THURSDAY, JUNE 5, 1913.

DYNAMICS OF GOLF.

The Soul of Golf. By P. A. Vaile. Pp. xiii + 356. (London: Macmillan and Co., Ltd., 1912.) Price 6*s.* net.

THIS is a breezy, well-written book, full of valuable hints to the ambitious golfer. Much of the instruction takes the form of attack upon the writings of other exponents, and this makes lively reading. With a great deal of the criticism most golfers who have tried to formulate the principles of the game will agree. But it is not human to be perfect, and Mr. Vaile does not escape falling into pitfalls himself, especially when dealing with the dynamical aspect of things. To the November number of *The Fortnightly Review* he contributed an article on the dynamics of golf, in which he seems to regard himself as a supreme authority. In one respect this article is an improvement on the book, for he accepts in its simplicity Newton's explanation of the swerve of the spinning ball advancing in air, and in one paragraph gives quite a good account of this phenomenon, very much as Tait did years ago. Unfortunately he obscures the explanation in a later paragraph when he says that it is "the continual friction on the lower portion of the ball which gradually forces it up."

Mr. Vaile is merciless in his exposure of looseness of language. Yet in his discussion of the value of furrows cut on the face of iron clubs (a method, by the way, first adopted by Tait), he writes that "marking is frequently done by great deep lines, and, particularly in the mashie, nearly always by lines which run from heel to toe. Now in the great majority of mashie shots, when one is putting on cut one requires lines running in an exactly opposite direction"—that is, if English means anything, from toe to heel! Mr. Vaile, of course, does not mean that, any more than Sir J. J. Thomson means that the golf-ball is spinning like a sleeping top when he says that slicing and pulling are due to rotation about a vertical axis. Sir J. J. Thomson does not say that this is the only spin that exists; but it is the component of spin about the vertical axis which has to do with the phenomena of slicing and pulling. When the ball is rotating about an axis not truly horizontal, there must be a component about a vertical axis. This component, regarded from above, will be either right-handed or left-handed, according to circumstances, producing respectively slicing or pulling. This, obviously, is the meaning to be attached to Sir J. J. Thomson's words. In his article Mr. Vaile says: "Prof. Thomson must now realise that if the axis of spin was the same in each ball"—that is, each sliced or pulled ball—"their conduct on landing would be similar." Can Mr. Vaile not imagine that though the axis of spin may be the same, the direction of rotation about the axis may be either the one way or the other?

Mr. Vaile is to be congratulated upon the clear way in which he describes the conditions under which the so-called "push-shot" with cleek or iron is obtained. But the main feature of this stroke was well understood on the golf-links of St. Andrews and Musselburgh long before the days of Varden or Vaile. The divots of turf which were removed by the club after it hit the ball proved incontestably that this particular stroke of club on ball occurred during the descent of the club. In his article on long driving in *The Badminton Magazine* of March, 1896, the late Prof. Tait shows clearly how underspin is produced. In his figures on p. 370, Tait represents the velocity of the clubhead at impact by the line *AB*, and remarks that "*AB* may be made to take any direction we please—*i.e.* the clubhead may be represented as moving in any direction whatever; but it *is quite sufficient for our purpose*[1] to treat it as moving horizontally." Mr. Vaile regards this sentence as meaning that Tait considered every well-driven ball as being projected by a horizontal blow; for he deliberately says that a "fundamental error" of the late Prof. Tait consisted "in regarding the blow of a golf-club as being a force directed in a line parallel with the horizon." This is really very bad. Yet there is a worse case of unpardonable carelessness in Mr. Vaile's reading of the *Badminton* article.

In a footnote on p. 380 of this article Tait, with the honesty of the real investigator, points out the difficulties under which his "laboratory experiments" on the *velocity of projection* of a golf-ball were made, and Mr. Vaile quotes this footnote as if it referred to a totally different experiment described on p. 381. The latter experiment, with one end of a long, untwisted tape "tied to the ball and the other to the ground," was clearly not made in the laboratory at all. The ball was driven into a stiff clay face, not into the 10-inch disc of clay spoken of in the footnote; and the difficulties of aim did not enter into the experiment with the tape. Tait always found the tape twisted in such a way as to show underspin. Mr. Vaile will not believe it. He should therefore try the experiment himself instead of criticising what he has not taken the trouble to understand aright. By this experiment Tait proved to the simplest intellect that underspin was invariably present in

[1] The italics are ours.

a well-struck ball. But before the experiment was thought of Tait had proved to the mind capable of understanding the dynamics of golf that it is not possible to obtain the *distance* of flight and the *time* of flight by balls projected with *permissible* velocities at the *small angles of elevation* which characterise well-driven balls, unless an uplifting force comes into play.

Mr. Vaile is neither fair to Tait nor true to fact. In his chapter x. he says, quite untruly—for the dates can easily be given[2]—that Tait did not take underspin into consideration until after a great drive by which his son Freddie proved that the father's calculations were wrong. He then proceeds to point out what he thinks are errors in Tait's article in *The Badminton Magazine*, which has been already referred to. For example, Tait's remark that "the existence of rotation is manifested at once by the strange effects it produces on the curvature of the path" is branded "as incorrect from a scientific point of view," and "also badly stated." What follows on p. 225 of "The Soul of Golf" shows that our author has not grasped the scientific significance of the problem. He says that it is well known to all golfers that the spin begins to work as the velocity of the ball decreases, and then makes the astounding statement that "it is incorrect to refer to the strange effects it (rotation) produces on the curvature of the path, for it is the rotation itself which produces the curvature."

If this means anything other than Tait meant, it means that the parabola described by a projectile *in vacuo* has no curvature, nor has the path described in air by a ball devoid of rotation. Gravity apparently is not in it! Mr. Vaile fails to see that Tait is comparing the path of a rotating golf-ball with the path it would have had if no rotation had existed. The real dynamic truth is that the underspin begins to work from the very beginning of the drive. The curvature of the path is influenced *from the start*, as witness the upward concavity of the wind-cheater. Not only so, but the underspin exerts its greatest influence at the beginning of the drive when the spin and the velocity are both at their greatest. When Mr. Vaile asserts that it is in the second part of the trajectory that the back-spin is exerting its greatest influence, he is confusing what the eye seems to see with what has been really taking place. The ordinary golfer, indeed, is quite ignorant of what any particular path would have been had there been no spin; also he is badly placed to see the real form of the path, and the initial velocity is too great for him to follow the early details of the flight. Tait's calculated curves bring out the form of the wind-cheater beautifully (see NATURE, June 29, 1893). These calculations are based on the combined effect of gravity and the upward force due to coexistence of translation and spin. Both these motions are present from the beginning, and must dynamically assert themselves from the start. To speak of pace, when there is enough of it, as beating spin, is nonsense. Spin alone has no lifting or swerving power. It must coexist with translational velocity; and the lifting power increases with the amounts of both.[3] The particular instant at which the eye recognises the accumulated effect of the upward lift proves nothing as to the manner in which this lifting force has gone through its successive values. The idea that the spin asserts itself only after the ball has travelled a considerable part of the trajectory is dynamically grotesque and hopelessly erroneous.

The flight of the golf-ball is not a problem which can be solved by intuition; and the man who has not mastered Tait's papers on the path of a rotating spherical projectile is not in a position to criticise Tait's conclusions. If Mr. Vaile will take the trouble to turn up the first of these papers he will find pictured a theoretical curve the gradually increasing curvature of which as the linear speed of the projectile falls off will reveal to him all the essential characteristics of the path of the sliced ball. He may then possibly understand the truth which Tait was wont to impress upon his students year by year, that the direct evidence of our senses is frequently misleading unless controlled and corrected by reason.

There are several other statements in Mr. Vaile's account of the flight of the golf-ball which are scientifically unsound. Thus, on p. 244 he says that the club

"is nearly always moving either upwards or downwards in a curve at the moment it strikes the ball, so that it stands to reason, especially when the club-face is travelling upwards, which is what it does in the great majority of cases, that the blow is never delivered horizontally, but is always struck more or less upward through the ball's centre of mass."

This is deliciously loose, for it means grammatically that when the club-face is travelling either upwards or downwards it strikes the ball upward through the centre of mass. Of course, Mr. Vaile does not mean to say so. What he seems to mean to assert is that in the *great majority of cases* the impulse is through the centre of mass of the ball. If that were so, there could be no underspin, nor, indeed, any spin at all. The great majority of

[2] See, for example, "A Golf Myth: Prof. Tait's Alleged Error," in *Golf Illustrated*, January 1, 1909; or in my "Life and Scientific Work of P. G. Tait," pp. 26–28.

[3] See, for example, Lord Rayleigh, "On the Irregular Flight of a Tennis Ball," *Messenger of Mathematics*, 1877; "Scientific Papers," vol. i.

strokes would be unaccompanied by the phenomena of slicing or pulling or rising above the natural gravitational path. The dynamical condition for the production of underspin is clearly pointed out by Tait in his various articles. The resultant blow must be delivered so as to act in a line which passes beneath the centre of mass. For this purpose the blow need not be horizontal; but a horizontal stroke with a lofted club will produce underspin if the club-face hits the ball below the height of the centre. In this sense loft is an important factor in the production of underspin. In all cases, whether the ball is hit with a downward or a practically horizontal stroke, the production of underspin depends on the existence of a pronounced tangential component of impulse, and this requires that the direction of the blow must be inclined to the face of the club.

Mr. Vaile expresses the same idea when he speaks of the ball being hit with a glancing blow. In his explanation of the manner in which the wind-cheater is produced he is indeed quite sound; and it is a matter of regret that a book so admirable in many respects should be marred, not only by faulty dynamics, but by an inability to follow the dynamical reasoning of a master like Tait. Mr. Vaile sneers at the mathematician and physicist as having gone on utterly fallacious lines. He misquotes, and when he quotes aright he not unfrequently misunderstands. Nevertheless, on the more practical aspects of the game, when he is speaking for himself, and not piling up adjectives of denunciation against the mathematician, Mr. Vaile has done no small service in removing some of the clouds of mystery with which popular writers have obscured the soul of golf.

C. G. KNOTT.

THE AGE OF THE EARTH.

The Age of the Earth. By A. Holmes. Pp. xii + 196. (London and New York: Harper and Brothers, 1913.) Price 2*s.* 6*d.* net.

THE question "For how long has it been possible for organic beings to have lived on the earth?" must always be one of supreme interest; and it is good to find a book which states shortly but quite clearly how far we have proceeded towards an answer.

No great weight ought ever to have been given to the argument from the lengthening of the day, because it assumes that the ratio of the polar and equatorial diameters of the earth now is the same as when the earth ceased to be liquid; in spite of the fact that great forces are acting tending to change this ratio. Kelvin's argument from the temperature gradient downwards in the earth's crust ceased to be of value when it was shown that greater conductivity in the interior led to an enormously larger answer; for whether such greater conductivity is or is not probable, it could not be said to be impossible. We are sorry that Mr. Holmes should refer to the work of Mr. Clarence King as if it affected the question. He, following Kelvin, assumed that there could be no greater conductivity inside the earth than in the crust. But all earth-cooling arguments have been set aside by Mr. Strutt's measurement of radium in rocks, and they are now of historical interest only.

Three of the old arguments still hold the field—one from the sun's energy, a second from the amount of salt in the oceans, and the third from observations of rates of erosion and deposit of sediment. To these a fourth is now being added which is likely to have great weight in settling the matter—the increase in the proportion of lead to uranium in rocks as time goes on. Mr. Holmes has himself devoted much time to the laboratory study of radio-active minerals, and of the creation of lead and helium from uranium; in the present state of our knowledge we can suggest no modification of his figures. He ought, however, we think, to be prepared to accept a less age for the earliest sedimentary rocks than 1300 million years.

Consideration of the amount of sodium in the ocean gives less than a quarter of this age, as does also the consideration of the accumulation of carbonate of lime. These two methods of study are on a much less certain basis than the calculation from the rate of accumulation of sediment, which, however, gives about the same age. With this last method Mr. Holmes, as a geologist, is very familiar. The suggestion that erosion used to take place more slowly because all continents were smaller and lower in level than now, would lead to a better agreement between the two methods which he favours. If the average slopes were 60 per cent. of what they are now, we are led to multiply the age by four. On the whole, we feel with Mr. Holmes that the question is in a fair way towards settlement, but, unlike him, we still see a difficulty due to the age of the sun. A person who has not made the calculation will scarcely believe in the liberality with which Kelvin treated his opponents in regard to the argument based on the sun's heat. Assuming that the whole mass of the sun was once scattered through space, and by mere gravitation the stuff came together as we now have it, and considering that it is denser in its central part, the total amount of energy given out as heat cannot be much greater than 25 million

times the amount of heat now given out in one year. Kelvin, after making this kind of calculation, said: "It seems, therefore, on the whole, most probable that the sun has not illuminated the earth for 100 million years, and almost certain that he has not done so for 500 million years."

The possibility that the existence of radium in the sun might increase the calculated age has been carefully considered, and it is found that it will not do so; it has no practical effect on the result if the proportion of radium to other substances is taken to be the same as it is on the earth.

It may have been the possibility of a much less radiation from the sun in the past that caused Kelvin to be so generous. But, making every allowance of this kind, it is difficult to imagine a greater age than 100 million years; indeed, it is difficult to imagine so great an age. It seems absolutely necessary to find more energy than mere gravitational energy, and we are very loth to assume that the matter which now forms the sun had once much greater atomic energy than it possesses now. It is curious that the mathematics of a spherical mass of gas, published in NATURE, July 13, 1899, pp. 250 and 252, should lead to a speculation of this very kind; that is, that the mass of gas could not exist unless there was originally some more atomic energy than we find it to possess in the laboratory. Lord Kelvin thought that this conclusion merely meant that such a body would collapse until its stuff ceased to behave as a perfect gas. In these days when the facts of radio-activity are unsettling our beliefs, and it is necessary to get the sun's heat argument into agreement with the others, there is a temptation to let our thoughts linger on the other speculation, although, indeed, it must be quite absurd. And yet we know that the second law of thermodynamics is being evaded somewhere in the universe.

Our thanks are due to Mr. Holmes for this very welcome and interesting little book. J. P.

POPULAR BOTANY AND GARDENING.

(1) *Trees and How They Grow.* By G. Clarke Nuttall. With 15 Autochromes by H. Essenhigh Corke. Pp. xi + 184 + plates. (London: Cassell and Co., Ltd., 1913.) Price 6*s.* net.

(2) *Wild Flowers as They Grow.* Photographed in Colour Direct from Nature by H. Essenhigh Corke. With Descriptive Text by G. Clarke Nuttall. Fifth Series. Pp. viii + 200. (London: Cassell and Co., Ltd., 1913.) Price 5*s.* net.

(3) *Garden Flowers as They Grow.* Photographed in Colour Direct from Nature by H. Essenhigh-Corke. With Descriptive Text by H. H. Thomas. Pp. iii + 197. (London: Cassell and Co., Ltd., 1913.) Price 5*s.* net.

(4) *Garden Work: A Practical Manual of School Gardening.* By William Good. Pp. xvi + 399 + plates. (London: Blackie and Son, Ltd., 1913.) Price 3*s.* 6*d.* net.

(5) *Dahlias.* By George Gordon. Pp. xi + 115 + 8 coloured plates. (London and Edinburgh: T. C. and E. C. Jack.) Price 1*s.* 6*d.* net. (Present-Day Gardening.)

IT is somewhat difficult to know just what to say about the majority of the numerous popular works on botany and gardening that are turned out in such rapid succession in these days—in some cases the writers of such books rival even the most popular of popular novelists in their industry, turning out half-a-dozen or more sizeable books a year. If one is to judge them critically, one is bound to say that these books are, on the whole, rather poor; if inclined to cynicism, one would certainly say that most of them are totally unnecessary; but, after all, one cannot but rejoice at the increasing interest in plant-life and gardening of which this flood of good, bad, and indifferent books may be regarded as the outcome and reflection. One may at least admit that compilers of books of this kind are making fairly good use of improved methods of colour and other illustration processes; that the letterpress, though too often hasty and slipshod, is freer from actual inaccuracies than one might have expected; and that these books are likely to arouse the reader's interest. So much to the good; only, since the writing of such books appears to be fatally easy, let us hope that some few readers may resist the temptation to write books themselves.

(1) This is a readable and interesting account of a number of common trees, with fifteen coloured plates by Mr. Corke, in addition to which the author contributes a large number of remarkably good photographs, including stages in the germination of the seeds and the unfolding of the buds in the majority of the trees dealt with. So much has been done in the letterpress to make the story of these trees attractive that it seems a pity the author did not give, either as introduction or appendix, a general account of the growth of trees and the many interesting biological features (leaf-mosaics, for instance) which they present, and perhaps some account of the ecology of woodlands as developed in Britain—to mention only one or two of the aspects of tree-life not touched upon.

