THURSDAY, JANUARY 1, 1914.

EVOLUTION AND GENETICS.

Problems of Genetics. By William Bateson, F.R.S. Pp. ix+258. (London: Oxford University Press; New Haven: Yale University Press, 1913.) Price 17*s.* net.

IN 1901 there came into the possession of Yale University the sum of 85,000 dollars with which to establish an annual course of lectures "designed to illustrate the presence and providence, the wisdom and goodness of God, as manifested in the natural and moral world." The endowment is not incomparable in scope and purpose with the well-known Gifford Trust at the Scottish Universities, but it is perhaps characteristic of a younger nation to prefer the natural world to the moral, and rather to seek for wisdom in the facts of nature themselves than in the philosophic wrappings spun around them by the learned through the ages. Certainly it would appear logical that any appraisement of the Almighty's influence in the natural world should be preceded by some knowledge of nature itself.

The task which Mr. Bateson, as Silliman lecturer, set before himself was a discussion of some of the wider problems of biology in the light of knowledge acquired by Mendelian methods of analysis, and the reader who would get most from the book should have some acquaintance with the phenomena of heredity recently brought to light by the method of experiment. To one with even an elementary knowledge of these phenomena, Mr. Bateson's book cannot fail to prove of absorbing interest. For he has the rare gift of infusing something of strangeness into the commonplace, and in his hands the seemingly familiar takes on an aspect of remoteness which once again provokes curiosity.

Nearly twenty years ago the author laid stress on the distinction between meristic and substantive variation, and to-day he is able to emphasise that distinction. The one is connected with the mechanical side of genetics, with the manner in which material is divided and distributed; while the other deals with the chemical side, with the constitution of the materials themselves. To the mechanical problems of genetics, the problems involved in cell division and in the repetition of parts, two of the earlier chapters in the book are devoted. As the result of an interesting discussion Mr. Bateson formulates the rule that germ cells differ from somatic cells in that their differentiations are outside the geometrical order which governs the differentiation of the somatic cells. With the germ cell begins a new geometrical order—a new individual. As to the process which led to the new order—why the cell divides, and why parts become repeated—we are as much in the dark as ever. Mr. Bateson suggests interesting analogies, such as a series of wind-made ripple marks on sand. Yet what is the wind, the meristic force that acts on cell and tissue? The answer is at present beyond us, but Mr. Bateson is not without hope that when the more highly analytical mind of the trained physicist is brought to bear upon the problem, a solution will ultimately be found. At any rate he is not disposed to follow Driesch in declaring that the expression of the living machine in terms of natural knowledge is a hopeless undertaking.

The greater part of the book is concerned with substantive variation, and it is pointed out that through recent work, genetical and chemical, a start has been made towards a real classification of these phenomena. The structural and colour varieties of the sweet pea, the primula, or the mouse can be related to the wild form in terms of their factorial composition. On an evolutionary interpretation it must be supposed that the new form has arisen by the loss of a factor, or, much more rarely, by the addition of one. Can we suppose that species are related to one another in a similar way? Owing to sterility, experimental evidence is generally difficult to obtain, but there are strong indications that some interspecific crosses will eventually find a simple interpretation in terms of Mendelian factors. To what extent such an interpretation may be widely applied, Mr. Bateson is uncertain, but so far he does not see any fatal objection. Even in the well-known case of the Œnotheras, which comes in for lengthy discussion, an explanation in terms of factors is not yet precluded.

Three chapters are devoted to variation and locality, and several interesting cases are brought forward which will probably be unfamiliar to many readers of the book. The main drift of these chapters is the difficulty of accounting for such cases through the agency of natural selection. "Had the phenomena of local variation been studied in detail before Darwin wrote, the attempt to make selection responsible for fixity wherever found could never have been made."

Perhaps the part of the book which will be read with most interest by zoologists is that devoted to the effects of changed conditions. Considerable stir in the biological world has been created recently by experiments which appear to demonstrate the transmission of an effect produced in an organism by a specific alteration of the conditions under which it normally lives. The best known instances are probably Tower's experi-

ments with the potato-beetle and Kammerer's with various amphibia Mr. Bateson has rendered valuable service by subjecting the accounts of these and other experiments to critical examination, and he argues strongly against accepting any case of the kind yet brought forward on the evidence at present available

Taken altogether, this is the freshest and most original book on the problem of species that has appeared for many a year. Whether the reader sees eye to eye with Mr. Bateson or not, there can be no question about its stimulative value. Even if we are further off from the goal than most biologists suppose, there is the consolation that the road to it is more than ever a road of adventure.

TYPICAL GEOGRAPHY BOOKS.

(1) *A Text-book of Geography.* By A. W. Andrews. Pp. xii + 655. (London: Edward Arnold, 1913.) Price 5*s*.

(2) *The Upper Thames Country and the Severn-Avon Plain.* By N. E. MacMunn. Pp. 124. (Oxford: Clarendon Press, 1913.) Price 1*s*. 8*d*.

(3) *A Leisurely Tour in England.* By J. J. Hissey. Pp. xviii + 400 + plates. (London: Macmillan and Co., Ltd., 1913.) Price 10*s*. net.

(1) MR. ANDREWS'S text-book is particularly important from three points of view. He has paid special attention to climate, to maps, and to typical physical conditions. In reference to climate he makes great use of theoretical sun-force, based upon the mid-day altitude of the sun, of actual isotherms, and of the periods in months when temperatures lie between certain limits, *e.g.* 50°—68° F. From the data which he supplies, the student who works through the exercises provided will have a definite and precise knowledge of the climatic facts of the world, arranged in a systematic way. The presentation is novel, but none the less valuable. The numerous maps are appropriate and useful, and the author emphasises the point that most maps used by students are better called diagrams than maps. It is unfortunate that the methods of shading employed for some of these maps makes it difficult to follow the details closely; and even broad points of resemblance and contrast do not show with sufficient clearness; the maps which appear towards the end of the book are a distinct improvement in this respect.

