping power of different forms of atoms. The present paper describes a method of determining the *true* absorption coefficient.

**Royal Irish Academy,** April 23.—Dr. F. A. Tarleton, president, in the chair.—Magneto-optic rotation: F. E. **Hackett.** The author examines the two dispersion formulæ deduced by Drude for the magneto-optic rotation, and brings forward a method to decide between them. The analysis consists in deducing from the constants of the formula, based on the hypothesis of rotating ions, the quotient of the area of the ionic orbit by the period of the ion for the absorption bands of carbon disulphide and creosote. The radii of the ionic orbits thus obtained are 100 times the ordinary molecular radii. From this result it is argued that the theory of rotating ions cannot account for more than one-thousandth of the rotation observed in these substances. A similar analysis applied to the constants of the Hall effect formula leads to values of $\epsilon/m$ of the same order as are obtained for electrons. Similar results are shown to hold in general for diamagnetic substances. It is then concluded that the theory based on the Hall effect gives a sufficient explanation of the rotation in diamagnetic substances.—The total solar eclipse of August 30, 1905: A. L. **Cortie.** The observations recorded in this paper were made at Vinaroz, on the Mediterranean coast of Spain. The results were:—(1) the corona was of the maximum type; (2) there were numerous prominences, especially one great group on the east limb of the sun; (3) the lower corona was much disturbed over this group, with a marked structure of arches and interlacing rings; (4) a well-marked vortex-ring with a white centre was connected with the prominences; (5) a ray, of presumably dark matter, and a group of plumes, marked the south-east quadrant; (6) the dark ray and plumes coincided in position with the sun-spot regions, and were possibly connected with the area disturbed by the great February spot; (7) some straight bright rays marked the south-west quadrant, also in the region of the spot-zones; (8) the general trend of the streamers was north and south, the largest streamers being placed almost at the south pole; (9) the inner corona was a ring of intense brilliancy, comparable to the full moon; (10) the streamers seemed in general to mark the regions of prominences more than those of spots.—Sixteen years' observations on the relation of temperature and rainfall to the spread of scarlatina, measles, and typhoid fever: R. Sydney **Marsden.** Weekly returns of cases of these diseases and the corresponding weekly variations of temperature and rainfall had been recorded for the years 1890–1905 at Birkenhead, and curve diagrams had been worked out to show the relation of the diseases to amount of rainfall and temperature as these varied above or below their average normal amount. Atmospheric temperature was found to have no effect on the spread of these diseases. As regards rainfall, this was shown to have no influence whatever as regards measles, but in the case of scarlatina the number of cases increased after deficient rainfall and decreased after rain; the number of *cases* increases after a series of dry years.

Newsholme has shown diphtheria to be affected in a similar manner. Dr. Marsden asks: Is it possible that scarlatina and diphtheria are "allotropic" forms of the same disease? In the case of typhoid, the number of cases occurring seems to be independent of whether it is a wet or dry year, but there seems to be a slight tendency for the number of cases to fall after rain.

PARIS.