(2) Messrs. Nuttall and Corke are steadily working their way through the British flora; in this volume the former describes, and the latter depicts, a fifth batch of twenty-five native wild flowers. The coloured plates are unusually good, even for

this series; practically all the colours are as true to life as present processes of reproduction can make them, and one can scarcely select any for special praise, though the pictures of butterbur, dwarf thistle, corncockle, and teasel are perhaps among the most pleasing. The line-drawings in the text are still rather too diagrammatic and poorly executed, as in previous volumes. On the other hand, the descriptions show great improvement, the author having incorporated in his accounts the results of quite recent observations on the biology of both flowers and vegetative organs—as an instance of the latter we may mention his account of recent experiments on the biological significance of the water-pitchers of the teasel.

(3) Here the same indefatigable illustrator contributes twenty coloured plates to what is probably the first volume of a companion series of picture-books on garden flowers. It is not easy to see for what class of reader a book of this kind is intended, though the text is pleasingly written, and the pictures nice to look through—one is tempted to suggest that this sort of book is simply meant to be laid on the parlour table for the delectation of the waiting visitor, as a change from the old-fashioned album or book of views. The practical gardener has surely no use for books like this, and the text is not such as to be of much service to the amateur grower. Still, there seems to be a brisk demand for any and every sort of book on botany or gardening that is illustrated in colour and attractively got up in a "suitable-for-presentation" style, and we may leave it at that.

(4) This is another book which scarcely appears to fill a distinct gap in the copious literature of gardening. The author is enthusiastic and practical, but the botanical portions of the book (chapters iii. and iv.) are rather badly in need of revision, and some of the illustrations are poor woodcuts which contrast strangely with the many excellent photographs; some of these cuts (*e.g.* those on pp. 48, 162, 170, 171, 174, 226, and 241) would be well-nigh unrecognisable if not labelled. Since this book is published at a low price, and may come into sufficient demand to make a second edition necessary, it is to be hoped that it will be subjected to considerable revision; apart from the unsatisfactory blocks just referred to, at least half of the illustrations given are neither necessary nor helpful as aids to the comprehension of the letterpress, and might well be omitted, or replaced by more useful pictures. It is only just to add that, apart from the more botanical portions, the text is thoroughly practical and clear, and the book would form a very useful guide to the amateur gardener, as well as to the school-teacher, for whom it is more particularly intended.

One thing that certainly ought to be omitted from a new edition is the preface, the writer of which appears entirely to have overlooked the danger of advising the turning loose of troops of school-children armed with trowels and collecting-tins—what this has to do with school-gardening is hard to see—to help in the extermination of rare plants. It would have been much more to the point to have directed attention to the urgent need for the protection of wild plants against the avarice of collectors old enough to know better, rather than to deplore the fact that the vasculum and fern-trowel are not yet ubiquitous in this country. We have quite enough plant-collectors as it is, though we could do with more students of plant-life in field and garden—that is quite another thing.

(5) The editor of the "Present-Day Gardening" series, which is rapidly becoming an invaluable library in itself, is to be congratulated on having secured for the authorship of the volume on dahlias the president of the National Dahlia Society. Needless to say, Mr. Gordon has succeeded in giving, within comparatively small compass, an immense amount of information of all kinds about these flowers, including an extremely interesting historical chapter and the thoroughly practical hints regarding cultivation that might be expected from a writer of authority upon the subject. The eight coloured plates by Mr. Waltham are well chosen and beautiful. It may seem somewhat ungracious to find fault with such a fine series as this, but the pasteboard binding is very liable to get cracked in use, and one cannot help wishing that more resistant material had been used in covering the books. F. CAVERS.

OUR BOOKSHELF.

Wild Life. An Illustrated Monthly. Vol. i., Nos. 1–5. Edited by Douglas English. (London: *Wild Life* Publishing Co., 1913.)

LAST summer the members of the Zoological Photographic Club held an exhibition at the offices of the Zoological Society, and the object of this periodical is to continue and extend the work of that exhibition. The first number appeared in January and promised well. Mr. R. B. Lodge wrote of eagles and vultures in Albania, and Mr. Farren, who showed some wonderfully beautiful photographs, described the life of the egrets in the valley of the Guadalquivir, where Mr. Abel Chapman and Mr. Buck have done so much to preserve this species. Mr. Francis Ward had some interesting notes and plates of fishes, living birds, and otters: the photographs were taken in his pond on a method of his own invention.

The editor's paper on the sand-wasp (*Odynerus spinipes*) was welcome as breaking new ground in photography, for of photographs of birds it is possible to get weary, unless they have something new to tell us; and that is by no means always the case, in spite of the editor's extravagant claim (p. 8) that our knowledge of British birds has been doubled in the last decade by photography alone.

We are glad to see that in the four succeeding numbers the art is applied freely to insects and reptiles, as well as to birds and quadrupeds. The March number contains some admirable photos of the three species of British snakes, and also a good paper on the snake-fly and the alder-fly, with illustrations showing a decided improvement on those of the sand-wasps. The April number has a paper with good illustrations of young moles, and the May number is appropriately devoted mainly to the cuckoo. Special mention may be made of Mr. Oliver Pike's "bioscope record" of the performance of a young cuckoo in ejecting from the nest a sedge-warbler older and larger than itself. We wish the editor and his contributors all success in their work, hoping at the same time that, in spite of the beauty of its illustrations, *Wild Life* will not be used by beginners simply as a picture-book.

Photographic Supplement to Stanford's Geological Atlas of Great Britain and Ireland. Arranged and edited by H. B. Woodward, F.R.S., with the cooperation of Miss Hilda D. Sharpe. Pp. 113. (London: Edward Stanford, Ltd., 1913.) Price 4*s.* net.

Two years ago Miss Hilda Sharpe published a field notebook of geological illustrations (see NATURE, vol. lxxxviii., p. 74), and she has now done further service by collecting nearly half the photographs in Mr. H. B. Woodward's volume. Some of the remaining half have been previously published by the Geological Survey, and others are from the series in the care of the British Association. Among the most original and suggestive are Miss Sharpe's own "View from Summit of Caer Caradoc," showing the outweathered cones of Uriconian rock, and Mr. Armstrong's "Escarpment of Millstone Grit, near Leek." Landscapes like these, and the Survey's "Raised Beaches near Strome Ferry," illustrate the geological atlas better than any number of quarry-sections. Among the latter, however, the Jurassic Clay and Limestone at Bromham (No. 68) and the Chalk and Thanet Sand at Crayford (No. 89) are highly characteristic. The Scotch views include the Torridon Sandstone and the mountainous features near Glen Etive; but the wild heart of Skye is unrepresented. Ireland is honoured by one picture, a rather distant view of the Giant's Causeway; but should this very compact basaltic lava be called a dolerite?

We are glad to see Mr. H. Preston's work in England well utilised, as in the cases of the Norwich Crag of Thorpe (No. 97) and the massive limestones of Lincolnshire; but such a book always makes us ask for more. Those who use the atlas will look for further help in realising the country. Can we not have the cirques of Snowdon, the long lakes of Westmoreland, white between their rain-swept hills, the highland border beyond Stirling, or the scarp of the intrusive sheet that fixed the margin of the Roman world? G. A. J. C.

A Dictionary of English and Folk-Names of British Birds. By H. Kirke Swann. Pp. xii+266. (London: Witherby and Co., 1913.) Price 10*s.* net.

THIS book is strictly a dictionary, and on that account less interesting to turn over than Mr. Swainson's "Provincial Names of Birds," published for the English Dialect Society in 1886, which also dealt to some extent with the folklore. Mr. Swann, however, claims to have added some three thousand names to those collected by his predecessor: he has evidently taken great pains, and deserves much credit for a handbook which will always be useful. We will make one critical remark only. If Welsh, Gaelic, Cornish, and Irish names are freely admitted to the list, why not Anglo-Saxon, which are at the roots of our own local names? "Enid," for example, was the English word for a duck till the fifteenth century, but it is not here. Mr. Swann's work begins with Chaucer; but he might well search the Anglo-Saxon vocabularies for addenda to a second edition.

Religious Beliefs of Scientists: Including over 140 hitherto Unpublished Letters on Science and Religion from Eminent Men of Science. By A. H. Tabrum. With an Introduction by Rev. C. L. Drawbridge. New and enlarged edition. Pp. xxi+309. (London: Hunter and Longhurst, 1913.) Price 2*s.* 6*d.* net.

To the second edition of this collection of letters forty new communications, which Mr. Tabrum has received in reply to his questions from workers in science, have been added. Such a compilation of opinions must necessarily be of doubtful value, the questions propounded unavoidably lack precision, and the answers too often turn out to be very general in character. But the volume will be of interest to the class of reader who is anxious to know the opinions of distinguished men on important questions outside their own special fields of knowledge.

The British Empire with its World Setting. By J. B. Reynolds. Pp. viii+200. (London: Adam and Charles Black, 1913.) Price 1*s.* 4*d.*

THE attempt to survey the geography of the British Empire in a little book of this size, at the same time providing an outline sketch of the geography of the rest of the world and upwards of ninety maps, diagrams, and illustrations, more than forty of them being full-page pictures, was bound to lead to very severe compression. The number of place-names on a single page is often far greater than children can be expected reasonably to remember. The book is very attractive in appearance, and the writer's name is a guarantee for accuracy.

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.]*

A Plea for Uniformity in Radio-active Nomenclature.

IN a letter to NATURE (vol. lxxvi., p. 661, 1907) Prof. Rutherford advised against an immediate adoption of a permanent system of nomenclature for the radio-elements since the discovery of a new element in the midst of a series would entail the alteration of the names of a possible half-dozen others which follow it. It was considered, however, that the number of products still to be discovered was nearly exhausted, and that when there was a general consensus of opinion that such was the case, chemists and physicists should meet together in order to revise the whole system of nomenclature.

An opposite view was taken by Mr. Norman R. Campbell (NATURE, vol. lxxxiv., p. 203, 1910), who urged the adoption without further delay of a system of nomenclature for the radio-elements which would admit of interpolation, and would explain relationships between objects named. Since this would constitute a permanent system of naming, those names which are acknowledged as temporary might be at once dispensed with without having to wait for an indefinite time in the future when all the elements in a series are assumed to have been discovered.

Little attention, however, seems to have been given to this suggestion. New elements have been discovered since then, and the names assigned to some of them are even more unsystematic than the names previously given to other elements of the same series. As examples of this diversity of naming may be mentioned mesothorium 1, radium C^1, and radium C_1.

It might be urged in defence of the names now in use that no satisfactory system has yet been devised which would provide for the naming of elements yet to be discovered, and would show relationships between elements either in a straight or branched series. The most favoured system of naming the radio-elements seems to be that by which an element is designated by a letter or number following the name of the first of a group of elements. Such a system, however, does not admit of interpolation, and there may thus be good grounds for the delay in adopting a permanent system of nomenclature.

The object of the present note is to direct attention particularly to the diversity and careless use of symbols selected to represent the names of the radio-elements now in use. The lack of uniformity in the use of symbols is illustrated by the following examples, most of which were taken from recent numbers of the *Philosophical Magazine* and the *Physikalische Zeitschrift*:—

Uranium.—U and Ur.

Actinium.—Ac, Act, and Akt.

Radium A.—Ra A, RaA, and Ra-A. The symbols of all other elements designated by a letter are likewise written in one or other of the three ways represented.

Uranium 2.—U 2 (or Ur 2), U_2, U-2, U-two, and U_{II}. A similar diversity is observed in the symbols of all elements which are designated by a number.

Radio-thorium.—Radio-Th, Radioth, Ra Th, Radth, Rad Th, Rad-Th, and Rt.

Mesothorium.—Meso-Th, Mesoth, Mesth, Mes-Th, and Ms.

Radium A, Radium B, and Radium C when considered collectively.—Ra A, Ra B, and Ra C; Ra A, B, and C; RaA+B+C; Ra(A+B+C); A, B and C; A+B+C. The active deposit of other series is likewise referred to in a corresponding variety of ways.

Such a diversity of symbols must be very confusing to the student in radio-activity, and particularly to the future student when referring back to the work of the present day.

No less confusing is the use of duplicate names in the case of several of the elements. Thus the product following radium is sometimes called radium emanation (Ra Em), and sometimes nitron (Nt); that following radium C is called radium D, and also radio-lead; and that following radium E has the duplicate names radium F (Ra F) and polonium (Po). These different names for the same element are often to be found in the same article. In the same way the terms X-ray and Röntgen ray are still used for the same radiation.

In an abstract journal like *Chemical Abstracts*, where only the symbols of the elements are used, it is particularly desirable that each element should be always represented by the same symbol. In the case of some of the radio-elements this is not possible since no standard symbols have yet been decided on. It would thus seem worth while to adopt by general agreement uniform symbols for the radio-elements, even although the names of some of the elements may be considered as only temporary.

WILLIAM H. ROSS.
H. JERMAIN CREIGHTON.
Swarthmore College, U.S.A., May 14.

Pianoforte Touch.

I HAVE been very much interested in Prof. Bryan's article on pianoforte touch in NATURE of May 8. There is, of course, no question with anyone who is a pianist that dynamic differences of touch produce enormous differences of quality in the tones of a well-made pianoforte. My own observations in the matter do not go very far, but, amongst other things, it has seemed to me that two things are important: (1) the harmonics of a note have always seemed to me to be most prominent when the note has been produced by the least possible "hit" by the fingers, in fact, when the note is practically produced by pressure alone. Pressure alone is, of course, unable to produce a note, and a certain fractional hit is always necessary to give the hammer the necessary momentum.

(2) As a result of (1), it seems worthy of note that variations in quality must be produced by differences in the time the hammer is in contact with the string. Since the sensitive fingers of a trained pianist will be able to produce an infinite variety of pressure and hit from the heaviest arm staccato to the merest "caress" of a key, it is possible to produce very large differences of quality as well as large differences in intensity.

My own experiences with a player-piano have made me well-nigh despair of its capabilities in its present form. In spite of the instinctive control it is certainly possible to obtain with it, its mechanical details seem to me to fall far short of the ideal that a musician can demand. It is, of course, practically impossible to produce a differentiation of intensity between notes of the same chord, and to a musical ear it is this difference of intensity which enables differences in quality to be detected and appreciated. Prof. Bryan seems to have been able to control this differentiation in quality in a solo passage, and if he can produce a mechanical arrangement which can even approximate to the sensitiveness of a pianist's fingers, he will certainly go far to make the piano-player more acceptable to musicians.

I have often endeavoured to make a player-piano play Chopin's First Ballade, but I have never yet succeeded in overcoming the uncompromising self-assertiveness of the mechanism. It seems to me a curious fact that while a piano-player can often play Beethoven acceptably, it fails hopelessly with Chopin, especially in works like the ballades and nocturnes. I have succeeded in getting presentable performances of the sonatas, and I had almost said of the scherzos, but the lack of flexibility of the instrument seems to make it impossible in music where differences in colour are so important as in the ballades and nocturnes.

Although I have no doubt it will be possible to devise a mechanical arrangement which will improve the player in the direction I have mentioned, yet it would seem impossible to make any mechanism sufficiently sensitive to be able to produce effects such as those which can be produced by the fingers, just as it may be possible to produce an aëroplane which is capable of marvellous evolutions, while it never attains the instinctive facility of a bird.

CHRISTOPHER W. C. WHEATLEY.

The College, Epsom, May 23.

On the Habitat of Protodrilus and the Occurrence of the Archiannelid, Saccocirrus, on the South Coast of England.

ONE habitat of Protodrilus on the English coast has already been mentioned in NATURE of March 27 (p. 85). This animal, however, has since been found in so many similar localities in the Plymouth district that there can be little doubt that it will be found on other parts of the coast when looked for in suitable situations. Protodrilus has indeed now been taken in numbers in eleven different localities between Salcombe and Looe.

In one of these situations there was found, along with Protodrilus, a species of the interesting genus Saccocirrus, which, as is well known, appears to link up the Archiannelids with the Polychætes. This genus has not apparently been taken outside the Mediterranean region except at Madeira, but, as in the case of Protodrilus, it may very likely be found on other parts of the coast when looked for in suitable places. Hence the following description of the habitat of these animals may induce some of the readers of NATURE to look for them on other parts of our coasts.

In all cases Protodrilus—and in one case Saccocirrus—has been found in gravel just below the high-water mark of neap tides where fresh water runs or percolates into the sea, and in nearly all cases the animals were taken at the lower level of a gravelly beach where the gravel passes into a rocky foreshore. Given these conditions in the Plymouth district, namely fresh water running over or percolating through gravel near the high-water mark of neap tides with rocks at the lower levels, and one is practically certain to find Protodrilus where the gravel meets the rocks, and especially under stones embedded in gravel in the pools at the junction of the gravel and the rocks.