Countries are described in turn; for example, Russia in Europe is considered in five pages of text; climate, products, and trade are briefly summarised, and the main description is given under the heads of the separate river basins and their drainage regions. This illustration will suffice to show the main emphasis of the book, and to indicate that the outlook is physical, not human, physiographic, not economic. This is distinctly a book for the teacher's book shelves.

(2) Miss MacMunn's brief study is an excellent example of work on a definite region. Simply written, it provides sufficient evidence of a geographical kind to interest readers of all ages, and the general treatment is so suggestive that older students should be able to obtain an accurate knowledge of the district studied, not only from the text, but from the numerous maps, which are clear and precise in their presentation of the facts which they are intended to indicate. It seems rather a pity that opportunity was not taken to indicate on some of the maps the location and range of view of the camera for some of the more important photographic illustrations. The fact that many readers will find it necessary to consult Ordnance Survey maps of the district is not in itself a blemish, for the older student who can use such maps will find that Miss MacMunn's book suggests ideas which may be profitably followed out in connection with the multifarious detail which these maps contain.

(3) Mr. Hissey's book is a delightful record of a leisurely tour in search of the picturesque. He reaped the reward of loitering by the way, and found the unfamiliar in a familiar land in a pilgrimage by means of a trustworthy little motor-car through parts of rural England, than which he can imagine no more delightful touring ground. So the author speaks of his book in the preface, and his work breathes the calm and peaceful delight which he took in the pastoral scenery, the quiet homesteads, the peaceful villages. The charm of the book is increased by the numerous appropriate illustrations. B. C. W.

ORGANIC CHEMISTRY, AND ONE OF ITS APPLICATIONS.

(1) *Organic Chemistry for Advanced Students.* By Prof. J. B. Cohen, F.R.S. Vol. ii. Pp. vii + 427. (London: Edward Arnold, 1913.) Price 16*s*. net.

(2) *The Volatile Oils.* By E. Gildemeister and Fr. Hoffmann. Second edition by E. Gildemeister. Authorised translation by Edward Kremers. Vol i. Pp. xiii + 677. (London, Bombay, and Calcutta: Longmans, Green and Co., 1913.) Price 20*s*. net.

(1) IN the present writer's student days the favourite text-book of advanced organic chemistry was Prof. von Richter's well-known work, which had just been translated into English. Roughly, one might express the difference between that work and Prof.

Cohen's by saying that whilst the former was largely an accumulation of facts, the latter is chiefly an exposition of theories and principles. There is much less recital and much more discussion. The mechanism of the chemical reaction, rather than the properties of the product, is now insisted on; and rightly so, for this aspect of the matter is the more philosophically interesting and scientifically valuable.

In the first chapter, dealing with the valency of carbon, we come at once into a region where speculation and discussion are rife. The author explains the chief theories which have been propounded to account for the existence of bivalent and tervalent carbon, unsaturated groups, labile forms, and so on. He then passes to the consideration of the nature of organic reactions, including such processes as the addition of elements or groups to unsaturated compounds, autoxidation, catalytic reduction and oxidation, condensation, and the formation of chains and rings. The portions dealing respectively with Thiele's theory of partial valencies and with condensation processes will be found especially useful. Indeed, these first two chapters of the work, with their references, might well have served as the basis for the address of the president of Section B at the recent meeting of the British Association.

In chapter iii. we have an exposition of the dynamics of organic reactions. It is satisfactory to note that many of the examples are drawn from the Transactions of the Chemical Society of London—as indeed is the case throughout the book.

Molecular volume, refractivity, dispersivity, magnetic rotation, thermochemistry, and absorption-spectra are next dealt with, and the results applied to problems of molecular architecture. An interesting discussion of the relations between colour and structure follows, and the book ends with an account of the photochemistry of organic compounds.

Occasionally it is not too clear which of two or more theories the author adopts, or favours; but a student who masters the substance of this and the companion volume will be justified in considering himself well grounded.

(2) The first edition of this work has been favourably known for several years to chemists and others concerned with essential oils. To use the translator's phrase, it was "a happy blending of history with chemical science and technology"; and this characteristic is maintained in the new edition. Two volumes, however, are now required, the one under review containing (*inter alia*) the historical matter. This has received additions here and there, but remains substantially as when first published. The authors outline the development of the trade in spices and aromatics during the Middle Ages, and trace the general history of the volatile oils—the essential principles of most spices and aromatic plants—from early Egyptian times onwards. Following this are sections giving the history of the individual volatile oils and of distillation processes. The whole forms an interesting and valuable monograph, enriched with numerous references and quotations; the sketches of ancient distilling apparatus and the photographs of their modern successors are worthy of note for the contrast they offer.

Distillation is a subject closely connected with that of volatile oils, since these are usually obtained by distilling the oil-bearing plants with steam. Not always, however; in certain cases heat destroys the delicacy of the perfume, or the oil does not separate from the condensed water. In such instances the oil is either extracted direct from the flowers with a volatile solvent such as petroleum ether, or absorbed by a suitable fat (*enfleurage*: maceration). These processes are described by the authors in the next chapter, after which the general chemical constituents of the oils are dealt with. The chapter describing these is the longest and most important in the book. All necessary information appears to be given, including numerous structural formulæ, and lists of the plants in which each constituent has been found.

Finally, there is an account of the general physical and chemical methods used in the assay of volatile oils, with notes on adulterants, and two useful analytical tables. The characters of the individual oils are not dealt with in the present volume, but the new edition of "Gildemeister" promises to be the best work on volatile oils which has yet appeared in English. C. S.

OUR BOOKSHELF.

Early Wars of Wessex: Being Studies from England's School of Arms in the West. By A. F. Major. Edited by the late Chas. W. Whistler. Pp. xvi+238. (Cambridge: University Press, 1913.) Price 10*s.* 6*d.* net.