**Academy of Sciences**, May 21.—M. H. Poincaré in the chair.—The president announced the loss by death of M. Bischoffscheim.—The discontinuity of the specific heats at saturation and Thomson's curves: E. H. **Amagat.**—Simple relations between the dynamical reactions of muscle and the energy which produces them: A. **Chauveau.**—Geometrical loci of centres of gravity: Haton **de la Goupillière.**—The intestinal origin of tuberculous tracheo-bronchial adenopathy: A. **Calmette,** C. **Guérin,** and A. **Déléarde.** The work communicated in the present paper has an important bearing on the question of the spread of tuberculosis by milk. It has been shown experimentally in the case of animals, and clinically in twenty-four cases of children, that whenever tuberculous infection is manifested by tracheo-bronchial adenopathy, tuberculous bacilli exist in the mesenteric ganglions, even when the latter appear to be healthy. These bacilli make their way into the system by the intestine.—Geodesic and magnetic work in the neighbourhood of Tananarive: Ed. El. **Colin.** The magnetic elements are given in tabular form for forty-nine stations round Tananarive.—A magnetic collimator which transforms a binocular into an instrument for taking bearings: A. **Berget.** A compass with a collimating lens and a system of totally reflecting prisms is fitted to one of the telescopes of the binocular, allowing the position of the needle of the compass to be read off to about 0·25 of a degree if held in the hand, or more closely if a support is used. The right-hand telescope is directed at the object the position of which is to be examined; the magnetic azimuth is read off directly at the same time in the left limb of the binocular.—The correlation between the variations of the absorption bands of crystals in a magnetic field and the magnetic rotatory polarisation: Jean **Becquerel.**—The sulphides, selenides, and tellurides of tin: H. **Pélabon.** The effect of the gradual addition of sulphur to tin on the melting point has been studied, and the relation between the percentage of added sulphur and the melting point given in the form of a curve. The corresponding curves for selenium and tellurium are also given.—The direct oxidation of cæsium and some properties of the peroxide of cæsium: E. **Rengade.** Oxygen, even when well dried, attacks cæsium energetically at the ordinary temperature. At −40° C. the metal blackens, but there is no incandescence; at −80° C. the action is very slow, and it is only after some minutes that the metal commences to tarnish. The action of an excess of oxygen gives cæsium peroxide, $Cs_2O_4$, a yellow oxide, easily dissociated at high temperatures. Water acts on it at ordinary temperatures, giving the hydroxide CsOH, oxygen, and hydrogen peroxide. Gently heated in carbon dioxide, cæsium carbonate and oxygen are produced. Dry hydrogen commences to reduce the peroxide at about 300° C.—New methods of preparing some organic compounds of arsenic: V. **Auger.** Methylarsinic and cacodylic acids can now be obtained commercially at a moderate price, and with these substances as starting points the author shows how various arsenic compounds can be readily prepared, including methylarsine iodide, $CH_3AsI_2$; methylarsine oxide, $CH_3AsO$; methylarsine chloride, $CH_3AsCl_2$; cacodyl chloride, $(CH_3)_2AsCl$; cacodyl, $As_2(CH_3)_4$; and tetramethylarsonium iodide, $(CH_3)_4AsI$.—Researches on diazo-compounds. The transformation of azo-orthocarboxylates into *c*-oxyindazylic compounds: P. **Freundler.**—The gases from thermal springs. The determination of the rare gases: general presence of argon and helium: Charles **Moureu.** Analyses are given of the gases from forty-three springs of mineral waters. Argon has been recognised in the whole of the forty-three samples examined, and helium in thirty-nine. It is possible that helium is also present in the remaining four, but in proportions so small that its presence is masked by the argon spectrum.—The elasticity of organic tissues: Ad. **Goy.** The apparatus described allows of six determinations being carried out nearly simultaneously on separate samples of muscle, the latter being surrounded by a fluid appropriate to its preservation. Drying in the course of the measurements is thus avoided.—The regenerator of fibrin and comparative estimations of this substance in different vascular territories of the dog after defibrination: M. **Doyon,** A. **Morel,** and N. **Kareff.**—A reaction of the oxydase type presented by the halogen compounds of the rare earths: E. **Fouard.** The oxidation of hydroquinone was determined in the presence of equimolecular solutions of the chlorides of thorium, cerium, lanthanum, neodymium, praseodymium, and samarium. The presence of the salts increased the rate of oxidation, samarium being the most active in this respect. The action is comparable to an oxydase.—The effect of adrenalin on the amount of glycogen in muscle: Mme. Z. **Gatin-Gruzewska.** The injection into a rabbit of a solution of adrenalin (containing 1 mg.) caused the total disappearance of the glycogen both in the liver and muscles. When the effect of the injection has passed off, the animal, if fed, has not lost the power of producing glycogen.—The identity of *Hemipygus tuberculosis* and *Hemicidadis crenularis*: M. **Seguin.**

CALCUTTA.

**Asiatic Society of Bengal**, May 2.—The relative proportion of the sexes in *Helopeltis theivora*: H. H. **Mann.** Hitherto no careful investigations have been made as to the relative number of males and females in any species of Heteropteron, but the fact that *Helopeltis theivora* is a serious pest of tea has given the chance for ascertaining details in its case. The paper summarises the result of daily catching of the insects for three years, and it is concluded that (1) the females are always much more numerous than the males; (2) the proportion of males increases as the conditions of life become more difficult.—Notes on the freshwater fauna of India, No. 5, some animals found associated with *Spongilla carteri* in Calcutta: Dr. N. **Annandale.** Several animals have been observed to use the dead skeleton of the sponge as a shelter for themselves or for their eggs, while an Oligochæte worm (*Chaetogaster spongillae*, sp.nov.), two chironomid larvæ, a coleopterous larva, and a larva of the neuropterous genus Sisyra appear to have a more intimate connection with the living organism. The advantage of this connection is in some cases reciprocal.—The life-history of an aquatic weevil: Dr. N. **Annandale** and C. A. **Paiva.** A general account of the mode of life and metamorphosis of a weevil which feeds on and lays its eggs in the submerged parts of the water-plant Limnanthemum.—A new goby from fresh and brackish water in Lower Bengal: Dr. N. **Annandale.** An account of a minute fish of the genus Gobius, which appears to have escaped notice owing to its retention of juvenile characters.—Preliminary note on the rats of Calcutta: Dr. W. C. **Hossack.** The author shows that the subject of rats has become of practical importance owing to the part they play in the propagation of plague. He names and gives chief characters of the four varieties found in Calcutta. He shows that colour is very variable and not a trustworthy distinction, and gives a table of the principal measurements of the four varieties found.