In appearance the species of Protodrilus found near Plymouth, *P. flavocapitatus*, resembles a piece of silk thread about half an inch long, looking brownish-white to creamy-white on a dark background, and having a rosy-coloured portion just behind the head; the body is often curved in a characteristically sinuous manner, and may become rolled up into a close spiral coil if the animal is alarmed. Saccocirrus is very similar to Protodrilus in habits, but is larger, attaining a length of nearly 2 in., and having a correspondingly thicker body, which is opaque-white in colour. This species of Saccocirrus has not yet been determined, but it does not appear to be the same as the *papillocercus* of Bobretzky as revised by U. Pierantoni (*Ann del Mus. Zool. Napoli* (N.S.), vol. ii., No. 18, 1907).

J. H. ORTON

The Laboratory, Citadel Hill, Plymouth.

Sub-Red Crag Flint Implements and the Ipswich Skeleton.

THE best reply to Mr. J. Reid Moir's criticism (NATURE, May 22, p. 296) on my paper in the Manchester memoirs discussing his sub-Crag flints will be the paper itself when published. The second part of his letter, dealing with the Ipswich skeleton, reveals so complete a change of ground that it is necessary to comment on it. In his original description (Proceedings of the Prehistoric Society of East Anglia, vol. i., part ii., p. 194) Mr. Moir laid very great stress on the fact that the contracted skeleton was lying partly embedded in glacial sand, and partly in decalcified boulder clay.

In a report (*ibid.*, p. 196) by Mr. W. Whitaker, F.R.S., appears the following:—"The bony cavity of the skull is filled with earth of the same kind as that beneath which the skeleton was found, a brown loam, and the filling is so thorough that a cast of the cavity has been made."

Dr. Arthur Keith, in his description (*ibid.*, p. 203) of the Ipswich skeleton, remarks "that on reaching the museum the bones were exposed by removing from them the overlying boulder clay and leaving them still *in situ*, on the underlying glacial sands," and adds, "There is the further advantage that anyone can now examine the exact relationship of the parts to the strata in which they lie."

Mr. J. Reid Moir now says "that in his opinion the skeleton was either buried in the sand, or else covered by blown sand to a considerable depth." In either case the skeleton, when found, should have lain entirely in sand and the cranial cast in boulder clay would have been impossible. Mr. Moir's present view is hence quite inconsistent with his original description of the occurrence, and, as he cannot have it both ways, he must choose which view he prefers to stand by.

W. H. SUTCLIFFE.

Littleborough, May 27.

Antennæ for Wireless Telegraphy.

I FIND that an iron bedstead with wire mattress on the top (fourth) floor of this house answers quite well as antennæ for the receipt of wireless signals. It is only necessary to connect the receiving apparatus, which includes a Brown relay, between the bedstead and the water-pipe to receive the Admiralty signals loudly, and others from various unidentified stations faintly but quite audibly.

I find also that with the bedstead antennæ it is possible to get the time signals from the Eiffel Tower. As might be expected, the signals are not very loud, but are sufficiently audible to be recognised and read easily.

A. A. CAMPBELL SWINTON.

40 Chester Square, S.W.

Use of a Carbon Filament Lamp to Charge Electroscopes.

I FIND that a very convenient way of charging an ordinary gold-leaf electroscope is to rub the charging rod with the glass bulb of a glowing carbon filament lamp. The leaf system becomes negatively charged. It is quite easy to charge a Braun electrostatic voltmeter to several thousand volts in this way.

There appears to be nothing mysterious in the phenomenon. The glass of the lamp is kept hot and

free from moisture by the heat supplied from within, and is therefore always in a suitable state for producing electricity by friction against metals or other substance. It is obvious that the corpuscles shot off from the glowing filament and sticking to the inside of the bulb can have little or no part in the production of such high potentials, for the very greatest speed they could acquire would be that corresponding to the voltage of the supply mains. A glass tube filled with hot mercury can, in fact, be used as successfully as the lamp.

This lamp method of producing electricity by friction is so easy to employ, and, moreover, so certain in action (the degree of electrification can be regulated to a nicety), that it is bound to be of interest to users of electroscopes. R. WHIDDINGTON.

Naid or Tubificid?

IN NATURE for November 16, 1911 (p. 78), I directed attention to the fact that a tiny annelid known as Rhyacodrilus had been found in England, and that it differed in some respects from the specimens recorded for Switzerland. Some difficulty was experienced by the Continental authorities in assigning it a place. Ditlevsen contended that it belonged rather to the Naididæ than to the Tubificidæ, but Michaelsen in his various publications refers it to the latter. In his "Süsswasserfauna Deutschlands" he specially distinguishes those annelids which reproduce by fission from those which form cocoons, and places the Naididæ in the former group, while the Tubificidæ are relegated to the latter. Then he places Rhyacodrilus (=Taupodrilus) among the Tubificidæ, because it is possessed of sexual organs.

Aided by a Government grant for the study of annelid bionomics and economics, I have just been able to make an interesting discovery. Rhyacodrilus is found in our midland streams, and in the summer is possessed of all the organs belonging to the Tubificids. In the winter and spring, however, it adopts the Naid method of reproduction, and forms a chain (Tierkette). It is therefore a link between the two families, and the question arises: To which does it most certainly belong? I favour the Naid association.

Swadlincote, May 16. HILDERIC FRIEND.

WORK OF THE EUGENICS RECORD OFFICE.

PROF. DAVENPORT and his staff of collaborators and "field" workers have shown great activity in the collection of family histories. The two first of a series of quarto memoirs, beautifully printed at the expense of Mr. Rockefeller, and published by the Eugenics Record Office, contain elaborate accounts of the members of two particular stocks whose claim to fame resembles and rivals that of the Jukes. The "Hill Folk," whose relationships with one another and with their common ancestry were investigated by Miss Danielson, comprise more than 700 persons all descended from two particular individuals who settled near a New England town in about the year 1800. Elaborate calculations as to their cost to the town and State for aid as paupers and for maintenance in prisons and institutions reveal the fact that these charges are constantly and rapidly increasing. Feeble-mindedness, alcoholism and the evils which spring from each or both in combination are terribly prevalent among them, and their distribution within the families is clearly shown in the extensive pedigree charts which embellish the memoir.

Although Prof. Davenport does not claim that the material here collected is of a kind suitable for the study of inheritance, it is of interest to note that from it he propounds a theory on the transmission of feeble-mindedness of a kind very different from that suggested by himself and Dr. Weeks in their paper "A First Study in Inheritance of Epilepsy" (Eugenics Record Office, Bulletin No. 4, 1911).

According to his earlier view, feeble-mindedness and epilepsy are both due to the absence of a gametic factor the presence of which is necessary for normal development. They are thus transmitted as a simple recessive character which might appear in either or both of these forms.

The material collected in the memoir under review, when analysed, gives results quite incompatible with this theory, and another and more complex one is consequently suggested. In the latter, which is propounded not as a dogma, but as a tentative hypothesis, different types of feeble-mindedness are taken into consideration, and it is supposed that each depends on the absence of a separate factor. Thus when two feeble-minded persons whose defect is of the same type are mated together, all their children will reproduce it, but where the type of mental defect of one parent is different from that of the other, none of their children need necessarily be feeble-minded at all.

The second memoir deals with a family to which the fictitious name of Nam has been attributed. The origin of the Nams is described as follows:—"In 1760 there lived in the mountains of Western Massachusetts a set of people called Nam, descended from the union of a roving Dutchman, who had wandered there from the Hudson Valley, and an Indian princess. These people were wealthy in land, having inherited it from their Indian ancestors." The family in more recent times is said to be characterised by alcoholism and lack of ambition. As in the case of the Hill Folk, Dr. Davenport has prepared a bill of what they have cost the State. We do not, however, agree with his system of accounting, in which everything is entered on the debit side and nothing on the credit. Even the most valuable of citizens would show up badly in this system. Thus the largest item of the Nams' account, forming two-thirds of the total, is their drink bill of rather more than a million dollars, distributed among 700 of them. If we were to take 700 prosperous professional men in England it would not be an overestimate to suppose that each would have a drink bill of something like 5000 dollars in fifty years, or, combined, their total bill for drink would be more than double the total bill of the Nams for all items. Thus, if nothing is reckoned on the credit side, we could come to the surprising conclusion that the Nams were the less unprofitable of the two.

The other publications of the Eugenics Record Office are their octavo bulletins. Of these, eight have appeared, three dealing with the inheritance of insanity. Special attention may be directed to that of Dr. Cotton, the medical director of the New Jersey State Hospital for the Insane (Bulletin No. 8, 1912). E. H. J. S.

LORD AVEBURY, F.R.S.

LORD AVEBURY, whose death on May 28 we recorded last week with regret, was a many-sided man, one of those gifted men who, without making any very profound advance in science, yet succeeded in making science acceptable and even welcome to the ordinary man. He was a banker by profession, and an antiquary, a politician, a man of science and of letters by inclination. He was born in London on April 30, 1834, the eldest son of Sir John William Lubbock, third baronet. His school was Eton, which, however, he left at a schoolboy age to enter his father's banking business. Throughout his life Lord Avebury, or, as he was for many years better known, Sir John Lubbock—he succeeded his father in 1865—showed a great capacity for steady, plodding work, not only in the City, but in politics, municipal administration, and in scientific and archæological research, and his activities were of the widest.

In 1870 Sir John Lubbock was returned for the borough of Maidstone, and he held this seat for ten years. In 1872 he became vice-chancellor of the University of London, and eight years later he was elected member for that university, and for the next twenty years he represented this seat of learning. He was active as a Parliamentarian, taking an especial interest in questions of education and social reform. He made a particularly good university representative, being a man of learning as well as of affairs. Amongst the many good causes he advocated, perhaps the establishment of bank holidays was the one most widely known and the one which will preserve his name the longest. In 1900 he was raised to the peerage as the first Lord Avebury, and it is characteristic of him that he chose a title intimately connected with archæology.

For many years Lord Avebury was a neighbour of Charles Darwin at Down, Kent, and it may have been their friendship that led to his interest in "Ants, Bees, and Wasps"; "The Senses, Instincts, and Intelligence of Animals"; "The Collembola and Thysanura"; "Flowers, Fruits, and Leaves," and in "The Origin and Metamorphoses of Insects," as five of his most illuminating books are entitled. He and his helpers added materially to our knowledge of the habits and instincts of social and other insects, and to our acquaintance with the activity of many forms of vegetable growth. His work, indeed, did much to pave the way for the great interest now taken in insects, especially at present in relation to the conveyance of disease.

But Lord Avebury by no means confined his attention to biological studies. He was an expert on banking; he was the first president of the Institute of Bankers, president of the London Chamber of Commerce, and for twenty-five years he was secretary of the London Bankers Association and president of the Central Association of Bankers. For five years he was president of the London Chamber of Commerce, and he published important treatises on coins and currency, and on municipal and national trading. His was a very steadying influence on the commercial world. Without having the dominant influence of a Pierpont Morgan, or the great American banker's power of handling a financial crisis, he had an infinite capacity for mastering detail, and a great gift for bearing in mind many things of importance which are apt to be overlooked in the ordinary course of business.

Lord Avebury took much interest in municipal government, and was vice-chairman of the London County Council in 1889 and 1890, and chairman from 1890 to 1892. Nor must it be forgotten that he was principal of the London Working Men's College, and did most admirable work in connection with that institution. His "Hundred Best Books" was the result of a lecture delivered at the college.

Few men have attained eminence in so many subjects, an eminence which would satisfy many a specialist. Part of this eminence was due to a gift of style. An American contemporary once described him as an "elegant British writer on bugs." Even his most strictly scientific monographs were written in an engaging manner, and none more so than his "Origin of Civilisation and the Primitive Condition of Man," which is now in its sixth edition. Perhaps of his scientific works "The Scenery of England" and "The Scenery of Switzerland" are the most enduring. The former is still recommended by the teachers in many a university as a most admirable introduction to the study of geology. He seemed to have an instinct for knowing "what the public wants," and his more popular literary works appealed widely to "the man in the street." "The Pleasures of Life," "The Use of Life," "The Beauties of Nature," sold by the hundreds of thousands—in fact, a quarter of a million of "The Pleasures of Life" have already been disposed of, apart from more than forty foreign editions. These books, though they partake of the nature of reprinted commonplace books, certainly hit the popular taste, and were in their influence wholly healthy and helpful.

In our restricted columns it would be impossible to enumerate the numerous associations over which Lord Avebury presided. He was, indeed, to paraphrase an Elizabethan phrase, "President General to the Age." He was president of the British Association in its jubilee year, and president of the Entomological, Ethnological, Linnean, Statistical, African, and Ray Societies; president of the Anthropological Institute, of the International Institute of Sociology, and of the International Association for Prehistoric Archæology; of the International Association of Zoology, and of the

International Library Association. Here, again, our space forbids us to catalogue his almost inexhaustible list of honours, but we must mention that he was a Commander of the Legion of Honour, and he held the Order Pour le Mérite. He was elected a Fellow of the Royal Society in 1858.

Lord Avebury married firstly Ellen, only child of the Rev. Peter Hordern, and secondly Alice Augusta Laurentia, daughter of the late General A. A. L. Fox-Pitt-Rivers, a granddaughter of the second Baron Stanley of Alderley. He is succeeded by his eldest son, the Hon. J. B. Lubbock, who is a partner in the banking firm of Robarts, Lubbock and Co.

PROF. J. T. NICOLSON.

THE early death of Dr. J. T. Nicolson, professor of mechanical engineering in the Manchester School of Technology and in the University of Manchester, will be much regretted by a wide circle of friends. His health during the past six months had given serious cause for anxiety, but had improved sufficiently to allow him to return to his duties. There followed a sudden relapse, and he died at Macclesfield on May 27 after a brief illness.

Prof. Nicolson was born at Amble, in Northumberland, in 1860, and received his early education at Watson's College, Edinburgh. He was then apprenticed to Hawthorne Leslie and Co., Newcastle-on-Tyne. From there he gained a Whitworth scholarship and entered Edinburgh University, where he graduated in 1889, obtaining the D.Sc. degree some years later. After graduation he spent two years in Charlottenburg, where he investigated the strength of materials under Prof. Martens. After holding the position of assistant-lecturer in engineering in the University of Cambridge, he was appointed in 1892 professor of mechanical engineering in McGill University, Montreal. He took an active part in the equipment of the engineering department and in arranging the courses of instruction for students. During his stay in Montreal he undertook an investigation with Prof. Callendar on the valve-leakage of steam on the surface of cylinders. This important investigation led to the award of the Telford premium to the authors. Prof. Nicolson resigned his professorship in Montreal in 1899 in order to take charge of the engineering department of the School of Technology, Manchester, and was largely responsible for the whole engineering equipment of that institution—an equipment which in variety and extent is even now unsurpassed in this country. When degree courses were instituted in the School of Technology in connection with the University of Manchester he was appointed the first professor of mechanical engineering, a position which he held until his death.

Prof. Nicolson's tenure of the chair at Manchester was marked by several important and extensive investigations. He made detailed experiments on rapid-cutting steels, in which he showed the relations between the cut and speed and the durability. The results of these investigations were published as a report by the Manchester Association of Engineers in 1903, and were well received by the engineering profession. As was characteristic of Prof. Nicolson, he immediately applied the experimental results to the improvement of the design of machine tools.

During the last few years of his life he took up the question of the transfer of heat to boilers. The late Prof. Osborne Reynolds had predicted in 1874 on theoretical grounds that the rate of transfer of heat from a gas or fluid to a solid surface should increase with the velocity of movement. This was confirmed for fluids by the experiments of Dr. Stanton in 1897. Prof. Nicolson, in an elaborate series of experiments, showed that the same result held for gases. He then applied this idea to the design of boilers and condensers, the essential point being that the heated gases were driven at a high speed through the tubes of the boiler, the water circulating in the opposite direction. As a result of an extended trial of a 60-h.p. boiler over sixty days, it was found that the efficiency of such a combination was considerably greater than that of the ordinary boiler. There has been much difference of opinion among engineers as to the practicability of this idea, but Prof. Nicolson himself had the strongest belief in the greater overall efficiency to be obtained by his methods.

The training of Prof. Nicolson fitted him admirably to fill the position of a professor of engineering, for he had not only a wide scientific outlook, but took a keen interest in the practical side of his profession. This is shown by the promptness with which he applied the results of his scientific investigations to the improvement of engineering practice. He was a man with strong opinions on engineering questions, and vigorously supported his position when attacked. His personal integrity, straightforward character, and sympathy with their scientific difficulties endeared him to his colleagues, while his vigorous personality and ability as a teacher made a strong and lasting impression on all his students. Owing to his increasing deafness he was unable in recent years to take that active part in administrative matters for which his wide outlook well fitted him. His premature death is a great loss to science, and will be much regretted by his colleagues both in Manchester and Montreal.