"WESSEX had to face a determined enemy, which was the most important factor in her steady rise to power" (p. 87). "The western Wessex frontier was for two centuries practically the school of arms for England" (p. 91). After the wedge of Anglo-Saxon conquest was driven to the Severn by the battle of Deorham in 577, separating the Welsh of the Cornish peninsula from their kindred, the Welsh kingdom of Dyvnaint (Dumnonia) kept its independence for two centuries. The Cornish kingdom held out for another century. It was the Welsh that kept this famous "school of arms" going, and it took Wessex some 350 years altogether to learn its lessons (p. 83).

Such, in brief, is the "burden" of this erudite but eminently readable book. It is a fine text-book of open-air history, an attempt to write history "writ large on the face of the country" (p. vii). The available documents are read and expounded *in situ*, so to speak. Archæology, traditions, and folklore "assign their true value to records which have hitherto been loosely read" (p. viii). Accounts of the Scandinavian invasions of western England are read, very properly, in the light of northern antiquities. The first Danish invaders allied themselves with the "bottled-up" "One and Alls," and we learn much about peaceful Danish settlements on the coasts of the Severn. Two archæological maps, many plans and diagrams of camps, and a copious index mark the thoroughness and finish which characterise the whole work. JOHN GRIFFITH.

The British Journal Photographic Almanac, 1914. Edited by G. E. Brown. Pp. 1496. (London: Henry Greenwood and Co.) Price 1*s*. net.

To photographers the approaching end of the year and the beginning of a new one is always heralded by the announcement of the publication of this almost indispensable year-book, which is so familiar to them and a natural fixture in their studios. The copious material contained between the two covers and the useful facts embodied in it has made it a book of reference difficult to part with. The issue for this year follows mainly the lines of its predecessors, but new features of course have been inserted. These, to state them briefly, comprise a glossary of photographic terms, which, no doubt, will be helpful to many a beginner in the subject of photography.

Lists are given of the German, French, and Italian equivalents for the chief appliances and operations, and these should be most serviceable to those who study foreign photographic journals and books, but have no technical dictionary at their elbow. The beginner is also favourably treated with an excellent series of reproductions of negatives incorrectly exposed and developed, which should show him more than words can express what he must avoid; the accompanying text will also prove of service. The epitome of progress, novelties in apparatus, formulæ for the principal photographic processes, miscellaneous information, tables, &c., are as full and complete as ever, and the great number of advertisements are a valuable feature of the volume.

Hazell's Annual for 1914. Edited by T. A. Ingram. Pp. cxiii + 592. (London: Hazell, Watson and Viney, Ltd., 1914.) Price 3*s*. 6*d*. net.

In addition to its revision up to November 25 last, this twenty-ninth issue of "Hazell's Annual" contains a section entitled "Occurrences during Printing." It justifies its claim to give the most recent information on the topics of the day. A section running to some forty pages is headed "The March of Science," and provides a summary of progress made in the world of science during 1913. An index containing 10,000 references makes it easy for the reader to find his way about the volume.

LETTERS TO THE EDITOR.

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

The Pressure of Radiation.

With reference to my letter on this subject in NATURE of December 18, the majority of my correspondents complain that, although I may have indicated the possibility of my own view, I have not shown why the simpler relation, that the pressure is always one-third of the energy density, is untenable. As I cannot reply to each individually, I shall be glad if you will allow me space to rectify this omission.

It is generally admitted that the total heat required for the emission (or evolved in the absorption) of unit volume of radiation is the sum of the intrinsic energy density, E/v, and the external work p. By Carnot's principle, this must be equal to $T(dp/dT)$. Whence, if $E/v=3p$, we obtain immediately the fourth power law for full radiation in the usual manner. It would appear, however, by similar reasoning, if E/v is equal to $3p$ for each separate frequency, that radiation of constant frequency should also increase with temperature according to the fourth power law, which is certainly not the case. Either Carnot's principle does not apply, or E/v is not equal to $3p$ for each separate frequency. I have chosen the latter alternative.

It has been shown by Lord Rayleigh, Lorentz, Larmor, Jeans, and others that the electromagnetic equations (from which $E/v=3p$ was first deduced) lead inexorably to Rayleigh's formula,

$$E_\lambda = 8\pi R\lambda^{-4}T/N,$$

without the exponential term, for the partition of energy in full radiation per unit range of wave-length λ. This result appears to be true in the limit for long waves and high temperatures, but is otherwise so hopelessly at variance with experiment as to suggest that something may have been overlooked in the application or interpretation of the equations.

Some of my correspondents point out that Nichols and Hull have already shown by experiment that the pressure of a beam of light is equal to the energy density irrespective of wave-length. According to my theory, the mechanical effect which they measured should be equal to the total energy density, $E/v+p$, as deduced from their energy measurements. Their result is in perfect agreement with my theory, but it is not quite such a simple matter (and may even prove to be impossible) to measure p separately from E/v, which is the experiment that I proposed to attack.

H. L. CALLENDAR.

Imperial College of Science, S.W.,
December 27, 1913.

Atomic Models and X-Ray Spectra.

Mr. H. G. K. Moseley has published in the December issue of the *Philosophical Magazine* a very interesting paper describing his measurements of the wave-lengths of the characteristic X-ray lines of various metals. He has succeeded in calculating the wave-lengths of one-half of the lines he observed, assuming Bohr's atom and supposing the positive charge on the nucleus to correspond to the place of the element in the periodic table as suggested by van den Broek. He concludes that the agreement between calculated and observed wave-lengths strongly supports the views of Rutherford and of Bohr.

It appears to me that Moseley's research really only supports the views of Rutherford and of van den Broek. As I propose to show in detail in a paper to

be published shortly in the *Verhandlungen der deutschen physikalischen Gesellschaft*, the relation between the wave-length and the positive charge may be obtained in a large number of different ways. For the present it may suffice to point out that it may be derived from a simple consideration of the dimensions of the quantities involved.