GÖTTINGEN.

**Royal Society of Sciences.**—The *Nachrichten* (physico-mathematical section), part i. for 1906, contains the following memoirs communicated to the society:—

December 23, 1905.—The calculation of chemical equilibrium from thermal measurements: W. **Nernst.**—Determination of the velocity of propagation and absorption of earthquake waves which have traversed the anti-point of the original focus: G. **Angenheister.**—Comparison of the seismic diagrams, from Upsala and Göttingen, of earthquake waves which have encircled the globe: F. **Akerblom.**

January 13.—The equilibrium of the sun's atmosphere: W. **Schwarzschild.**

February 3.—The number and dimensions of the taste-buds in the circumvallate papillæ of man at various periods of life: F. **Heiderich.**—The action of luminous rays upon

living cells: E. **Hertel.**—Electric phenomena accompanying the disintegration of ammonium: A. **Coehn.** (March 3.—A second communication on the same subject.)

February 17.—Researches from the Göttingen University Chemical Laboratory, XV.:—(1) The process of isomerisation in oximes; (2) isomeric forms of cyclodimethylhexylamine; (3) the simplest methene-hydrocarbons of the various ring-systems and their transformation into alicyclic aldehydes: O. **Wallach.**—Contributions to the theory of vortex-rings: J. **Weingarten.**

## DIARY OF SOCIETIES.

*THURSDAY*, JUNE 7.

ROYAL SOCIETY, at 4.30.—On the Osmotic Pressures of some Concentrated Solutions: Earl of Berkeley and E. G. J. Hartley.—On the Regeneration of Bone: Sir William MacEwen, F.R.S.—The Effects of Self-induction in an Iron Cylinder: Prof. E. Wilson.—An Account of the Pendulum Observations connecting Kew and Greenwich Observatories, made in 1903: Major G. P. Lenox-Conyngham.

ROYAL INSTITUTION, at 5.—Man and the Glacial Period: Prof. W. J. Sollas, F.R.S.

LINNEAN SOCIETY, at 8.—On Two New Species of Populus from Darjeeling: H. H. Haines.—Biscayan Plankton, part viii., The Cephalopoda: W. E. Hoyle.—Part ix., The Medusæ: E. T. Browne.

CHEMICAL SOCIETY, at 8.30.—Ammonium Selenate and the Question of Isodimorphism in the Alkali Series: A. E. H. Tutton.—An Improved Beckman Apparatus for Molecular Weight Determination: J. M. Sanders.—Resolution of Lactic Acid by Morphine: J. C. Irvine.—The Vapour Pressures of Binary Mixtures, part i., The Possible Types of Vapour-pressure Curves: A. Marshall.—Action of Sodium on *aa*-Dichlorpropylene: I. Smedley.—Thiocarbamide as a Solvent for Gold: J. Moir.—The Action of Sulphur Dioxide and Aluminium Chloride on Aromatic Compounds: S. Smiles and R. Le Rossignol.

*FRIDAY*, JUNE 8.

ROYAL INSTITUTION, at 9.—Studies on Charcoal and Liquid Air: Sir James Dewar, F.R.S.

PHYSICAL SOCIETY, at 8.—On the Solution of Problems in Diffraction by the Aid of Contour Integration: H. Davies.—The Effect of Radium in Facilitating the Visible Electric Discharge *in vacuo*: A. A. Campbell Swinton.—Mr. J. Goold's Experiments with a Vibrating Steel Plate, exhibited by Messrs. Newton and Co.—Fluid (liquid) resistance: Col. de Villamil.

ROYAL ASTRONOMICAL SOCIETY, at 5.—The New Reduction of the Meridian Observations of Groombridge: Lewis Boss.—On Mr. Cowell's Discussion of Ancient Eclipses of the Sun: Simon Newcomb.—The Physical Condition of Mars: R. Crawford.—*Promised Papers:* Results of Micrometer Measures of Double Stars made with the 28-inch Refractor in the Year 1905: Royal Observatory, Greenwich.—Errors of Jupiter from Photographic and Transit Circle Observations: Royal Observatory, Greenwich.—A Simple Method of obtaining an Approximate Solution of Kepler's Problem (an Instrument will be shown by which the Solution is Effected): A. A. Rambaut.—Solar Parallax Papers, No. 4; the Magnitude Equation in Meridian Circle Right Ascensions of the "Étoiles de Repère": A. R. Hinks.—Spherical Slide Rule: W. B. Blaikie.—Discussion on some of the Results of Observations of the Solar Eclipse of 1905 August 30.—Contributions are promised by Prof. H. H. Turner and Mr. H. F. Newall.—Mr. Newall promises a Paper, Notes on Polarisation Phenomena in the Solar Corona.