NOTES.

THE home list of honours conferred on the occasion of H.M. the King's birthday on June 3 includes three new Privy Councillors, seven new baronets, and twenty-six knights. The only fellow of the Royal Society in the list is Prof. E. A. Schäfer, professor of physiology in the University of Edinburgh, who has received the honour of knighthood. The same honour has been conferred upon Prof. J. H. Biles, professor of naval architecture in the University of Glasgow. Prof. T. H. Middleton, formerly professor

of agriculture in the University of Cambridge, and now assistant secretary, Board of Agriculture and Fisheries, has been appointed a Companion of the Order of the Bath (C.B.). The appointments to the Order of the Indian Empire (C.I.E.) include Major G. K. Walker, professor of sanitary science, Punjab Veterinary College; Mr. L. Mercer, president of the Forest Research Institute and College, Dehra Dun; and Mr. J. H. Lace, Chief Conservator of Forests, Burma.

IN opening, on Tuesday, June 3, the new buildings of the medical school at Guy's Hospital, Mr. A. J. Balfour delivered an address in which he pleaded for the endowment of research. In the course of his remarks he said:—Some people unacquainted with the movement of modern science may ask why it is that in 1913 apparatus, buildings, and expenditure of all kinds are required infinitely in excess of what was necessary even fifty years ago. The necessity arises not merely through the growth of the great urban population, but through the inherent progress of science itself. Fifty years ago some branches of science, such as physics, biology, and even some modern parts of chemistry, although studied by those who intended to devote their lives to medicine, had nevertheless an incomparably smaller connection with medicine than exists at the present time. As the connection of other collateral sciences with the science and practice of medicine has become closer, so the apparatus required has greatly increased in cost, so the amount of knowledge required from the teachers and the specialisation of the teachers have grown, until we may sometimes wonder how it is possible for any physician in a great practice even to keep himself abreast of what is being done in his own country and by researchers in all the other countries who are now engaged in happy rivalry for the furtherance of knowledge.

BESIDES the man of practical intuition and besides the man who can teach, Mr. Balfour added in the address referred to above, we want, if a medical school is to be all that it might be, a man who can investigate, a man who possesses that kind of originality which enables him to point out in what direction the next advance should be made, where progress may be expected, where nature may, under existing conditions, be most easily compelled to yield up her secrets. This man is the researcher. Genius is rare in any country and in any profession. All that organisation can do is to give to those rarely endowed individuals some opportunity by which they can exercise effectively for the common advantage the gifts which God has given them. If a man is going to devote to research hours which might profitably be given to the general practice of his profession, he must have a position of security in which he can feel that he is not sacrificing the interest of those nearest and dearest to him in the pursuit and advancement of new knowledge. The public must assist the great hospitals by a form of endowment which will enable them when they obtain a man with a genius for research to keep him and to use him. There are men who have quite a unique talent for research, who probably would not be very great clinical physicians. Places must be found for such men. This is absolutely necessary if there is to be a true organisation of medical research. The actual sufferings of the moment touch all hearts, but my appeal now is for the future, in favour of having academic lines of research of which the public knows nothing and yet on which depends the real future of the healing art.

THE bicentenary of the Imperial Botanic Garden at St. Petersburg, which was founded in 1713 by Peter the Great, will be celebrated this month.

LORD GLENCONNER has presented 1000*l.* to the Edinburgh Royal Infirmary for the purchase of radium to be used in the work of the institution.

THE twenty-fourth conference of the Museums Association is to be held in Hull from July 14 to 18, when Mr. E. Howarth will occupy the chair.

PROF. C. S. SHERRINGTON, F.R.S., has been appointed an additional member of the Departmental Committee on the lighting of factories and workshops.

NEWS has reached us from Mexico of the death, on April 23, at forty-seven years of age, of Prof. L. G. León, general secretary of the Mexico Astronomical Society. His death is deeply regretted by the members of the society, who appreciate highly his activity and work for astronomical science.

ON June 11 the Right Hon. the Lord Mayor of London will officially open the Anglo-German Exhibition at the Crystal Palace. The exhibition includes a section on industry, with subsections relating to chemistry, surgical and optical instruments, electricity, and agriculture and forestry, among others.

AN excursion to Minehead and district, West Somerset, has been arranged by the Geologists' Association for June 20–24. The directors are Mr. L. Richardson and the president, Dr. J. W. Evans. On the Saturday, June 21, there will be an opportunity to study the classic sections of Upper Keuper, Rhætic, and Lower Lias in the neighbourhood of Watchet.

ANNOUNCEMENT is made that Mr. Arthur James has decided, as a memorial to his late brother, Mr. William James, to give the income of a sum of 20,000*l.* for cancer research to the Middlesex Hospital, as being the institution where clinical and pathological researches on the disease are most closely combined.

PROF. A. G. RUTHVEN, curator of the museum of the University of Michigan, is in charge of an expedition that will sail from New York on June 15 for Colombia, South America. The expedition will make its headquarters near Santa Marta, and will study the fauna from the sea-level to the mountain summits. The party will also include Prof. A. S. Pearse, of Wisconsin, and Mr. F. Gaige.

THE autumn meeting of the Iron and Steel Institute will be held in Brussels, from Monday to Thursday, September 1–4. The opening meeting will be held in the hall of the Palais des Académies on Monday, September 1, when a selection of papers will be read and discussed. In the evening a reception will be held by the burgomaster at the Hotel de Ville. It is hoped

that his Majesty King Albert will receive the members at the Royal Palace, Brussels, on September 2.

THREE Chadwick public lectures, on nature and nurture in mental development, will be given by Dr. F. W. Mott, F.R.S., at the Royal Society of Arts, on Fridays, June 6, 13, and 20. Admission to the lectures is free. Information concerning future Chadwick lectures may be obtained of the secretary, Mrs. Aubrey Richardson, at the offices of the Trust, 8 Dartmouth Street, Westminster.

IN February last the Italian Colonial Office appointed a commission to undertake the scientific study of the country of Tripoli. Prof. F. Eredia, of Rome, informs us that the commission has now travelled through the area, and has collected valuable geological, agricultural, botanical, and meteorological data. Meteorological stations have been established by Prof. Eredia in appropriate situations. Temperature and rainfall observations are to be sent from these stations to the Ufficio Centrale di Meteorologia in Rome, and will be published monthly, with the observations received regularly already from the Tripoli Meteorological Observatory.

WE are asked to state that the British Fire Prevention Committee, having established a technical library that will be known as the International Fire Library, with a nucleus of more than 2000 books dealing specifically with matters of fire prevention, fire service, and fire loss, is now desirous of directing the attention of authors, public authorities, publishers, and collectors to the fact that a new catalogue is in preparation, and that any books, pamphlets, or reports which they are able to spare for this collection should be addressed as soon as possible to the honorary chief librarian, The International Fire Library, 8 Waterloo Place, Pall Mall, S.W.

THE death is announced of Prof. Ernst Kittl, director of the geological and palæontological section of the Imperial Museum of Natural History, Vienna. Born in 1854, Prof. Kittl became custos of the Vienna Museum in 1893, and subsequently succeeded Prof. T. Fuchs as head of his department. He was the author of numerous papers and memoirs on fossils, chiefly Mollusca, and he prepared a valuable guide-book to the geology of the Salzkammergut for the meeting of the International Geological Congress at Vienna in 1903. For many years he was an active member of the Austrian Tourist Club, and from 1889 to 1898 he edited the publications of its natural history section.

THE death is announced of Dr. Léon Pervinquière, lecturer on palæontology in the University of Paris. After a brilliant career as student in the University, he spent three years in investigating the geology of central Tunis, and on his return published an exhaustive volume on the region, with the best geological map of Tunis which has hitherto been prepared. At the same time he made a great collection of Tunisian fossils, which he afterwards studied in Paris, and the results of his researches were published in two handsome volumes on the Jurassic and Cretaceous Mollusca. Two years ago Pervinquière accompanied a boundary commission to examine the geology of the frontier between Tunis and Tripoli, and made valuable contributions to our knowledge of the extreme southern part of these countries. His untimely death at the age of forty is a serious loss to geological science.

THE death is reported, in his fifty-sixth year, of Prof. W. Hallock, for the last eleven years professor of physics at Columbia University, New York. He graduated at that University in 1879, and then studied at Würzburg, where he was for a short time an assistant in the physical laboratory. Returning to America in 1882, he was successively a physicist on the U.S. Geological Survey, professor of physics at the Corcoran Scientific School, Washington, professor of chemistry at the National College of Pharmacy, and assistant in charge of the Astrophysical Observatory of the Smithsonian Institution. For ten years before his appointment to the full professorship he was associate professor of physics at Columbia. While on the staff of the Geological Survey he conducted the investigation of the subterranean temperatures in the dry well at Wheeling, where the drill went down to 4500 ft. below the surface of the earth. For three years Prof. Hallock was at work in the Yellowstone Cañon, investigating the phenomena of the hot springs and geysers there. Among other subjects that attracted his attention were the effects of pressure on powdered materials, and the thermal expansion of rocks.

AN account has reached this country of the experiences of Mr. Frank Wild and his companions in the Antarctic. Mr. Wild led the second party of Dr. Mawson's Australasian Expedition. This party was dispatched by the leader to Sabrina Land or Knox Land; the existence of the former was disproved, while the latter was found to be unapproachable. The party, however, "landed" on a glacier in motion, and established a depôt on the land behind it. Thence the party divided, carrying out surveys east and west; the eastern section carried its work as far as 101° E., and explored inland for fifty miles, to an altitude of 4500 ft., while the western section worked along the coast to effect a junction with the surveys of the German expedition of 1902. Its route also lay at high altitudes. The discovery of the largest known rookery of emperor penguins is recorded. Severe weather conditions were encountered, and it is stated that the same blizzard which proved fatal to Scott held Wild's party prisoners for nine days. The new land was taken possession of in the name of Queen Mary's Land; it is a continuation of the King Edward VII. plateau, and has an upward slope towards the pole, and a coast-line of 350 miles.

A VERY interesting circular has just been issued by the Department of Mines of Canada, directing attention to the fact that an experimental laboratory for the concentration and treatment of Canadian minerals has been installed by the Department at Ottawa. The laboratory includes both small-scale laboratory apparatus and plant of working size, though, of course, not unduly large, for the practical treatment of bulk samples. The plant is to be operated free of all charges upon Canadian ores, the minimum

amount for a laboratory test being 200 lb. of mineral, and for a working test not less than 5 tons. It is true that something of the same kind has been done previously in Australasia, but never upon the same liberal scale, and the intelligent enterprise of the Canadian Government in thus facilitating the development of mining and metallurgical industries in the Dominion cannot be too highly appreciated. It is sincerely to be hoped that the example may be followed elsewhere.

THE summer meeting of the Institution of Naval Architects is to be held in Glasgow on June 23–27. The premises of the Institution of Engineers and Shipbuilders in Scotland have been placed at the disposal of the visitors to Glasgow. Among the papers included in the programme of proceedings may be mentioned:—Dr. S. J. P. Thearle, note on some cases of fatigue in the steel material of steamers; Messrs. G. S. Baker and J. L. Kent, effect of form and size on the resistance of ships; Prof. A. H. Gibson and J. Hannay Thompson, experiments on "suction" or interaction between passing vessels; Mr. A. Cannon, experimental determination of the effect of internal loose water upon the rolling of a ship amongst a regular series of waves; Mr. Lloyd Woollard, effect of water chambers on the rolling of ships; Prof. L. Gümbel, on the criterion for the occurrence of cavitation. The programme also includes a variety of functions, visits to works, and excursions, in addition to the more serious business of the meeting.

MR. A. RADCLYFFE DUGMORE, the pioneer photographer of big game in their native haunts, and the author of "Camera Adventures in the African Wilds" and other works on kindred subjects, delivered, at the Æolian Hall on May 30, the first of two lectures entitled "Stalking Big Game with a Camera." This lecture dealt solely with his experiences in British East Africa, where he succeeded in getting some splendid flashlight photographs of lions creeping up to a "kill" at night, and of hartebeests drinking at a water-hole. He was very fortunate also in securing pictures of rhinoceroses, giraffes, zebras, gazelles, and buffaloes in the open, two of them, showing a large black rhinoceros in the act of charging the photographer, being particularly impressive. So close was the beast at the final click of the shutter that he had to be turned with a rifle bullet; but to Mr. Dugmore's credit be it said that he claims never to have used firearms unless his own life was in danger or unless meat was required for feeding the members of the expedition. Many of the photographs show beautiful spots in the scenery of East Africa, one with a group of Grant's gazelles in the foreground and the snow-clad summit of Kilimanjaro breaking through the clouds in the distance being especially charming. Mr. Dugmore is a clever and practised lecturer, and those who are interested in living animals could not spend a pleasanter hour and a half than by visiting the Æolian Hall this evening, June 5, when the second of the two lectures will be given.

MR. R. E. DENNETT, Deputy Conservator of Forests, Nigeria, a well-known authority on the negroes of West Africa, has reprinted from the Journal of the African Society a paper entitled "A Common Basis of Religion." In our existing knowledge of Bantu culture, derived from writers like Miss Mary Kingsley and Sir A. Ellis, it is startling to find the negro credited with a system of philosophy, including no fewer than 201 parts, each representing an Orisha, or departed spirit. It is said to be based on on elaborate scheme of symbolism, and the order of these symbols represents "to the psychologist what the periodic classification is to the chemist, or perhaps another form of Newland's law of octaves." The exposition, as it stands, is most ingenious, and the writer concludes by stating that by "superimposing the kinetic parts upon the potential in the moral and intellectual categories we note that the soul becomes the home of faith, the mind of idealism, the body of the senses, the will of life." At the same time, it must be remembered that the interpretation largely rests on the verbal analysis of native terms, and it may possibly be held that while our knowledge of Bantu philology scarcely warrants the conclusions, Mr. Dennett may have read between the lines of his authorities more than they may be reasonably admitted to bear.

A RECENT number of the Annals of Tropical Medicine and Parasitology (vol. vii., No. 1) contains a detailed study, by Major Christophers, I.M.S., upon the colour-markings and other variable characters of Anophelinæ, with special reference to the systematic and phylogenetic grouping of the species. The publication of this memoir in a medical journal may cause it to be overlooked by naturalists, to whom it should be of special interest. The author concludes that colour-markings can be utilised, equally with structural characters, in a natural classification of the anophelines and for placing species in groups to which they have affinities. A classification based on colour-marking approximates very closely to one based on scale-structure, but shows the affinities and relation between the groups much more clearly. The tendency of the phylogenetic evolution of the group is towards elaboration of ornament and development of scales; the more scaly an anopheline, the more advanced phylogenetically it would appear to be. Three main subdivisions are recognised; the Protoanopheles, occuring both in the Old and New Worlds; the Deuteranopheles, chiefly African, South Asian, and Malayan; and the Neoanopheles, a peculiar Australasian type.

THE report of the Philadelphia Zoological Society for 1912–13 records a large increase in receipts over the previous year, this increase being distributed over every month of the year.

THE *Naturwissenschaftliche Wochenschrift* of May 11 (No. 19, Bd. xii.) contains an excellent summary, with bibliography, by Dr. Oberstein, of the fungoid diseases of animals and the bacterial diseases of plants.

WE have to acknowledge the receipt of a copy of the third part of vol. i. of the *Sarawak Museum Journal*, the contents of which include an article by Mr. C. Aurivillius on Bornean longicorn beetles, and a second, by Mr. C. J. Gahan, on those remarkable Indo-Malay coleopterous larvæ commonly termed

"trilobites," the adult condition of which is still unknown. Mr. Gahan suggests that the larval stage may be permanently retained in the females.

EXTINCT North American horses, all referable to the modern genus, form the subject of a paper by Mr. O. P. Hay, published as No. 1969 (vol. xliv., pp. 569–594) of the Proceedings of the U.S. National Museum. Four species are described as new, two of these being based on teeth alone, while each of the other two is represented by the skull. No. 1975 (vol. xliv., pp. 649–654) of the same serial is devoted to the description of a remarkably fine skeleton of a zeuglodont lately set up in the museum. For these primitive whales Mr. J. W. Gidley, the author of the article, revives the extremely inappropriate name Basilosaurus, despite the fact that it was replaced by its sponsor, Sir R. Owen, by Zeuglodon when the mammalian nature of the remains became evident.

WE have received reprints of two papers by Mr. W. E. Collinge on the relation of wild birds to forestry and on the destruction and dispersal of weed seeds by wild birds. In the former it is pointed out that but few wild birds are directly hurtful to forests in this country, the majority of species found in or near forests being distinctly beneficial owing to their destruction of insects and small mammals. Attention is directed to the importance of providing nesting-boxes in forests for the insectivorous birds. Merely to protect these birds is not sufficient; their multiplication must also be looked after. In the second paper many interesting details are given as to the frequency with which birds completely destroy even hard fruits and seeds, but there are so many cases in which the seeds pass through the bird's alimentary canal without being injured that the author cannot regard the seed-eating birds as a class as being beneficial—on the whole, they appear to act as distributors of weed seeds to a much larger extent than is generally supposed.