The frequency ν can only be supposed to depend upon the magnitude of the positive and negative charges Ne and ne, upon the mass of the moving charge m, upon the distance between the charges r, and, if we wish to introduce the quanta, upon Planck's element of action, h. As Nne^2, m, r, and h must be combined in such a way that the dimension of the resulting quantity is that of one finds

$$(NnML^3T^{-2})^x M^y L^z (ML^2T^{-1})^u = T^{-1}, \text{ or}$$

$x+y+u=0$, $3x+z+2u=0$, and $-2x-u=-1$, whence $y=x-1$, $z=x-2$, and $u=1-2x$.

It is interesting to see what assumptions are necessary to produce an approximate agreement with the experimental data if one inserts various values for x.

If $x=0$ we find $\nu = \text{const.}\ \frac{h}{mr^2}$ the constant being of the order unity as Einstein pointed out. Assuming the characteristic X-rays to be due to the movement of a single electron, we must suppose r to be proportional to $1/N$, where N corresponds to the number of free positive charges on the nucleus found by Rutherford and van den Broek. Roughly speaking, this would be the case if the repulsive force keeping the electrons away from the centre were proportional to $1/r^3$, as suggested by Sir Joseph Thomson. If $x=\frac{1}{2}$ we find $\nu = \text{const}\ \sqrt{\frac{nNe^2}{mr^3}}$. This formula is interesting, as it does not contain h, *i.e.* it may be derived from the ordinary laws of mechanics. It also reduces to Moseley's formula if $r \sim 1/N$.

If $x=1$ the formula is $\nu = \text{const.}\ \frac{nNe^2}{hr}$. If one electron is supposed to oscillate, r must again be assumed proportional to $1/N$ to fit the facts. If all $n=N$ electrons oscillate, r must be supposed to be constant. In this case the formula accounts also for the second series of lines which Moseley's formula fails to do. They may be calculated with great exactitude by putting $\nu = \text{const.}\ \frac{N(N-1)e^2}{hr}$, which corresponds to an atom which has lost an electron.

If we put $x=2$ we find $\nu = \text{const.}\ \frac{n^2N^2e^4m}{h^3}$, which is obviously identical with Moseley's formula, if we suppose only one electron to oscillate. The agreement of Bohr's constant with experimental data is not convincing to my mind in view of the large number of arbitrary assumptions in his derivation.

All the above formulæ are independent of the choice of any special model. They are selected so that the expression for ν is successively independent of e^2, h, m, or r. They would seem to prove that Moseley's figures need not be taken to confirm Bohr's views on the constitution of the atom. The only essential assumption common to all of them is that N should correspond to the place of the element in the periodic table approximately as suggested by Rutherford and van den Broek, and it would seem therefore that this hypothesis only can be said to be supported by Moseley's experiments.

F. A. LINDEMANN.

Sidmouth, December 28, 1913.

The Plumage Bill.

SIR HARRY JOHNSTON'S plea for the Plumage Bill in NATURE of December 11 will, no doubt, be considered an acceptable contribution by those who believe they possess the mental altitude to which he was born. I venture, however, to suggest that if he and his friends will leave their high mental estate and descend to the plain facts that business men must consider in this lower sphere, he will be obliged to admit that, like the trade, the educated naturalist has much to learn.

He admits the glaring defects of the Plumage Bill, but welcomes the measure as better than none. If he and his friends are able to conceive nothing more than an admittedly bad Bill, that will have no effect on bird-life, he is scarcely justified in his abuse of those who are willing, and trying to solve the problem of saving both the birds and the trade.

His presumption that none but an educated naturalist knows how the skins are procured, or the approximate habitat of the birds, or their right name in English or Latin, does not raise the controversy to any higher plane. Was he not an educated naturalist who bestowed the name of Apoda upon one of the species of paradise bird, believing it be born without feet? In 1908, before the Select Committee of the House of Lords, did not Sir Harry Johnston's friend, Mr. Buckland, declare that the destruction of birds of paradise was at that time so rapid that the species could not last more than two or three years? I see little more in the article which Sir Harry Johnston quotes from *The Times of Ceylon* than a confirmation of the trade statements that the birds of paradise are collected under a system regulating their killing, and that the family is in no danger of extermination. The article shows the valuable commercial asset that Dutch New Guinea possesses, and that its Government is taking full advantage of it under an adequate system of protection.

Mr. Buckland will be surprised to hear that there are so many birds left that this year's production is likely to result in a trade of about 200,000 skins, but he will perhaps be pleased to know that I do not believe it. Both gentlemen should be more concerned in those beautiful specimens said to fetch as much as 40*l.* or more. These are undoubtedly the rare and disappearing species that have no trade interest, but are eagerly sought after for scientific purposes. Even though they be the last survivors of their kind and need some stronger measures than any existing, in order to prevent their utter extermination, supporters of the Plumage Bill have conceived nothing more than a measure that permits their import until none are left, and also prohibits the import of species that are plentiful.

L. JOSEPH.

Plumage Committee of the Textile Trade Section of the London Chamber of Commerce,
Oxford Court, Cannon Street, London, E.C.
December 17.

MY reply to Mr. Joseph is as follows:—

I only admit the defects of the proposed Plumage Bill in that it is not sufficiently drastic. But I am always one of those who think half a loaf is better than no bread, and that great restrictive or revolutionary measures of legislation are seldom carried all at once. I should like to see British officers and tourists restrained from destroying the wild mammalian fauna throughout the British Dominions; meantime I welcome sporting licences, close times—any measure which may tend to prolong the existence of interesting wild beasts. So although I should prefer a more complete exclusion from this country of the plumage of rare and remarkable wild birds, I am prepared to accept Mr. Hobhouse's Bill as an instalment of protective legislation.