GEOLOGISTS' ASSOCIATION, at 8.—The Higher Zones of the Upper Chalk in the Western Part of the London Basin: H. J. Osborne White and Ll. Treacher.

MALACOLOGICAL SOCIETY, at 8.—Mollusca of the *Porcupine* Expeditions, 1869–70, Supplemental Notes, part iii.: E. R. Sykes.—Notes on the Dates of Publication of the "Mineral Conchology" and "Genera Rec. Foss. Shells": E. R. Sykes.—Description of *Oliva ispidula*, L., var. *longispira*: F. G. Bridgman.—On *Chloritis heteromphalus*: H. A. Pilsbry.

*MONDAY*, JUNE 11.

ROYAL GEOGRAPHICAL SOCIETY, at 8.30.—The Geography of the Indian Ocean: J. Stanley Gardiner.

SOCIETY OF CHEMICAL INDUSTRY, at 8.—Recent Progress in the Cement Industry: Bertram Blount.—On Purifying and Stabilising Guncotton: Dr. R. Robertson.

INSTITUTE OF ACTUARIES, at 5.—Fifty-ninth Annual General Meeting.

*TUESDAY*, JUNE 12.

ANTHROPOLOGICAL INSTITUTE, at 8.15.—Two Years among the Akikoyu of British East Africa: W. Scoresby Routledge.

MINERALOGICAL SOCIETY, at 8.—On the Occurrence of Axinite in the Area South of Bodmin, in Cornwall: G. Barrow.—Cassiterite Pseudomorphs from Bolivia: R. Pearce.—Notes on Skiodromes and Isogyres: Dr. J. W. Evans.

*WEDNESDAY*, JUNE 13.

GEOLOGICAL SOCIETY, at 8.—Recumbent Folds produced as a Result of Flow: Prof. W. J. Sollas, F.R.S.—The Crag of Iceland—an Intercalation in the Basalt Formation: Dr. Helgi Pjetursson.

VICTORIA INSTITUTE, at 4.—Wonders and Romance of Insect Life: Frederick Enock.

*THURSDAY*, JUNE 14.

ROYAL SOCIETY, at 4.30.—*Probable papers:* The Experimental Analysis of the Growth of Cancer: Dr. E. F. Bashford, J. A. Murray, and W. H. Bowen.—On the Electrical and Photographic Phenomena manifested by certain Substances that are commonly supposed to be Ætiologically Associated with Carcinoma: Dr. W. S. Lazarus-Barlow.—The Bone Marrow; a Cytological Study forming an Introduction to the Normal and Pathological Histology of the Tissue: Dr. W. E. Carnegie Dickson.—On the Relation of the Liver Cells to the Blood Vessels and Lymphatics: P. T. Herring and S. Simpson.—(1) Note on Lipase; (2) The Hydrolytic Action of Acids in Presence of Salts: Prof. H. E. Armstrong, F.R.S.

MATHEMATICAL SOCIETY, at 5.30.—Exhibition of Models of Space-filling Solids: W. Bailey.—The Algebra of Apolar Linear Complexes: Dr. H. F. Baker.

INSTITUTION OF MINING ENGINEERS, at 11 a.m.—Address by the President.—The Commercial Possibilities of Electric Winding for Main Shafts and Auxiliary Work: W. C. Mountain.—Electrically-driven Air-compressors, combined with the working of the Ingersoll-Sergeant Heading-machines, and the subsequent working of the Busty Seam: A. Thompson.—Practical Problems of Machine-mining: Sam Mavor.—The Strength of Brazed Joints in Steel Wires: Prof. Henry Louis.—Bye-product Coke and the Huessener Bye-product Coke Ovens: J. A. Roelofsen.—Considerations on Deep Mining: George Farmer.

*FRIDAY*, JUNE 15.

INSTITUTION OF MINING ENGINEERS, at 10.30 a.m.—Rescue Apparatus and the Experience made therewith at the Courrières Collieries by the German Rescue Party: G. A. Meyer.—A New Apparatus for Rescue-work in Mines: W. E. Garforth.—A Rateau Exhaust-steam-driven Three-phase Haulage Plant: William Maurice.—Development of Placer Gold-mining in the Klondike District, Canada: J. B. Tyrrell.—Mining Education: Prof. J. W. Gregory.—The Capacity-current and its Effect on Leakage Indications on Three-phase Electrical Power-service: Sydney F. Walker.—Petroleum Occurrences in the Orange River Colony: A. R. Sawyer.

NATIONAL ASSOCIATION FOR THE PROMOTION OF TECHNICAL AND SECONDARY EDUCATION, at 3.—Annual General Meeting.

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