AT the commencement of a very interesting article on our present knowledge of the earliest quadrupedal vertebrates (Tetrapoda), Prof. F. Broili points out that the occurrence of remains of land plants in the Lower Silurian of North America and the Upper Silurian of Kellerwald and the Hartz, coupled with their occasional presence in the Lower Devonian, may be taken as strong presumptive evidence of the existence of a contemporary vertebrate land-fauna. The first actual evidence of such an early fauna does not occur, however, until the Upper Devonian, and then only in the shape of the remarkable footprint from Warren County, Pennsylvania, to which O. C. Marsh gave the name Thinopus. Very noteworthy is the fact that this print represents a relatively large animal, vastly superior in point of size to the tiny salamanders of the succeeding Lower Carboniferous epoch, although equalled in this respect by Eosaurus of the Upper Carboniferous of Nova Scotia. Its evidence appears, however, quite indisputable, and we must therefore assume the Tetrapoda to have attained a relatively high degree of development in the Devonian, and thus to have been well represented in the Silurian. This being so, the Carboniferous and Permo-Triassic forms, interesting and in many respects generalised as they are, cannot be regarded as the earliest types, and, consequently, any attempts to formulate the phylogeny of the group must be to a great extent premature. The author has much to say regarding the structure and affinities of labyrinthodonts and anomodonts, but space permits only of the remark that he regards most of these, not even excluding dicynodonts, as amphibious.

WE have received three numbers of the *Bollettino* of the Italian Seismological Society, forming a volume of more than 300 pages, and containing notices of the earthquakes recorded in Italy during the first half of the year 1909. The total number of entries is 726, all but seventy of which refer to shocks that originated within the area of Italy. This number, which is much greater than usual, is partly due to the frequency of the after-shocks of the Messina earthquake of December 28, 1908. Dr. Martinelli, the editor of the volume, connects 152 shocks with this great earthquake, but many shocks recorded at Messina and other isolated places, if more fully known, might have to be placed in the same category.

THE Commonwealth Meteorologist has recently issued sheet maps showing the mean temperature and mean rainfall of Australia for the separate months and for the year. These maps confirm in the main those published in the "Atlas of Meteorology," so far as regards the south-eastern portion of the larger island; they extend the information over the remainder of the continent, and thus include Tasmania. The earlier maps, based on the *Challenger* results, show temperatures for six alternate months only. The most striking points of difference occur in the annual maps. The annual isotherms in the atlas map sweep southwards between the coasts; the new maps show roughly a sweep to the north. The annual isohyets on the new maps show much greater detail for the north and east coasts, and indicate that parts of the north coast receive more than 60 in. and Geraldton district on the Queensland coast more than 140 in. annually. The new monthly rainfall maps indicate clearly the winter rains in the south and the summer rains in the north.

ACCORDING to the *résumé* of the communications made to the French Physical Society at the meeting on April 18, a large proportion of the evening was devoted to a discussion of the results of recent determinations of the radiation constants, σ of Stefan's law and c of Wien's and Planck's laws. One of the most recent and most accurate determinations of c is that of Warburg, Leithäuser, Hupka, and Müller, made at the Reichsanstalt, and reported in the April number of the *Annalen der Physik*. According to this determination c has the value 1·437 centimetre-degrees, a number which differs little from the mean of the more modern of the previous determinations. The determinations of σ differ much more seriously from each other. The oldest values lie between 5·0 and 5·5, while almost all the newer values are above 5·5, those of Valentiner and Westphal being 5·58 and 5·54 respectively, while M. Féry has in three sets of experiments obtained values above

6·0. M. Bauer attributes these high values to erroneous determinations of the corrections to be applied to the observations for the reflecting power of lamp black. He gives as the most probable value of σ deduced from his own and other observations $(5{\cdot}60 \pm 0{\cdot}04) \times 10^{-12}$ watt/(degree)^4.

AN interesting account of the survey of the Alaskan boundary, by Mr. J. A. Flemer, appears in *The Engineering Magazine* for May. The northern section of this line follows the 141st meridian. The initial point, determined by telegraphic longitude, is at the crossing of this meridian and the Yukon River. The azimuth of the meridian at this station was determined astronomically, and the line itself is being projected both north and south by two observers, one an American and the other a Canadian. The international projection party is being followed by a triangulation party. The topographical work is being executed by the plane-table method, since the climatic conditions in this part of Alaska have not that extreme character inherent to south-east Alaska, where the photo-topographic surveying method had to be employed. The triangulation party which precedes the topographic party furnishes the latter with the needed geodetic control, based on the field computations. The plane-table sheets are on 1 : 45,000 scale, with a horizontal contour interval of 100 ft., and the topographic details are mapped with the 141st meridian as the median line of a strip four miles wide. The boundary is being marked with aluminium-bronze monuments, the monument-setting party cutting a vista through wooded areas 10 ft. on each side of the meridian.

THE Academy of Natural Sciences of Philadelphia commemorated its centenary in March, 1912, by a number of conferences, of which an account was published in the issue of NATURE for April 11, 1912 (vol. lxxxix., p. 143). On that occasion the academy decided to publish several volumes in commemoration of the centenary, and one of these —an index to the entire series of its Journal and Proceedings, from the first volume issued in 1817 to the close of 1910—recently made its appearance. The index forms a volume of 1433 pages, and consists of a catalogue of the contributions under the names of authors, and a reference to all species, genera, families, &c., described or mentioned in the several volumes, arranged alphabetically. The expense incurred in the preparation and publication of the work has compelled the publication committee to make a charge for it. The price, 3.50 dollars, carriage paid, is less than the cost of production. Copies may be obtained from the editor, Dr. E. J. Nolan, Academy of Natural Sciences, Logan Square, Philadelphia, Pa., U.S.A.

A CLASSIFIED catalogue of second-hand books, journals, and monographs on zoology and other branches of natural science, including works from the library of the late Mr. Robert Shelford, sometime curator of the museum, Sarawak, and afterwards assistant in the Hope Museum of Zoology, Oxford, has been issued by Messrs. Bowes and Bowes, Cambridge, who have the works on sale. Mr. F. Edwards, Marylebone, London, W., has just issued a catalogue of books on ornithology and oology, including copies of the works of John Gould, H. E. Dresser, Lord Lilford, Henry Seebohm, &c.; also a series of native original drawings, in colours, of birds of India and Malaysia.

WE have received the first number of a new periodical, *La Science et la Vie* (April, 1913), the object of which is to popularise science. The principal contributions are:—Time measurements and signals, by M. G. Bigourdan; the construction and life of a big gun, by Lieut.-Col. Picard; the little agents of death (dealing with insect carriers of disease), by M. J. Paul Dupuy; and "Can the onset of old age be retarded?" by Dr. Toulouse. The periodical is profusely illustrated, and is issued at the price of one franc the number. The list of collaborators includes the names of many well-known men of science.

OUR ASTRONOMICAL COLUMN.

PERIODIC SPECTRUM OF 12 CANES VENATICI.—A Kiel telegram, dated May 30, states that Belopolsky has found that the star 12 Canes Venatici exhibits a spectrum that is periodic. Lines appeared on the following dates, April 22, 27·8, May 4, 9, and 22·5, but on seventeen days they have been invisible.

POSITION OF THE AXIS OF MARS.—Prof. Percival Lowell publishes, in the Bulletin No. 56 of the Lowell Observatory, his observations and those of Mr. Slipher of the position of the polar cap of Mars for the determination of the axis of this planet. The observations were made towards the end of the year 1911, but they include others made by Mr. Slipher in 1909. The values of the position of the axis are given in the case of each observer for every alternate year from 1901 to 1909. As regards the results and their accuracy, it is stated at the end of the paper that the mean of all Prof. Lowell's measures for the last fourteen years gives for the tilt of the Martian equator to the Martian ecliptic the value 23·5°, while that obtained by Mr. Slipher for 1909 and 1911 gives precisely the same value. In this publication Prof. Lowell refers to Prof. H. Struve's communication to the Berlin Academy, in which it is stated that the motion of the satellites affords a better determination of the Martian axis than direct measurement of the polar caps. This view is not acceptable to Prof. Lowell, who says, "it seems advisable to here correct a few misapprehensions," and these are contained in the present bulletin.

THE SOLAR ECLIPSE OF APRIL 16–17, 1912.—A communication by M. Simonin to the *Comptes rendus* for April 28 contains the results of the discussion of observations made during the eclipse of the sun on April 16–17 of last year. It will be remembered that the central line extended from Portugal to Russia, and along that line, scattered at various points, a great number of observers noted the times of interior and exterior contacts. In fact, a large amount of material was available for discussion, and this has now been completed. The conclusions may be summed up as follows:—

The right ascension and declination of the moon's centre, published for April 17, 1912, by the *Connaissance des Temps*, and corrected after Newcomb, ought to be increased respectively by 0·63s. and 4·3″. The calculated values of the semi-diameters of the sun and moon at the earth's mean distance give the figures 15′ 59·96″ and 15′ 32·16″. The sun's semi-diameter

thus obtained exceeds by 0·33″ the value generally adopted for eclipses, while the moon's semi-diameter is a very little less than the mean of the two values adopted in the calculations of the *Connaissance des Temps*. The discussion also shows that the first exterior contact was in the mean observed six seconds too late, and the last three seconds too early, while the observations of the interior contacts were not affected by any such systematic error.

Details of the calculations will be published later in a memoir.

THE SPECTRUM OF NOVA GEMINORUM NO. 2.—The spectrum of Nova Geminorum No. 2 is the subject of a long communication by Prof. F. Küstner in *Astronomische Nachrichten*, No. 4654. Some time ago Dr. Giebeler, his assistant, published the results of a series of measures he made (*Astronomische Nachrichten*, No. 4582) of the fine sharp absorption lines in the nova spectrum, concluding that they gave an indication of the presence of radio-active elements. This paper contains an investigation by Prof. Küstner of the same and other negatives taken at Bonn of the nova, and the measures he secured and those of Dr. Giebeler are given together. The subject is discussed in considerable detail, and we can only here direct attention to the conclusions to which he has arrived with regard to the origins of 241 lines which are contained in his list. Thus he concludes that there is good evidence for the presence of uranium, titanium, and blue argon—that radium, manganese, and zirconium may be present, but that there is no evidence of the emanation, iron or vanadium. As regards calcium, helium, and magnesium he finds that certainly absorption lines observed corresponded to calcium H and K, probably also *g*, fairly certain He 4471·66, and questionable Mg 4481·34. It may be added that the wave-lengths of the enhanced lines of Lockyer were included in the investigation, and that little evidence was found for lines to be assigned to their origin; thus he rules out the presence of enhanced iron, titanium, and manganese. This paper should be read in connection with that recently published in the Monthly Notices of the R.A.S. by Prof. Newall and Mr. Stratton, who corroborate in the main the enhanced-line spectrum of the nova as first put forward by Sir Norman Lockyer in the case of Nova Persei.

SCIENCE, POLITICS, AND PROGRESS.

WE gave last week an account of the annual meeting of the British Science Guild and a summary of the report adopted at the meeting. We are glad to be able to supplement that article with abridged reports of the speech delivered by Lord Sydenham in proposing "that the best thanks of the British Science Guild be tendered to Viscount Haldane for his services as president since its foundation, and that Sir William Mather be elected to succeed him," and the reply made by Sir William Mather.

By the retirement of Lord Haldane, remarked Lord Sydenham, the guild was about to sustain a very severe loss, for in Lord Haldane they found a great leader and an inspiring power which had been of the utmost value in promoting the progress of the guild. It might be that there was a certain incompatibility between science and politics which the guild must strive in time to remove; or possibly science had not yet been brought to bear upon the delicate process of Cabinet making as it certainly should be. At least the spectacle of a Minister of the Crown who was a whole-hearted believer in the benefits of science and who could proclaim those benefits with knowledge and experience was a rare, if not a unique, phenomenon in this country. In Lord Haldane they had had an educationist who had long ago realised what technical education had done for other countries, and realised the deficiencies of the British Empire and had striven to remove them. And now the pleasant duty had been imposed upon him of proposing the election of his old friend Sir William Mather as their second president. The career of Sir William had been spent in the successful application of science to industry, and not only to processes and machines, but to men. It was in Sir William's great firm that the standard of forty-eight hours a week labour had long been adopted, and it was not an accident that for fifty years no strike had occurred in his business. As a member of Parliament, he was a persistent and consistent advocate of technical education. The guild has before it important national work. He (the speaker) felt confident that in Sir William they would have a most worthy successor to Lord Haldane.

Sir William Mather said he felt the deepest gratitude to the members of the guild for having so cordially elected him as their new president, but when he was first appealed to by Sir Norman Lockyer to take office he had some reluctance in assenting. He, however, had a great interest in the movement, for the British Science Guild claimed to teach the vital importance of using scientific methods in the common things of life. Those of them who were engaged in applying the fruits of scientific research and discovery furnished by the brilliant students of natural science realised the immeasurable debt the country owed to those who, in the long and patient work of laboratory experiment and the solitude of study, revealed the secrets of nature, and declared the scientific laws by which they might be adapted to the uses of man. The producers and manufacturers of the things that were used and consumed by the human race, and were necessary to its higher progress and happiness, had neither the time nor the requisite training to seek in the hidden treasure-house of nature for the sources of higher development. This was the work of the scientific explorer, and the guild embraced men who felt it to be a patriotic duty to encourage both the scientific explorer and the practical expert in the promotion of national prosperity and continual progress. They were beginning to realise in the twentieth century that there were latent forces in human beings as well as in nature that need to be exploited whereby their national welfare might be enhanced. The evils they deplored, the misery and suffering they saw among their fellow-creatures, were all preventable, and education in this matter became the most important thing in the world.

The British Science Guild had made education one of the chief objects of its study in relation to the training of children in their earliest years before the rational faculty became active, and this propaganda would be continued, for by this means only could the nation rise to higher achievements in removing the causes of poverty, misery, and disease, which affected the national progress, notwithstanding the wealth, power, and industrial prosperity which scientific discoveries had yielded to those who had been able to use them. It was not incompatible with individual ambition in the acquisition of wealth and power that the chief aim of the nation should be to encourage and support other means of adding to the contentment and welfare of the whole people. One of the most retrogressive conditions of present-day life in England was the recurring and increasing outbursts of passionate discontent amongst the working classes resulting in incalculable economic loss from strikes and lock-outs, and the deplorable absence of good feeling, sympathetic interest, and even patriotic effort between

employer and employee. But did anyone consider that this was a normal or inevitable condition of things? Surely not. It was the result of human forces ignorantly applied and producing woe where the common weal should prevail. Both parties in the struggle usually displayed an equal amount of ignorance, but with a truly educated people all industrial progress should be admittedly dependent on the perfect accord between capital and labour in the pursuit of an end mutually advantageous. The lamentable condition of things had been of late the subject of Parliamentary and Government concern. Admirable means, including the recommendation of the principle of the minimum wage, had been devised and must be continued, but meanwhile the whole nation was being kept in a condition of inefficiency compared with what they knew would be possible were the whole industrial population of employers and employed working together in perfect accord and with the common aim of producing the most perfect products at the minimum of cost and maximum of benefit to both labour and capital. Such accord would, he believed, be found to lie in some system of profit-sharing between employer and employed, which if scientifically applied would most certainly lead to increased efficiency and contentment.

He submitted, therefore, that it would be a proper function of the British Science Guild to study and, if possible, to initiate by some considered recommendations a new order of industrial organisation, based on scientific principles of management, in which full justice would be done to all the interests involved in developing to a condition of maximum efficiency the great resources of the nation.

At the banquet of the British Science Guild, held on Monday, May 26, the following speech was delivered by Sir David Gill, K.C.B., in proposing the toast of the guild :—

I have been asked to propose the toast of the British Science Guild—and I rise to do so with much pleasure, because I feel and know that the objects for which it was founded are most worthy, and because in many directions the guild is doing good and useful work.

The aims and objects of the guild may be summarised in a few words, viz. to bring science and scientific habits of thought to bear upon the problems of everyday life and administration. The guild has no politics in the ordinary sense of the word. It belongs to no political party—its object is to help any party, be it Radical or Conservative, or any department of State, any Parliamentary Committee or individual administration with advice or assistance based on scientific knowledge.