I continue to assert the utter ignorance of their trade and of the sources and correct nomenclature of their goods which characterise the firms trading the skins and plumes of wild birds. The fact that Linnaeus and

other naturalists of the eighteenth century exhibited ignorance of the nature of paradise birds is no parallel and no excuse. Mr. Buckland's reference was to the Great bird of paradise, which, I believe, is not far off extinction. Mr. Emery Stark's figures of 200,000 birds of paradise skins obviously refer to the many species inhabiting Dutch New Guinea and western Papuasia generally. In all there are some eighty-one or eighty-two distinct species of paradise birds, many of them confined to small areas, the majority living—unhappily—under Dutch rule; and about twenty species are nearly extinct by now on the smaller islands owing to the ruthless proceedings of the Malay, Papuan, and half-caste hunters. The females of some species, it must be remembered, are beautiful enough in plumage to be shot for the feather trade; this is also the case with the young males. It is possible, also, that most of the members of this group are monogamous, or that, like the peacocks and other extravagantly beautiful birds, *only the quite adult males* are fit for breeding. However it may be, all trustworthy authorities are agreed that the numbers of the paradise birds throughout Dutch Papuasia have very greatly diminished during the last thirty years, and that species common in Wallace's day are now extinct in this or that island or forest area.

The Government of the Dutch Indies has set on foot no efficient measures of protection—so far as I know, no measures at all, other than the issuing of licences to kill. I visited Holland two years ago to inquire into this matter, and was truly surprised to find the utter indifference with which it was regarded, even by Dutch zoologists; and Holland has produced some very great zoologists within the last fifty years. I deplore this mental lacuna which is, I fear, to be met with also among British biologists. But I am convinced it will disappear with the general spread of enlightenment. The same Dutchmen and Englishmen are exceedingly keen about the preservation of Dutch and British wild birds; they are simply thoughtless as to the rest of the world, forgetting that the new generation of dwellers in the British and Dutch Empires may daily curse the memories of the rulers of to-day who permitted a marvellous fauna of beautiful, wonderful, and harmless creatures to be extirpated solely for the gratification of the blood-lust among our sportsmen or the furnishing of wares for sale to silly women and magpie men.

A correspondent of *The Times* wrote the other day asking that the rose-ringed parrakeets of India might be handed over for destruction to the plumage trade. He must have been a person without a sense of beauty and colour-blind; for if there is, or was, one feature more than another that was lovely in Indian landscapes and old Indian towns it was the flocks of these grass-green, rose-tinted, or blossom-headed parrakeets. "But they ravage the natives' crops," he wrote. Well, I know India pretty well, and at one time spoke Hindustani sufficiently to converse with native landowners and peasants. I have never heard one such person complain seriously of the damage or loss done by these fluttering morsels of loveliness; but I have noted—as Rudyard Kipling and his father have noted—the many pet names in the vernacular for the parrakeets of India, and the native appreciation of their beauty. This is purely a native and a local affair. If the native of India wishes to thin out the parrakeets or other seed- or fruit-eating birds, *let him do so*; but do not permit it to be done for the infamously inadequate purpose of decorating Englishwomen's hats.

I remember in 1895 some British officers in north-west India decided that so many wild peacocks (they were semi-tame) must be "a dam' nuisance" to the native agriculturists and started out to organise a battue. But the battue was the other way about. The natives of the district, losing all restraint at the idea of their beautiful peacocks being slain to please the Sahib-lōg and the Gora-lōg, turned out with long sticks and thoroughly whacked the shooting-party. This episode was one of the many signs of unrest in India which characterised the year 1895. In this instance, if not in the others (for in most cases it was excellent measures of sanitation which provoked ignorant wrath), I thoroughly sympathised with the natives.

Mr. Joseph refers to paradise-bird skins worth in the trade 40*l.* or more, and states that these are eagerly sought after for scientific purposes. What nonsense!—unless he refers to pseudo-science. The true scientific ornithologist has by now in the collections of Britain, Italy, Germany, Holland, and France all the material he can possibly want for the external description of paradise birds. If he desires anything else it is in the way of the bodies of these birds. But even their myology, osteology, intestines—all their anatomy—are by now completely understood. We have, however, to learn much more about their life habits, their eggs, nests, and food. Material in such a quest can only be gathered by a trained scientific observer, such as from time to time is sent out by a learned society or a patron of learning. Scientific men would not go to the plumage-trading firms for such information, for they would not get it, or it would be quite untrustworthy. These firms buy their skins at second-hand, third-hand, fourth-hand, and their ignorance on the subject of ornithology is simply colossal.

I want to narrow the discussion to these unanswerable points. What are the legitimate uses of the skins or plumes of wild birds (excepting such as are carefully protected from diminution by rigid supervision and close times for breeding) in a civilised community—a community civilised enough to appreciate the economic uses of birds and the extreme beauty of birds in a landscape? Do the bodies of the birds I would desire to protect from the plumage-hunter serve as important articles of palatable food? No; except it be in a few instances, so few that they are of no importance in the argument. Do they serve to keep women, especially poor women, warm? No; quite useless for that purpose. Admitting that feathers and plumes do add to the beauty of a woman's costume, are we sufficiently supplied with such by using what we get from birds bred for the purpose or bred or protected for our food supply? Yes. From a hundred species and varieties. In all these circumstances a woman who wants to wear a humming-bird or a parrot's wing or a bird of paradise or egret plume must be depraved, and should not be pandered to and the trade which would live by ministering to such tastes should be closed down without compunction.

H. H. JOHNSTON.

A Palæobotanical Institute at the Royal Botanic Gardens, Kew.

MORE than two years ago there appeared an article in *The Times* (August 24, 1911) the title of which was "A Neglected Science: Fossil Botany and Mining." The chief contents of this article can be summed up as an appeal for the recognition of palæobotany, and was indeed thus named in NATURE of August 31, of the same year. The author of the article in *The Times* criticises "the official neglect of palæobotany in this country." It is admitted that the leadership of some branches of palæobotany is found in Britain, but this is stated to be wholly due to the zeal and

interest of some private gentlemen and to some professors of modern botany who "spend their whole leisure from their professional duties in the arduous labour of palæobotanical research."

But "there is no professorship of palæobotany at any of our universities or colleges. There is no lectureship or readership in palæobotany at any of our universities or colleges; and Cambridge alone has a demonstratorship, which is so ill-paid that it might be thought libellous to state the official salary attached. There is no post of palæobotanist to our Survey. . . . There is no post of palæobotanist at our great national Natural History Museum."

After having shown what has been done for palæobotany at Berlin, Stockholm, and Washington (U.S. Geological Survey), and after having developed the reasons—scientific and economic—why palæobotany should receive official support in Britain also, the author asks: "What should be done?" and supplies the following answer:—

"Much in the future. For the present what is urgently needed are professorships and lectureships at one or two of the universities—a professorship, for instance, in London, which would reach the geological students who go out from the School of Mines to all parts of the world. Then two posts at least should be established at the British Museum of Natural History: one for a palæobotanist of standing and repute who has travelled, who with a wide knowledge of the subject could fitly represent the science, and who, keeping abreast of the subject, could direct the work of a junior, and ultimately of several juniors. In our museum at present there are many specialists on animal fossils, and an important department of animal palæontology, while the palæobotanical department does not exist, and though there is a valuable collection of fossil plants the authorities only get in outside specialists from time to time to write monographs on them.

"What is ultimately wanted for the science is a properly equipped institute of palæobotany, which should represent all its sides—with a well-arranged museum, an academic and also economic side to its activities. The immediate need for the foundation of some posts in palæobotany should give trustees and governors food for thought, and might give some millionaire, anxious to be of service to his day and generation, an opportunity to do a unique and serviceable deed in endowing this neglected but important science."

The same appeal for the recognition of palæobotany as in the article referred to has recently been taken up again by Dr. Marie C. Stopes, in a lecture delivered at University College (University of London), on October 17, and published in an abridged form in NATURE of November 20, 1913. To the question what the palæobotanist in the future will demand the following answer is given:—"That in at least *one* institution in each civilised country there shall be a recognition of his science and adequate accommodation for it," after which the plan and details for such an institution, according to the opinion of Dr. Stopes, are fully developed for which the number of this journal cited should be consulted.

It is earnestly to be hoped that this proposition will be realised, and at the same time realised in the right way. As keeper of the palæobotanical department of the State Museum of Natural History (Naturhistoriska Riksmuseum) at Stockholm, which was specially mentioned in the article referred to, I may be permitted to express my opinion regarding the proposed palæobotanical institution. I have, it is true, no idea of the present position of the question here discussed, nor if there is any possibility of the realisation of the plan proposed below. But I hope that my British fellow-workers will not consider my suggestion as an intrusion, since they are probably aware of my deep interest in British palæobotany, by which I have profited so much myself during repeated visits to Britain.

I quite agree with Dr. Stopes that the establishment of a properly equipped British institute of palæobotany is a most urgent need, which ought not to be postponed. But in order to give such an institute an opportunity for working under the best conditions possible, I consider it almost necessary that it should be established in connection with the Royal Botanic Gardens, Kew. The reason for such a connection is simply this: that the scientific study of palæobotany signifies a constant and repeated comparison of the fossil plants with the recent ones. For the botanical determination of Palæozoic and Mesozoic plants the palæobotanist must compare the recent Pteridophytes and Gymnosperms, especially the tropical ones; and there exists no better opportunity than in the Kew Gardens, where the hothouses, temperate houses, museums, and herbaria offer the most excellent and complete materials possible for such work. The same holds true for the determination of dicotyledonous leaves of the Cretaceous and Tertiary. The determination of those leaves is a most difficult task, for which an extensive and repeated comparison with the leaves of trees and shrubs of the arboretums and gardens, of the temperate houses and hothouses, and, ultimately, of the herbaria is necessary. There is no other place in the United Kingdom which offers such excellent opportunities for this work as the Kew Gardens; and the same holds true for the determination of leaves, fruits, and seeds from the Quaternary also. It therefore seems evident that the Kew Gardens are the right place for the establishment of a palæobotanical institute, the headquarters for the British palæobotany of the future. A. G. NATHORST.

Stockholm, December 12, 1913.

Electrodeless Spectra of Hydrogen.

WHILE making experiments on the apparent production of neon and helium during electric discharges, I have noticed an effect which may be of interest to spectroscopists. A powerful oscillatory discharge is produced in eight or nine coils of wire from two Leyden jars, with a spark-gap of about 2 in. in parallel, connected to a large coil which is run from the main supply. Set in the coils of wire is a glass bulb of about 300 c.c. capacity provided below with a small bulb containing cocoanut charcoal, and connected by a side-tube and tap with a mercury pump. After evacuating, heating, and "washing out," the bulb with hydrogen, when pure hydrogen is admitted at a fairly low pressure and the discharge is passed, the glow is bluish in colour, and shows both hydrogen and mercury spectra; but if the charcoal bulb be cooled in liquid air so that mercury vapour and any other impurities are completely removed, the glow is of a brilliant rose colour, and shows only hydrogen lines. If the pressure is reduced, however, to a value somewhere below 1 mm., there appears in the middle of the rose ring a fairly bright blue zone; and whereas the former shows both the simple and complex spectra of hydrogen, the blue zone shows nothing but the elementary line spectrum; and, moreover, the blue line $\lambda 4861$ is more intense than the red line. Further reduction of pressure causes the obliteration of the blue zone by the spreading inwards of the rose ring.

As I have not found any mention of this isolation of the primary spectrum, with weakening of the α line, in pure dry hydrogen, the fact is possibly worth recording. IRVINE MASSON.

University College, London, December 11.