It is sad to think how very few of our leading politicians—how very few, indeed, of our members of Parliament—have any serious knowledge of science; and yet it is upon science, and largely upon science alone, that the whole progress of our modern civilisation depends. I would be the last man in the world to deny the advantages of culture as it was understood 100 years ago. I mean the civilising, the refining, and the elevating influence of literature, art, and philosophy, apart from modern science based on experiment and observation. But it is not by progress in the older directions that we have to look chiefly for the modern betterment of mankind—the betterment of the health, the comfort, the safety, and the convenience of the great body of our fellow-citizens. We must go back to the days of Greece for the sculptures that in the present day we strive to emulate; and the like is true of the architecture of Greece and of our early cathedral builders. We have to go back to Giotte for reverence in painting, to Holbein, Titian, Giorgioni, Rembrandt, and Velasquez for other qualities in art that we cannot equal in the present day. In literature it is the same story—Homer, Virgil, Shakespeare, Dante, and Milton are not of our day, nor have we since seen their like. In philosophy I doubt if we have made much real advance since the days of Plato.

But in science what has not the progress been in recent days? That is a story known to you all, and I need scarcely dwell upon it. Tycho Brahe, Kepler, and Newton have laid the foundation of the fair superstructure of modern dynamical astronomy; and Stokes, Kirchoff, and Bunsen have laid on a no less sure foundation our present-day knowledge of the chemistry of suns and worlds other than our own. Chemistry and physics have advanced with giant strides within the last century, and in the present day we see the dawn of a knowledge of the constitution of the atom.

The invention of the steam engine is, by comparison with the fullness of art in the days of Greece, a thing of yesterday, and so practically is the scientific coordination of the laws of heat and electricity, the invention of the dynamo, and the transformation of energy into light and heat and *vice versâ*. The mythical æther is used to convey our wireless messages around the world, and we can travel on sea and land with a rapidity, comfort, and luxury almost undreamt of by men of only fifty years ago. We can travel, if we so desire, under the sea or over the sea, or we can fly in the air.

Medical science has made marvellous strides. Pain and suffering have been diminished and life has been prolonged. All these are steps in the progress of mankind, in the betterment of the conditions of life, which we owe to science and to science alone. I am aware that there is still a school of men who contend that we are no happier or better for this progress. I need scarcely say that I do not agree with them, but I do not propose to bore you with arguments on so trite a subject; the simple fact remains that if we, in these little islands of ours, do not progress with the times by the aid of science and the cultivation of our manhood, we shall be left behind in the race of progress—a strong man armed will come upon us and our inheritance will another take.

That is absolutely certain; so that whether the men of old were wiser and happier without science is not a question that requires discussion. The simple alternative is whether, in face of the competition of other nations, we of this presently great Empire are to be content to give up our place and power, or whether by the successful cultivation of our manhood and our science, we shall keep our place among the nations. Since science is so important to our existence as a nation, is it not strange that amongst our leading legislators there are so few who have any reasonable acquaintance with science?

I do not speak so much of the ordinary member of Parliament—he, poor man, in the present day, has got very little to do with the government of the country. He may have his convictions, he may have devoted time and knowledge and thought to the preparation of a useful Bill—but the chance of getting it even discussed by the House of Commons is small indeed; he may be thankful if he is not compelled by the crack of the party whip to vote for something that is in total opposition to the principles of his own Bill.

The real government of the country lies thus in the hands of a comparatively small number of men, and too often of men who have been selected for fluency of speech, readiness in debate, and a certain personal magnetism that appeals to the masses, rather than for the qualities of the highest statesmanship and sound scientific knowledge. The politician as a rule has had an eye to politics from an early age, and his reading has gone in the direction of history and

political economy, generally to the entire neglect of the more exact departments of science, and, above all, he prefers votes to history, political economy, science, or anything else. The instincts of the man of exact science are indeed opposed to those of the normal party politician. The man of science must be very sure of his grounds before he makes a statement, and must rigidly compare all existing facts with any theory before he declares the probability, or his personal conviction, of its truth. Above all, he must be careful to avoid the influence of preconceived views of his own or the views of his friends before he draws his inferences from observed facts. Where would the party politician be if he based his action on such grounds? He would soon be hounded out of his party, or reduced to slavish submission by the party whip.

So long as we have party government I fear there is no escape from the predicament. The object of the Science Guild is to provide some partial remedy at least for this undesirable state of affairs.

When Ministers have on any particular subject recognised the need of scientific advice they always have the Royal Society to which they may apply, and from that society they can always obtain sound advice on any subject that involves exact science. But it needs some scientific knowledge to know when sound scientific advice is required; and too often Governments do not know when they should ask for such advice, or they may know enough to realise that acceptance of the advice they require might involve expenditure that would not purchase votes or might lead to action that would be unpopular with some of their constituents.

Now it is here that a body like the Science Guild may rightly and does most rightly and properly come in. Unlike the Royal Society, it does not wait to be consulted. As a non-political body, it desires no party advantage from its action. Therefore when a Bill is in course of preparation or discussion in which it is clear that scientific advice has been neglected or not demanded, the Science Guild refers the matter to a competent committee of its own, and tenders advice without solicitation. It does not stump the country to proclaim its views; it leaves to the Government or the member who fathers the Bill the responsibility of adoption or non-adoption of its advice; it leaves to others to use any further pressure that may be required, based upon the views of the Science Guild.

Our guild is yet young, and it takes time before the elector at large can realise the due weight of its views. But no one can question the competence of its committees; the men who compose them are well known for their scientific standing and sound practical common sense; and, as time goes on, Governments will more and more find the importance of listening to the advice so tendered. No man was more sensible of this than was Lord Haldane, who has been our president since the formation of the guild nearly seven years ago. It is with much regret we learn that the pressing duties of his high office have compelled Lord Haldane to resign the presidency of the guild. We are most grateful to him for the services he has rendered, and for the recognition he has given to the value of the work aimed at and done by the guild.

We all, I am sure, are gratified to know that the Rt. Hon. Sir William Mather has consented to fill the chair vacated by Lord Haldane's retirement. He, as we all know, has taken a prominent part in the promotion of technical education throughout the country. He has been an able and active member of the guild, and we all have confidence that in his hands and under his inspiring influence the work of the Science Guild will grow and flourish.

JOINT MEETING OF BRITISH AND FRENCH ELECTRICAL ENGINEERS.

DURING the joint meeting of the British and French Electrical Engineering Institutions, held in Paris on May 21–24, a wide range of subjects was discussed. The greater part of the time was devoted to electric railway traction. The electrical equipment of purely urban and suburban railways has already become almost a mere question of economics and technical detail; the broader engineering and scientific problems are solved. So far, however, the replacement of the steam train by the electric train on main lines has only been limited, and this is a work for which the electrical engineer is making ready. Its consideration cannot be deferred until the improvements in the economy of generating and distributing electrical energy, and converting it into mechanical energy on the train, are such that there can be no other reasonable method than to burn the coal at the pit's mouth instead of the locomotive furnace; for in the meantime the "electrification" of suburban lines must continue, and the railway engineers naturally desire to equip their lines on some system which will lend itself to main line traffic as well as suburban, without extensive alterations being necessary when the second part of the problem is taken in hand. For this reason, the presentation and discussion of six papers on electric railways by French electrical engineers of high repute was particularly well timed.

The chief reason for different methods in dealing with urban railways pure and simple and main line railways may be summed up in two words, viz. distance and locomotives. On an urban or suburban line, the energy required is spread over a comparatively small geographical area; while on a main line the energy has to be transmitted over a considerable distance. Again, the traffic on an urban or suburban line is mainly passenger traffic, while a large proportion of the traffic on a main line is for the conveyance of goods.

In the majority of suburban lines a comparatively low electrical pressure (500 or 600 volts) is carried on the conductor along the track; this means a proportionately large current is required, but the voltage-drop and loss of energy which this entails are not serious on account of the small distance between the power station or substation and the train. Partly to facilitate the conveyance of this high current from the conductor rail to the train, and partly to enable trains to be conveniently subdivisible into lengths corresponding with the density of traffic at various periods of the day, the "multiple-unit" system is employed, in which there are two or more motor-coaches on each train, each taking current from the "live" rail conductor, but all controlled from the cab of the front motor-coach.

On long main lines, on the other hand, it is obviously more economical to transmit the energy to the train in the form of a higher potential and lower current, and this is the more desirable owing to the necessity of using locomotives, at all events for the goods traffic, which entail transmission of the whole of the current to the train at one point or one set of contacts with the live conductor. Therefore, other things being equal, a high-pressure single-phase current, as is being used on the London, Brighton and South Coast Railway, and also to some extent on the Midland Railway, and on several American and German lines, is indicated as the solution to the problem so far as main line traffic only is concerned; it is easy to generate and transmit, and requires only one live conductor, which is overhead. On the other hand, the overhead work introduces complications and expense for suburban traffic in which there are many

lines of tracks and many points and crossings, the equipment of a single-phase locomotive costs more and weighs more than that on any other system, and, last but not least, there is a great risk of serious disturbance to telephone and telegraph lines in the neighbourhood due to both electrostatic and electromagnetic induction.

In three-phase working, as used on most of the Italian electric railways, the second of these three disadvantages does not obtain, but the first disadvantage is accentuated owing to the need of two live conductors for each line of track, and the possible effect on the telegraph and telephone lines is the same. The high-tension continuous-current system is growing in favour, therefore, but it suffers from other disadvantages, although it would certainly appear to fulfil most completely the conditions required in a large number of cases. Standardisation is, of course, desirable for railway working, owing to the through traffic from one line to another, and many suburban lines are already equipped on the medium-pressure third-rail system. In the full discussion of the subject in Paris, the relative values of these and other technical points were weighed.

Among the other papers read at the Paris meeting was one by Mr. W. Slingo, engineer-in-chief of the British Post Office, on certain auxiliary apparatus in telephone exchanges. He described a class of apparatus, originally evolved in connection with automatic telephone exchanges, which is now being applied by the Post Office in some of the manual exchanges in London to assist in the distribution of traffic. In ordinary exchange working, when a subscriber removes his telephone from the hook, a lamp corresponding to his number glows, being actuated through a relay, and the operator to which this number is allotted, or one of the operators on either side of her, places a plug in the subscriber's answering jack immediately by the lamp, and makes the necessary connection. In spite of there being three operators who can attend to any subscriber in the busy hours of the day, there is nevertheless a certain amount of time in which each operator is not fully engaged. In the new "Avenue" exchange, an endeavour to level the work of the operators was made by using "ancillary" jacks for each subscriber, multipled over two other sections of the board, so that any one of nine disengaged operators could take any call. In the new system, however, this distributing of the calls to a free operator is made absolutely automatic. The allotment of groups of subscribers to definite operators is discontinued. As soon as a subscriber lifts his telephone from the hook, an automatic switch at the exchange end of his line selects a line leading to any operator who is idle for the moment, the calling lamp at her position glows, and she immediately answers the call.

Two lectures were given on the closing day of the meeting, one, by M. Georges Claude, on the neon light, and the other, by Commandant Ferrié, on the Eiffel Tower time signals. A discharge in a tube of neon gas gives a very pleasant red or orange-red light, which is, however, absolutely devoid of blue rays. M. Claude proposes to combine the use of these tubes with mercury-vapour tubes, and as the latter are rich in blue rays and devoid of red, a more or less white light is obtainable. A difficulty arises in the fact that while the neon tube requires high-tension alternating-current for the luminescent discharge, the mercury-vapour tube requires low-pressure continuous current. It appears, however, that M. Claude uses in his "correcting" tubes both neon and mercury, which, he said, renders them suitable for alternating current (the exact physical explanation of this was not given in the lecture), so that both tubes can be connected to the same circuit. He gave the efficiency of the combination at about 0·8 to 0·9 per candle.

Commandant Ferrié's lecture on the Eiffel Tower time signals was extremely interesting, but as this subject was described in detail in NATURE of March 13, it is unnecessary to do more than mention it briefly now. The time signals at present are sent out twice daily, from 10.44 to 10.49 a.m., and from 11.44 to 11.49 p.m. From July onwards there will be some alteration in the times for sending out these signals and also in the character and sequence of the warning signals. The times for the exact time signals will then be altered to 10 a.m. and midnight. To enable the greatest possible accuracy of observation, a series of 180 short dots regularly spaced at one second less about 1/50 of a second apart are sent out immediately before the ordinary night signals. To facilitate counting, the 60th and 120th dots are omitted. This series of dots is received by the Paris Observatory and other observatories, in each of which the operator listens at the same time to the beats of the master clock or another seconds chronometer. The two sets of beats thus constitute an "acoustic vernier," and during the time that the 180 wireless dots last, three coincidences spaced thirty seconds apart occur between the wireless dots and the beat of the clock. By noting the time indicated by the chronometer at the moment of coincidence, as well as the number of wireless impulses heard before the coincidence occurs, it is possible to calculate the time of the chronometer at the receipt of the first wireless impulse. For instance, if the Greenwich mean time of a coincidence was 23h. 30m. 25s., and the number of the stroke at coincidence was 42, the time of the first beat will have been 23h. 30m. 25s. minus 41 (1 − 1/50) seconds = 23h. 29m. 44·82s.

PROF. BERGSON ON PSYCHICAL RESEARCH.

PROF. HENRI BERGSON delivered his inaugural address as president of the Society for Psychical Research on Wednesday, May 28, in the Æolian Hall, New Bond Street. At the close of the address, which was delivered in French, and held the close attention of the company for nearly an hour and a half, Mr. A. J. Balfour, a past-president of the society, rose to express the thanks of the hearers, and characterised the address as the most interesting and illuminating one that the society has ever received. When we recall that Mr. Balfour himself, Prof. William James, Lord Rayleigh, the late F. W. H. Myers, and many other distinguished men have held the office of president, we can but feel that M. Bergson has justified both the choice of the society and his reputation as a maker of new thought.

M. Bergson took as his principal theme a study of the nature of the prejudices against the work and methods of the society; in fact, against its very existence—prejudices felt, not by the uninformed and unlearned, but by men of science, keenly desirous to extend the bounds of human knowledge. He attributed the objection to the methods which the experimenters in psychical research were forced to adopt in order to pursue their investigations—methods akin to the judicial, the historical, or even to those of the criminal detective, but, since the Renaissance, foreign to the world of natural and experimental science. The great development of mathematical science, based on the recovery of Greek learning, and carried forward by such men as Kepler, Galileo, and Newton, had given to the modern mind the conception of scientific

proof drawn from a series of accurate measurements of time, space, and mass which can be repeated at will, so that the man of science of to-day is inclined by his traditions and training to set aside as unworthy of consideration all phenomena which are incapable of treatment by the methods of precision and logical proof. Experimental psychology, however, that can measure rates of fatigue of memory, or persistence of association, has been received into the fold of orthodox natural science, and is making great progress towards a better comprehension of the workings of the human brain.

But readers of M. Bergson's book, especially those acquainted with "Matter and Memory," will recall that M. Bergson looks upon the human brain merely as a means of obtaining recollection, *un organe de rappel*, not as the essential phenomenon of human consciousness or of the life of the mind. Thus by the investigations of modern experimental psychology, we learn more about the instrument of communication between the outer and inner worlds—we do not extend our knowledge of those worlds themselves.

M. Bergson suggested that the function of the brain, and indeed of the recognised senses, is to limit rather than to extend the outlook of the mind. They become the organs of attention to life, picking out and preserving ready for use only those impressions and recollections which will be serviceable to the life of the individual or the species. Everything else is masked and put away where, in normal circumstances, it does not distract the attention of the participant from the things which help him to accomplish his mission in the world. But in certain circumstances, such as illness, shock, approaching dissolution of the partnership between mind and body, the limitation may suddenly disappear, the barrier breaks down—perhaps the reason for its existence is removed—and we get produced the phenomena with which the Society for Psychical Research is accustomed to occupy itself, regardless of mathematical theories concerning the nature of proof.

EXPOSURE OF THERMOMETERS FOR THE DETERMINATION OF AIR TEMPERATURE.

THE report of the Prussian Meteorological Institute for 1911 contains the fourth communication by Prof. G. Hellmann upon the above subject. The observations are discussed at considerable length under three principal heads :—(1) Exposure at a north window (formerly the usual method adopted in Germany) and in a Stevenson screen in a meadow (or field) at Potsdam. This section is accompanied by an interesting set of monthly diagrams showing the mean daily range due to both exposures. (2) Comparison of the Stevenson screen with the aspiration thermometer at Potsdam and Grünberg, in Silesia. (3) Comparison of the true air temperature in a meadow and in the north shade of Potsdam Observatory (about half a metre from the wall).

The following shortened summary gives some of the chief results deduced from the four communications :—

(1) The determination of the temperature near the north wall of a building is practically independent of the nature of the window exposure; the thermometer may even be hung freely, so long as it is not exposed to direct or indirect radiation.

(2) An aspiration thermometer installed near the north wall of a building gives results agreeing very closely with those of the usual window exposure; in the summer half-year the latter gives 0·1°–0·2° (C.) higher readings in the afternoon, while in the winter season the morning and evening observation hours give rather too low readings.

(3) A freely exposed Stevenson screen gives in North Germany too high readings at the afternoon observation throughout the year to the extent of 0·1°–0·2° in winter, and 0·2°–0·4° in summer. At the evening reading also it is 0·1°–0·2° too high in summer, and 0·1° too low in the other seasons; at other hours the differences are very small and of varying sign.

(4) The errors of this screen differ in different climates and with varying conditions of weather.

(5) The true temperature in the shade, on the north side of a building, both as regards absolute amount and daily period, is quite different from that obtained in an open field. At the 2h. p.m. reading the excess of temperature in the field is 0·1° in December and 1·0° in July. These differences increase with duration and intensity of sunshine, and decrease with strong winds.

(6) The true daily means in the north shade of a building and in a meadow differ but little from each other; in winter the meadow daily mean is 0·1°–0·3° the lower of the two.

(7) The hourly readings in the two positions are not comparable, but the daily means derived from the hours 7, 2, 9 by Kämtz's formula exhibit relatively small differences.

(8) The daily oscillation of temperature near the house is about 0·3° in December to 1·6° in June less than in the meadow.

(9) The daily maximum is from 0·1 hour in December to 0·9 hour in June later in the shade of the house than in the meadow, but the time of the occurrence of the minimum is the same in both positions.

HYDROGRAPHY IN ITALY.[1]

THE third annual report on the activities of the Italian Hydrographic Department deals with the year 1911, a period which is stated to have been of particular importance in its history, on account of certain drastic changes which were brought about in the administration of the service, through the passing of a law for the better regulation of the work of collecting and classifying data relating to rivers and their mountain basins, to lagoons and to the sea, and for the systematic study of all streams, their sources and outlets.

This new law assigned to the hydrographic service, in addition to the director, four specialist assistants, and has rendered possible the subdivision of the department into four sections, distinguished as fluvial-hydrographical, maritime-hydrographical, meteorological, and geological.

The report deals with the present and proposed fields of operations, and enumerates the various subservices to be undertaken. These are as follows :—(*a*) Meteorological; (*b*) aërological; (*c*) telegraphic, for forecasting the weather; (*d*) meteorological, for the city of Venice; (*e*) midday signalling for the port of Venice; (*f*) pluviometric; (*g*) nivometric; (*h*) hydrometric; (*i*) stream measurement; (*l*) flood prediction; (*m*) levelling observations; (*n*) maregraphic; (*o*) maregraphic for the city of Venice; and (*p*) maritime lagoon reclamation. Of these services (*b*), (*d*), (*e*), and (*g*) were only inaugurated in 1912.

Within the limits of a brief notice it is not possible to do more than thus indicate in very general terms the extent of ground covered by the report, and those who desire fuller information or who are interested in any way in the extension and development of hydro-

[1] "Terza Relazione Annuale del Direttore dell' Ufficio Idrografico." By Giovanni Magrini. Pp. 71+plates+maps. (Venice : Carlo Ferrari, 1912.)

graphical research can only be referred to the brochure itself, the seventy pages of which contain much useful and instructive data. Included will be found a number of photographs illustrating various stations, and diagrams showing the method of taking observations. In addition there are four relief maps of the north-eastern portion of Italy (Venice and the adjacent provinces), indicating the scope of operations and their localisation. There is an interesting description of the construction of an experimental tank at Stra.

POSITIVE RAYS OF ELECTRICITY.[1]

THE first part of the paper contains a discussion of the evidence afforded by the positive rays as to the nature of the ionisation of the gases in a discharge tube and the properties of atoms. The positive rays consist of:—

(1) Atoms with one positive charge.
(2) Molecules with one positive charge.
(3) Multiply charged atoms.
(4) Atoms with one negative charge.
(5) Molecules with one negative charge.

All the diatomic gaseous elements which have been examined furnish both atoms and molecules with single charges. The proportion of atoms to molecules varies very largely with the conditions of the electric discharge, and evidence is given that the charged atoms and molecules are produced by different processes. It is suggested that the ionisation which gives rise to molecules is due to kathode rays, while the charged atoms are produced by the impact of charged atoms and molecules.

All the elements examined, with the significant exceptions of hydrogen and a substance of atomic weight 3 (X_3), furnish, under certain conditions, atoms with more than one charge. The power of acquiring multiple charges seems to be connected with the atomic weight rather than with the valency or other chemical property of the atom. Thus the atom of mercury, the heaviest atom investigated, can have as many as eight changes, crypton five, argon three, while the lighter atoms, as a rule, have only two. No undoubted case of a doubly-charged *molecule* of an element or compound has yet been discovered.

The negative charge is found on the atoms of some elements, *e.g.* hydrogen, oxygen, carbon, sulphur, chlorine, but not on the atoms of nitrogen, helium, neon, argon, or mercury. It may be regarded as an indication of the chemical activity of the atom, in so far as this depends upon the intensity of the electric field outside the atom. No negatively electrified molecules of compounds have been observed; the only cases of negatively electrified molecules of elements are those of oxygen and carbon, and these only occur when the elements are liberated from special types of compounds.

The second part of the paper deals with the use of these rays as a method of chemical analysis. Several applications of the method are considered. The first of these is to the detection of rare gases in the atmosphere. It is shown that while none of the heavier gases in the atmosphere occurring in quantities comparable with that of xenon have escaped detection, this is not the case with the lighter gases.

"Neon," it is shown, is not a simple gas, but a mixture of two gases, containing a large quantity of a gas of atomic weight about 20, and a much smaller quantity of one with an atomic weight about 22. The "22" gas was first observed in samples of residues of liquid air supplied by Sir James Dewar, and has since been found in every specimen of neon examined, including a specimen supplied by M. Claud, of Paris, and a very carefully purified sample of neon prepared by Mr. Watson. The sample from M. Claud contained a small quantity of a substance with atomic weight 3, the properties of which are discussed later on.

Another application of this method was to the analysis of the gas in a small glass tube in which 30 mg. of radium bromide had been sealed for more than ten years; in addition to helium, the gas contained considerable quantities of "neon" or some element with very nearly the same atomic weight; there was also a trace of argon in the gas, a little more than would have been expected from the volume of air in the tube, although the difference was not very great.

The other application of the method is to the investigation of the properties of a substance for which $m/e=3$, X_3. This gas is given off by most solids when they are bombarded by kathode rays. Reasons are given for concluding that the substance is not the carbon alone with four charges.

The gas has the following properties:—

It can pass through tubes containing red-hot copper oxide, and then over potash without being absorbed.

It is not changed when sparked for a long time with an excess of oxygen, the oxygen being subsequently removed by phosphorus.

It can pass over metallic sodium without being absorbed, nor does it disappear when heated along with sodium vapour.

It is absorbed by charcoal cooled with liquid air, but it can circulate through a glass spiral immersed in liquid air without being condensed.

It combines with mercury vapour when an electric discharge is sent through the mixture; it also combines to some extent with red-hot copper when passed slowly over it. If stored over mercury vapour it seems to diminish, though very slowly. The gas has been detected after it has been stored for several weeks.

The study of the positive-ray photograph indicates that the substance is monatomic, and generally it seems to be similar in its behaviour to the inert gases, although its chemical properties are apparently a little more energetic.

[1] Summary of the Bakerian lecture delivered before the Royal Society on May 22 by Sir J. J. Thomson, O.M., F.R.S.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—Dr. Shipley, master of Christ's College, has been reappointed representative of the University on the council of the Marine Biological Association.

On June 3 the Rev. S. A. Donaldson, master of Magdalene College, was re-elected Vice-Chancellor of the University for a second year.

It is proposed to confer the degree of Doctor of Letters, *honoris causâ*, upon Commendatore Giacomo Boni, director of the excavations on the Forum and the Palatine.

The registrary reports that the matriculation this term brings the number of new students for the academic year 1912–13 up to 1200. In the last academic year the numbers were 1156.

Mr. R. Assheton, of Trinity College, and Mr. L. Doncaster, of King's College, have been approved by the general board of studies for the degree of Doctor of Science.

OXFORD.—A summer course in advanced practical organic chemistry, with demonstrations, will be held at Queen's College, on August 1–30, by Mr. F. D.

Chattaway, F.R.S. The class is open to students who are not members of the University.

THE new college buildings of Bedford College for Women at Regent's Park, London, N.W., are to be opened by the Queen on July 4, at 3 p.m.

VACATION courses for instrument-makers and glass-blowers will be held at the University of Leyden from August 21 to September 4. Particulars of the courses can be obtained from the director, Prof. H. Kamerlingh Onnes, or the general secretary, Dr. C. A. Crommelin.

THE Commemoration Day proceedings at Livingstone College on June 7 will be the celebration by the college of the Livingstone centenary. The reception of the special delegates and visitors by the principal will be from 3 to 3.30 p.m., and afterwards a number of addresses will be given and an exhibition held.

AT the end of the present academic year Cornell University, N.Y., will lose the services of Prof. H. H. Norris, who has occupied its chair of electrical engineering since 1905, and has been head of the department since 1909. He is resigning in order to undertake editorial work in connection with *The Electrical Railway Journal* and *The Electrical World*.

THE following appointments have been made to the faculty of the new school of technology in connection with Johns Hopkins University, Baltimore:—Prof. C. C. Thomas, of the University of Wisconsin, to the chair of mechanical engineering; Prof. C. J. Tilden, of the University of Michigan, to the chair of civil engineering; and Prof. J. B. Whitehead, hitherto professor of applied electricity in Johns Hopkins University, to the chair of electrical engineering.

AN influentially signed memorial has been sent to Lord Haldane, in his capacity of Chancellor of the University of Bristol, directing attention to the circumstances in which Mr. R. P. Cowl, formerly professor of English literature, was removed from the University of Bristol in 1910. The signatories point out that it appears that a grave injustice may have been committed, and ask for a full investigation of the case. In the first list of signatories there are many distinguished names, including the following men of science:—Prof. W. Ridgeway, Sir Bertram Windle, Profs. R. H. Yapp, J. A. Green, W. M. Travers, P. F. Frankland, Leonard Hill, William Bullock, J. Adams, Gisbert Kapp, F. W. Burstall, W. M. Bayliss, E. W. Hobson, and F. R. Japp.

IT is announced in *Science* that Mrs. G. W. Hooper, of San Francisco, has transferred to the University of California 200,000*l*. for the establishment of an institute of medical research. We learn from the same source that the late Prof. Louis A. Duhring, formerly professor in the University of Pennsylvania, in his will disposes of an estate valued at about 100,000*l*. The will creates a trust fund of 5000*l*., the income of which is to be used for the benefit of the department of cutaneous medicine, and it gives the University of Pennsylvania Hospital 10,000*l*. for the establishment of free beds in which cutaneous, cancerous, and allied diseases shall be treated and studied. After a number of private bequests have been made, the residue of the estate is to be given to the trustees of the University of Pennsylvania, and applied to the treatment of cutaneous diseases and their study.

THE Apprenticeship and Skilled Employment Association has issued its seventh annual report. The work of the association is, among other matters, to watch over the interests of juveniles so far as they are affected by fresh legislation. During the year under review the association has inquired into the hours of employment of van and errand boys, and the conditions of employment of boy clerks in the Civil Service; and representatives of the association have given evidence before the Royal Commission on the Civil Service. It is satisfactory to know that the London County Council has adopted a suggestion made a short time ago by the association that attendance at continuation classes should be made a condition of employment of their laboratory monitors. These lads on leaving the council's service have, as in the past, been referred to the association, and have in almost every case been successfully placed. The report gives further interesting evidence that there is a growing disposition among public bodies to make use of the services of the association in the matter of boys and girls under their supervision.

THE issue of *The Fortnightly Review* for June includes an article on vocational education by Mr. Cloudesley Brereton. The whole spirit of vocational education is, he maintains, that the manual work and crafts with which it deals should not be taught mechanically, or as a mere rule of thumb, but should be used as veritable instruments of culture. In London, vocational education has led, apart from the polytechnic movement and the great extension of trade schools, to the conversion of the higher elementary schools into central schools, to which has been given a definite bias for the preparation of the pupils for an industrial or commercial life; while the work in the infant schools and lower grades of the elementary schools is every day becoming more concrete and constructive. It is to be hoped, Mr. Brereton thinks, that any scheme of national education will immensely enlarge the facilities for vocational education, and be the means of bringing the university into closer touch with the business world and the locality of which it should be the spiritual and intellectual inspiration. One thing is, he says, at least certain: we shall never gain the full confidence of the business world and the working classes until we can show that education is practical, *i.e.* that it has an economic value; while if we are to retain the confidence of those who believe in the spiritual side of education, we must likewise hold fast to its humanistic ideals. Vocational education in the widest sense means the working out of the combination of these ideals.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, May 29.—Sir Archibald Geikie, K.C.B., president, in the chair.—Prof. A. B. **Macallum**: *Acineta tuberosa*: a study on the action of surface tension in determining the distribution of salts in living matter. In previous investigations it was found that the salts demonstrated microchemically to occur in the living cell were not uniformly diffused but were condensed or "localised" at points in its cytoplasm, or at parts of its surface. Amongst such salts were the compounds of potassium, which are very soluble and are not known to form precipitates in nature. It was concluded that some other force than simple osmotic pressure was concerned in this distribution of the salts, especially in the cases where the condensations were in those portions of the cell surface where, from the deformation observed, it was inferred that a lowering of surface tension was involved. The explanation advanced was that surface tension was the factor primarily concerned in these condensations. Two years ago an investigation of the distribution of potassium salts in *Acineta tuberosa*, a marine Suctorian Protozoan, gave results which appear to place

the matter beyond doubt. It would seem, from further investigations, that surface tension not only determines the condensations in the films and elsewhere in the organisms, but also maintains these condensations against the forces of diffusion.—Sir David **Bruce**, Majors D. **Harvey** and A. E. **Hamerton**, and Lady **Bruce**: Morphology of various strains of the trypanosome causing disease in man in Nyasaland. IV., The Mzimba strain.—Helen L. M. **Pixell**: Notes on *Toxoplasma gondii*.—J. C. F. **Fryer**: An investigation by pedigree breeding into the polymorphism of *Papilio polytes*, Linn.—Dr. S. **Russ** and Dr. Helen **Chambers**: The action of radium rays upon the cells of Jensen's rat sarcoma.

Physical Society, May 16.—Prof. C. H. Lees, vice-president, in the chair.—Dr. W. **Makower** and Dr. S. **Russ**: Some experiments to detect β rays from radium A. When an atom of radium A disintegrates an α particle is expelled which carries with it two positive atomic charges. At the same time the radium B atom formed recoils with a single positive charge. To explain this it is necessary to suppose that three negative electrons are expelled during the process. If these are emitted with a high velocity they should appear as β rays capable of detection; or they might consist of a slowly moving δ radiation which would escape such detection. The experiments, made by both methods in the hope of detecting β rays from radium A, failed to reveal any such radiation.—Dr. J. **Robinson**: Dust figures. The ripple formation in Kundt's tube was explained by W. König in 1891. His theory was based on the hydrodynamical forces between two particles in a stream. Certain measurements on dust figures produced by an electric spark have shown that these figures also can be explained in a similar way to the Kundt's tube figures. Cook suggested that viscosity must be introduced in order to account for the formation of ripples. The author shows that it is possible to account for ripple formation without introducing viscous forces at all. In the case of the Kundt's tube figures there is a variation of velocity of the air from a node to an antinode, which produces a variation in the forces, and this causes the powder to lose its uniformity of distribution and to form ripples. The necessary constraints for the ripples are forthcoming without the introduction of viscosity.—Dr. **Haworth**: Vibration galvanometer design. (1) The maximum amount of power available for vibrating the moving system of a vibration galvanometer of the moving-coil type is $V^2/4R$. As the frequency of the instrument is raised the losses increase rapidly, so it is an advantage to be able to increase the useful power input per unit voltage; the resistance of the instrument must be decreased. This can be done in a galvanometer of the Duddell type by leading the current in and out at the bottom bridge and short-circuiting the wires at the top bridge, and it results in an increase of sensibility. (2) Owing to the losses in the moving system increasing at a greater rate than the first power of the frequency, and because the frequency of the system increases at a slower rate than the reciprocal length of the string on account of the mass of the mirror, the flux density must be increased as the frequency increases. As the losses are low at low frequency and the mass of the mirror is not large, then, compared with the mass of the wire, the flux density required is moderate; but at high frequencies the flux density required is large. To obtain this result economically it is convenient to make the depth of the poles small compared with the maximum length of the wires. (3) A combination of (1) and (2) makes a satisfactory instrument with a much flatter voltmeter-sensibility-frequency curve than obtained usually.

DUBLIN.