BIRDS, GAME, AND TREES.[1]

MR. KEARTON'S books on British birds (1) are so well, and deservedly, known, that the new edition of his work entitled "British Birds' Nests" calls for only a brief notice. The original edition first saw the light in the autumn of 1895, and was the first book of its kind to be illustrated throughout by means of photographs taken direct from nature, and was declared by the late Dr. Bowdler Sharpe to "mark a new era in natural history." This was followed in 1891 by another volume, entitled, "Our Rarer British Breeding Birds." The present revised and enlarged edition of the first work contains the best of the pictures that appeared in the pages of the second, together with numerous photographs secured during the intervening years. To give an idea of the time and labour expended in gathering materials for this book, it may be mentioned that Mr. Richard Kearton, with his brother, Mr. Cherry Kearton, to whom, we understand, most of the photography is entrusted, have travelled more than thirty thousand miles and exposed more than ten thousand plates to secure the necessary illustrations of nesting sites and birds. In addition to the photographs, the book is illustrated with fifteen coloured plates of eggs.

Within the last ten years or so, the question of the preservation of wild animals from extermination at the hands of sportsmen and traders, who serve the fur and feather markets of the world, has pushed itself insistently to the front, and Dr. Hornaday's powerfully worded appeal (2) for the instant passing of legislative measures to arrest the imminent extinction which threatens some of our finest mammals and most beautiful birds—an appeal backed by incontrovertible statistics—is addressed to the sportsmen and governing bodies of every civilised state in the world. Much has been attempted already in this direction both in America, Africa, and Australia; but Dr. Hornaday's investigation of the question so far as Canada and the United States are concerned has revealed "a mass of evidence proving that . . . the existing legal system for the preservation of wild life is fatally defective," and that those who imagine the protective measures to be effectively operative are living in a fool's paradise. In a great measure this is due to the circumstance that fully 90 per cent. of the protective laws have been practically dictated by the killers of the game, with the result that in all but a few instances "open seasons" for slaughter have been carefully provided for so long as any game remains to be killed. According to Dr. Hornaday, whose authority in such a matter no one will be prepared to dispute, the point has now been reached where a choice has to be made between the enforcement of long closed seasons and a gameless continent!

An osprey and its eyrie. From "British Birds' Nests."

[1] (1) "British Birds' Nests: How, Where, and When to Find and Identify Them." By Richard Kearton. Illustrated from Photographs by Cherry and Richard Kearton. Pp. xii+520+plates. Revised and Enlarged Edition. (London: Cassell and Co., Ltd., 1913.) Price 14*s.* net.

(2) "Our Vanishing Wild Life: Its Extermination and Preservation." By Dr. W. T. Hornaday. Pp. xvi+411. (New York: Charles Scribner's Sons, 1913.) Price 1.50 dollars.

(3) "Trees in Winter: Their Study, Planting, Care and Identification." By Dr. M. F. Blakeslee and Dr. C. D. Jarvis. Pp. 446. (New York: The Macmillan Company; London: Macmillan and Co., Ltd., 1913.) Price 8*s.* 6*d.* net.

The first part of the book tells the pathetic tale of the causes and factors of extermination, mainly of birds and mammals, in process all over the world, from the song-birds of Europe and the Southern States of America, to the pheasants of the east and the big game of Africa. In the second part he deals with the economic and other reasons for the preservation of species, with the laws that should be passed to achieve that end, with game reserves, &c. The book is well illustrated with figures of many of the interesting species threatened with extermination, and with maps showing their past and present distribution.

"Trees in Winter" (3) is essentially a work on arboriculture. By the term winter the authors mean that period when the tree is in its resting condition, a period which may be considered to extend from the shedding of the leaves in the fall to the bursting of the buds in the spring, which varies for different trees in different localities. In the north-eastern United States, for instance, it may begin as early as the latter part of September, and may extend even into the middle of May.

The subject-matter is divided into two parts. Part i. deals with the buying, planting, and care of trees mainly during their dormant condition, but it also contains much valuable information, and many important hints on spraying and the treatment of fungus growths and insect pests during the growing season. It was written primarily for the use of those who possess trees of their own in gardens or parks, and not for a municipal tree-planting commission. Nevertheless, it will be of inestimable service to those responsible for the well-being and upkeep of trees in the streets and public squares within city precincts. This part was specially written at the request of the publishers as an economically useful addition to part ii., the material of which first appeared in pamphlet form as a bulletin of the Storrs Agricultural Experiment Station, and proved in such demand, especially for use in schools, that it seemed desirable to issue it in book form, and thus render it more widely available than would be the case if its circulation were restricted to the limitation of a State publication. This part deals with the identification of trees. It leads off with an analytical key to the genera and species; and this is followed by detailed descriptions of the species, systematically arranged, every species being illustrated by photographs showing its mode of growth, its twigs, fruit, and other structural details.

Although the trivial names employed are not always the same as those used in England—what we commonly know as the plane tree, for instance, is called the sycamore—this fact will in no way detract from the value of the book to arboriculturists in this country, because the admirable descriptions and pictures make confusion of the species impossible.

R. I. P.

THE MINERAL RESOURCES OF THE UNITED STATES.[1]

THE record of the annual mineral production of the United States has now increased in size until it occupies two large volumes of 2242 pages in all. These form a storehouse of information concerning a number of matters connected directly or indirectly with the mineral industry of America, whilst statistics of, and information about, the production of minerals in other parts of the world are given for the purpose of comparison. The methods are the same as those employed in previous years, one of the two volumes being devoted to the metalliferous minerals and the other to the non-metals. From the economic point of view the latter are the more important, the value of the coal production of the United States being nearly one-third of the total value of the whole of the mineral products, this latter amounting to the huge sum of close upon 400,000,000*l*. As the population of the United States is just about 92 millions, the annual mineral production amounts to well over 4*l*. per head of the population.