Royal Dublin Society, May 20.—Prof. James Wilson in the chair.—W. J. **Hartley**: A violet colouring matter and its production by a certain bacterium. The bacterium was isolated from the water supply of a creamery. The cultural characters resemble those of both *Bacterium violaceus* and *B. ianthinus*, as described by Macé. The colour was best produced on potato. Colour was not produced at 37° C., in the absence of air, or in the absence of more moisture than was sufficient for the growth of the organism. In artificial media colour was produced in the absence of peptone. The colouring matter extracted with alcohol is an amorphous blue-black, solid, without surface reflection. A weighed quantity was dissolved in alcohol, and the absorption spectra were examined optically and photographically at various dilutions. The spectra extended from $\lambda 670$ in the red to $\lambda 227$ in the ultra-violet. At the greatest dilution only one absorption band was observed, starting at $\lambda 6439$, and extending towards, but not further than, $\lambda 5000$; the ultra-violet absorption is general, with no indication of bands. This spectrum differs from that of the dyes, such as Hoffmann's violet, and from the spectra of violet colouring matters extracted from natural sources by Schneider, Moseley, Molisch, Krukenburg, and Lecoq de Boisbaudran. The chemical reactions of the solution resemble those of some natural violet colouring matters. It is an oxygenated substance which, in the presence of light, oxidises substances such as alcohol.—Rev. Henry V. **Gill**: The effect of a low potential electric current on photographic plates. The object of this communication was to describe some results which had been obtained from experiments on photographic plates. There is a great deal of uncertainty concerning the nature of the changes which take place in the sensitive surface of such plates when they are exposed to the action of light and other influences. Many physicists have studied the effect of passing electric sparks over the surface of dry photographic plates. On development a record of the path traversed by the discharge is obtained. The blackening of the plate is in great part due to the luminosity accompanying the discharge, and it is consequently difficult to determine the part played by the current as distinct from the luminosity of the spark. The discharge was non-luminous, and of comparatively low voltage, from 200 to 400 volts. The results obtained show that the effect of such a current on sensitive plates is complicated, and depends to a great extent on the nature of the terminals placed at the surface of the plate, between which the discharge takes place. The ions coming from the positive terminal seem to play the chief part in the reaction. When, for example, copper is employed as positive terminal, a considerable region of the plate surrounding the point of contact is found on development to be blackened; on the other hand, when platinum is used no blackening of the plate is produced. Silver and other metals produce characteristic effects. The effect at the negative terminal is very much less and does not depend on the nature of the terminal.

PARIS.

Academy of Sciences, May 26.—M. F. Guyon in the chair.—Emile **Picard**: Concerning the recent meeting of the International Association of Academies. A short account of the subjects discussed at the meeting at St. Petersburg.—Paul **Appell**: The Hermite polynomials $U_{m,n}$ and their analogues connected with spherical functions in hyperspace.—P. **Chofardet**: Observations of the Schaumasse comet, 1913*a*, made at the Observatory of Besançon with the bent equatorial. Positions are given for May 21 and 24. On

May 24 this comet appeared as a circular nebulosity 1·5′ diameter, magnitude between 8 and 9. There was a diffuse nucleus but no tail.—Nicolas **Kryloff**: Some properties of integral equations with non-symmetrical nucleus.—J. **Tamarkine**: The problem of the development of an arbitrary function in a Sturm-Liouville series.—W. F. **Osgood**: An extension of a theorem of Weierstrass and on a restriction of another theorem by the same author.—M. **d'Ocagne**: The general application of the method of aligned points to problems which reduce themselves to solutions of spherical triangles.—Th. **Got**: The equivalence of certain indefinite ternary quadratic forms of the same genus.—L. **Décombe**: The viscosity of the atom. In the absorption of light and in certain abnormal dielectric phenomena an explanation is found in a certain viscosity term, proportional to the velocity, and regarded hitherto as an empirical term. An attempt is made to connect this with the fundamental principles of mechanics.—A. **Tian**: The relation between light energy and photochemical action. An examination of the conditions under which the law of proportionality between photochemical effect and light absorption is verified.—L. **Chaumont**: The theory of apparatus serving for the study of elliptically polarised light.—R. **Fortrat**: The normal magnetic triplet and Preston's rule.—Jacques **Carvallo**: The electrical conductivity of pure ether. An arrangement is described securing the perfect isolation of the electrodes. Under a constant difference of potential of 1144 volts the conductivity diminished slowly for eight days, after which it remained constant. The extremely small residual conductivity observed is attributed to traces of impurities.—Keivin **Burns**: Interference measurements of wave-lengths in the iron spectrum. Employing the methods of Buisson and Fabry, interference measurements of the iron lines have been extended from wave-length 6500 to 8824.—Félix **Bidet**: The displacement limit of monoethylamine by ammonia gas. A study of the influence of temperature and pressure on the equilibrium limit and on the velocity of the reaction.—Georges **Charpy** and André **Cornu**: The separation of graphite in alloys of iron and silicon.—A. **Recoura**: The instability of ferric fluosilicate and its spontaneous transformation into another double fluoride of silicon and iron.—J. B. **Senderens** and J. **Abouleno**: The ester salts derived from octanol by the method of the authors; observations on the principle of this method. The application of the use of small quantities of sulphuric acid (2 per cent. to 3 per cent.) in the catalytic formation of esters.—Georges **Dupont**: The catalytic hydrogenation of the acetylene γ-glycols in presence of palladium black. Acetylene glycols of the fatty series treated with hydrogen and palladium black are more highly reduced than when platinum black is used. A mixture of a saturated glycol, alcohol, and hydrocarbon is produced. The difference between the two catalytic agents is still more marked with the aromatic acetylenic glycols, platinum giving the saturated glycols only, palladium the hydrocarbons.—A. **Guyot** and J. **Martinet**: The condensation of the primary and secondary aromatic amines with the mesoxalic esters. Synthesis in the indole series.—Jean **Nivière**: The action of α-monochlorohydrin and epichlorohydrin upon the monosodium derivative of glycerol.—Marcel **Lantenois**: Some new properties of carbon tetraiodide and its estimation in presence of iodoform. Carbon tetraiodide reacts with an aqueous solution of silver nitrate giving carbon dioxide, nitric acid, and silver nitrate; iodoform, with the same reagent, gives carbon monoxide, silver iodide, and iodate and nitric acid. When aqueous solution of silver nitrate is allowed to act upon a mixture of iodoform and carbon tetraiodide the proportion of carbon monoxide and dioxide evolved serves accurately to indicate the composition of the mixture.—Henri **Pottevin**: Cholera toxin and antitoxin.—A. **Besredka**: Study of the tubercle bacillus. A description of a good liquid medium for the culture of the tubercle bacillus. The growth after twenty-four hours in this liquid is as abundant as that of an ordinary microbe such as streptococcus. Bovine and human bacilli give distinctive growths in this medium.—Mme. A. **Hufnagel**: A periœsophagian organ observed in two Lepidoptera.—Em. **Bourquelot** and Em. **Verdon**: The use of increasing proportions of glucose in the biochemical synthesis of β-methylglucoside. The influence of the glucoside formed on the arrest of the reaction.

CALCUTTA.

Asiatic Society of Bengal, May 7.—D. **Prain** and I. H. **Burkill**: A synopsis of the Dioscoreas of the Old World, Africa excluded, with descriptions of new species and of varieties. Diagnoses of new species and varieties are given, as well as a key to the genus.—H. M. **Chibber**: Variations in the flowers of *Limnanthemum indicum*, Thwaites. Four hundred and fifty-seven flowers were examined and the variations observed are given in tabular form.—Maude L. **Cleghorn**: Notes on pollination of *Colocasia antiquorum*. The paper records some observations on the pollination of the Indian Kachu, and compares it with the process known in the European cuckoo-pint (*Arum maculatum*).—Jitendra Nath **Rakshit**: Double compounds of mercuric oxide with compounds containing ketonic radical. A compound is described of the formula C_3H_6O, $3HgO$.

BOOKS RECEIVED.

British Museum (Natural History). Catalogue of the Plants collected by Mr. and Mrs. P. A. Talbot in the Oban District, South Nigeria. By Dr. A. B. Rendle, E. G. Baker, H. F. Wernham, S. Moore, and others. Pp. x+157+17 plates. (London: The Trustees of the British Museum; Longmans and Co. and others.) 9*s*.

British Museum (Natural History). Catalogue of the British Species of Pisidium (Recent and Fossil) in the Collections of the British Museum (Natural History), with Notes on those of Western Europe. By B. B. Woodward. Pp. ix+144+xxx plates. (London: The Trustees of the British Museum; Longmans and Co. and others.) 10*s*. 6*d*.

Die biologischen Grundlagen der sekundären Geschlechtscharaktere. By Drs. J. Tandler and S. Grosz. Pp. 169. (Berlin: J. Springer.) 8 marks.

Qualitative Analyse vom Standpunkte der Ionenlehre. By Dr. W. Böttger. Dritte Auflage. Pp. xvii+565+plate. (Leipzig: W. Engelmann.) 11.20 marks.

A Text-Book on Trade Waste Waters: their Nature and Disposal. By Drs. H. M. Wilson and H. T. Calvert. Pp. xii+340. (London: C. Griffin and Co., Ltd.) 18*s*. net.

Preliminary Chemistry. By H. W. Bausor. Pp. 106. (London: W. B. Clive.) 1*s*. 6*d*.

Man and his Forerunners. By Prof. H. v. Buttel-Reepen. Translated by A. G. Thacker. Pp. x+96. (London: Longmans and Co.) 2*s*. 6*d*. net.

Researches on Irritability of Plants. By Prof. J. C. Bose. Pp. xxiv+376. (London: Longmans and Co.) 7*s*. 6*d*. net.

Egyptian Government. Ministry of Finance. Survey Department. Report on the Work of the Laboratories and of the Assay Office during 1912. By A. Lucas. Pp. 28. (Cairo: Government Press.) 5 P.T.

Electric Wiring. By Prof. W. C. Clinton. New edition. Pp. viii+197. (London: J. Murray.) 2*s*.

Unsere Kohlen. By P. Kukuk. Pp. x+120+plate. (Leipzig: B. G. Teubner.) 1.25 marks.

Problèmes de Mécanique et Cours de Cinématique. By Prof. C. Guichard. Pp. 156. (Paris: A. Hermann et Fils.) 6 francs.

Leçons de Thermodynamique. By Dr. M. Planck. Translated by R. Chevassus. Pp. 310. (Paris: A. Hermann et Fils.) 12 francs.

Western Australia. Meteorology of Australia. Commonwealth Bureau of Meteorology. Results of Meteorological Observations made in Western Australia during 1908. Pp. 130+maps. (Perth, W.A.: F. W. Simpson.)

Guide-Annuaire du Gouvernement Général de Madagascar et Dépendances. Année 1913. Pp. viii+788. (Tananarive: Imprimerie Officielle.)

Die Züchtung kolonialer Gewächse. Edited by C. Fruwirth. Pp. xix+184. (Berlin: P. Parey.) 9 marks.

Grundriss der Kristallographie. By Dr. G. Linck. Dritte Auflage. Pp. viii+272+iii plates. (Jena: G. Fischer.) 11.50 marks.

Das Pflanzenreich. Edited by A. Engler. 59 Heft (iv+251). Hydrophyllaceæ. By A. Brand. (Leipzig: W. Engelmann.) 10.60 marks.

An Elementary Treatise on Calculus. By W. S. Franklin, B. MacNutt, and R. L. Charles. Pp. x+253+41. (S. Bethlehem, Pa.: The Authors, Lehigh University.) 2 dollars.

Plants and Their Uses. By F. L. Sargent. Pp. x+610. (New York: H. Holt and Co.)

The Wanderings of Animals. By Dr. H. Gadow. Pp. vi+150+maps. Wireless Telegraphy. By Prof. C. L. Fortescue. Pp. vi+143. Beyond the Atom. By Prof. J. Cox. Pp. 151. Submerged Forests. By C. Reid. Pp. 129. Bees and Wasps. By O. H. Latter. Pp. vi+132. (Cambridge Manuals of Science and Literature.) (London: Cambridge University Press.) 1s. net each.

A Junior Course of Arithmetic. By H. S. Jones. Pp. ix+224. (London: Macmillan and Co., Ltd.) 1s. 6d.

Practical Bacteriology, Microbiology, and Serum Therapy (Medical and Veterinary). By Dr. A. Besson. Translated and adapted from the fifth French edition by Prof. H. J. Hutchens. Pp. xxx+892. (London: Longmans and Co.) 36s. net.

Liquid Steel: its Manufacture and Cost. By D. Carnegie, assisted by S. C. Gladwyn. Pp. xxv+520+x plates. (London: Longmans and Co.) 25s. net.

The Bodley Head Natural History. Vol. i., British Birds. Passeres. By E. D. Cuming. Pp. 120+iii plates. (London: J. Lane.) 2s. net.

DIARY OF SOCIETIES.

THURSDAY, JUNE 5.

ROYAL SOCIETY, at 4.30.—Croonian Lecture: The Origin of Mammals: Dr. R. Broom.—The Fossil Floras of the Wyre Forest, with Special Reference to the Geology of the Coalfield and its Relationships to the Neighbouring Coal Measure Areas: Dr. E. A. Newell Arber.

ROYAL INSTITUTION, at 3.—Recent Chemical Advances. III. The Structure of Crystals: Prof. W. J. Pope.

LINNEAN SOCIETY, at 8.—A Contribution to the Flora and Plant Formations of Kinabalu and the Highlands of British North Borneo: Miss L. S. Gibbs.—The Hydrophilidæ: Histeridæ of the Percy Sladen Expedition to the Seychelles: H. Scott.—Marine Algæ from the Indian Ocean: Mme. Weber van Bosse.—Myrmeleonidæ from the Indian Ocean: J. G. Needham.—Rhynchota of the Seychelles: I. Heteroptera: W. L. Distant.—Mystropetalon, Harv.: Prof. R. J. Harvey Gibson.

FRIDAY, JUNE 6.

ROYAL INSTITUTION, at 9.—Reflection and Refraction of Light as Concealing and Revealing Factors in Sub-aquatic Life: F. Ward.

GEOLOGISTS' ASSOCIATION, at 8.—Palæolithic Man in the Thames Valley: H. Dewey.

SATURDAY, JUNE 7.

ROYAL INSTITUTION, at 3.—Radio-activity. III. The Radio-active State of the Earth and Atmosphere: Prof. E. Rutherford. (The Tyndall Lectures.)

MONDAY, JUNE 9.

ROYAL GEOGRAPHICAL SOCIETY, at 8.30.—Across Southern Jubaland to the Lorian Swamp: I. N. Dracopoli.

TUESDAY, JUNE 10.

ROYAL ANTHROPOLOGICAL INSTITUTE (Royal College of Surgeons, Lincoln's Inn Fields, W.C.), at 2.30.—Racial Migrations in Africa: Sir H. H. Johnston.

WEDNESDAY, JUNE 11.

GEOLOGICAL SOCIETY, at 8.—Certain Upper Jurassic Strata of England: Dr. H. Salfeld.—The Volcanic Rocks of the Forfarshire Coast and their Associated Sediments: A. Jowett.—Metamorphosed Sediments between Machakos and Lake Magadi (British East Africa): J. Parkinson.

THURSDAY, JUNE 12.

ROYAL SOCIETY, at 4.30.—*Probable Papers:* Recent Researches on the Palatine in Relation to Geology, Ethnology, and Physics: Commendatore Boni.—The Trypanosomes causing Dourine (Mal de Coit or Beschälseuche): Dr. B. Blacklock and Dr. W. Yorke.—The Growth and Sporulation of the Benign and Malignant Tertian Malarial Parasites in the Culture Tube and in the Human Host: J. G. Thomson and D. Thomson.

FRIDAY, JUNE 13.

ROYAL ASTRONOMICAL SOCIETY, at 5.

MALACOLOGICAL SOCIETY, at 8.—Note on the Genus Pseudomalaxis, Fischer, and Descriptions of a New Species and a New Subgenus: Marqués de Monterosato.—Note on the Freshwater Mollusca found with *Unio Auriculatus*, Spengl, at Barn Elms, Surrey: A. S. Kennard and B. B. Woodward.—The Land Mollusca of the Kermadec Islands: Tom Iredale.—Definitions of Further New Genera of Zonitidæ: G. K. Gude.

PHYSICAL SOCIETY, at 8.—Some Experiments on Tinfoil Contact with Dielectrics: G. E. Bairsto.—A Method of Measuring the Pressure of Light by Means of Metal Foil: G. D. West.

CONTENTS.

Editorial and Publishing Offices:
MACMILLAN & CO., LTD.,
ST. MARTIN'S STREET, LONDON, W.C.

Advertisements and business letters to be addressed to the Publishers.

Editorial Communications to the Editor.
Telegraphic Address: PHUSIS, LONDON.
Telephone Number: GERRARD 8830.