The above total shows a small decrease, equal to 2·65 per cent., on the value of the production in 1910, in which latter year the record value attained in 1907 had again been nearly reached. Practically the whole of the above drop was due to a decline in the value of the pig-iron production, the statistics for the metalliferous minerals being based, as in previous years, upon the metals produced from the ores, and not upon the ores themselves. The production of pig-iron in 1911 was 23,649,547 tons, as against 27,303,567 tons in 1910, a decrease of 13·3 per cent., whilst the output of iron-ore declined simultaneously from 51,155,437 tons to 40,989,808 tons, equal to a decrease of 23·4 per cent. The only cause that can be assigned for this decrease was over-production in 1910, which necessarily caused a decreased demand in 1911. It is quite certain that this decrease was in no way due to natural causes, the capacity of the mines to produce the requisite supply of iron-ore being in no way diminished.

The output of gold was practically unchanged, whilst that of silver showed a moderate increase; in the same way there was but little difference in the copper production, whilst in the production of lead and zinc increases were shown, though in no case of any great importance.

The coal output in 1911 was but little less than in 1910, namely, just over 496 millions of tons, as against about 501½ millions of tons in 1910. In 1911 the production of petroleum, on the other hand, showed an increase, namely, 220½ millions, as against 209½ millions of barrels.

In a similar way fluctuations, though not to any marked extent, occur in the less important mineral products, but the net result left by the perusal of these statistics is the distinct impression

[1] "The Mineral Resources of the United States, Calendar Year 1911. Part i. Metals. Pp. 1013. Part ii. Non-metals. Pp. 1224+maps. (Washington: United States Geological Survey, Government Printing Office, 1912.)

that the mineral industry of the United States is in a sound and flourishing condition, and that the vast mineral resources of that great country are being steadily and profitably developed.

As to the volumes in which the results of these operations are chronicled, it is impossible to do more than express admiration for the care and attention bestowed upon them, and we can only wish that we had in this country a department capable of doing anything like similar justice to our own British mineral industry. H. L.

SIR TREVOR LAWRENCE, BART.

SIR TREVOR LAWRENCE, late President of the Royal Horticultural Society, and sometime Treasurer of St. Bartholomew's Hospital, died at his seat at Burford, Dorking, in his eighty-second year, on Monday night, December 22. Born on December 30, 1831, Sir Trevor was educated at Winchester, and afterwards at St. Bartholomew's Hospital, where his father was one of the staff and one of the teachers. After qualifying as a medical man, Trevor Lawrence joined the Indian Medical Service in 1853, seeing much active service during the Mutiny. In 1863 he retired from India, and in 1867 succeeded his father as second baronet. In 1869 he married Elizabeth, daughter of the late Mr. J. Matthew, of Burford, Dorking. From 1875 till 1892 he sat in Parliament.

Always interested in plants, Trevor Lawrence became during his Indian service a keen and successful gardener. This taste and talent he exercised and developed on his return to England, and although he was doubtless best known in gardening circles as an orchid grower, there was no particular branch of horticulture in which he was not keenly interested and in which he was not highly successful. Even in that especial branch of the craft in which he was deservedly famous—the cultivation of orchids—his innate love of plants for their own sake, which he appears to have inherited from his mother, was very conspicuous. In addition to one of the finest private collections of showy sorts, Sir Trevor had at Dorking probably the largest private collection of the less conspicuous, but very often more scientifically interesting genera and species from both hemispheres.

There was therefore everything that was appropriate in the election of Sir Trevor, in 1885, to the presidentship of the Royal Horticultural Society. But on Sir Trevor's part there was also a strong strain of chivalry and gallantry in his acceptance of this, at that time, thankless post. The Society was at a miserably low ebb, with an inadequate membership and still more inadequate finances. Supported in the struggle which ensued by a number of far-seeing and courageous colleagues, both against adverse external circumstances and against opposition from within the Society, the difficulties were overcome, and the assured financial position in which the Royal Horticultural Society stands to-day has been largely due to the steadfastness of purpose, tact and wisdom of Sir Trevor Lawrence during the presidentship of twenty-eight years, which ended with his retirement from that position on April 1 last.

Almost as great as the services he was able to render to gardening were those which Sir Trevor rendered to his own old hospital, the treasurership of which he was invited to undertake when he retired from Parliament. This post he held during twelve years of financial and other difficulties. The qualities which had stood him in such good stead in the Royal Horticultural Society enabled him here again to inaugurate much that was useful in the matter of extending the scientific equipment of the hospital, of securing for the staff some share in its management, and of establishing a sounder administrative policy with regard to its property. As a member of the council of King Edward's Hospital Fund, Sir Trevor was able to do much for the cause of hospitals generally.

A well-known and skilled collector of Chinese and European porcelain and the possessor of one of the finest collections of Japanese lacquer in Britain, Sir Trevor placed students of the latter under much obligation by printing for private circulation in 1895 a finely illustrated catalogue of his collection. A host of exquisite courtesy, and a counseller of great sagacity, Sir Trevor's death will be greatly mourned by a wide circle of friends.

A NEW BRITISH ANTARCTIC EXPEDITION.

THE science of geography will enlarge its bounds if the expedition to the South Pole, planned by Sir Ernest Shackleton, ends successfully. A start is to be made next October from Buenos Aires, and the plan proposed is to cross the south polar continent from the Weddell Sea, on the Atlantic side, to the Ross Sea, touching at the South Pole *en route*—a distance of some 1700 miles. Altogether the party will number forty-two, twelve being actual explorers, and the remainder the crews of the two ships that are to support the venture, one on each side of the Antarctic continent. Of the explorers, six expect to cover the whole ground from the point of landing on the Weddell Sea to the point of embarkation on the Ross Sea. The other six will be divided into two groups: one, composed of a biologist, a geologist, and a physicist, will probably remain at an experimental station on the Weddell Sea side; the other party of three will be told off to explore the land to the east, which is at present entirely unknown. These two wings of the expedition will eventually be taken back to South America, while the party which will accompany Sir Ernest across the continent is to be met at the Ross Sea base by the second ship from New Zealand, whither it will take them.

For the outward journey the *Aurora* has been chosen. Both this and the sister vessel will depend

for fuel on oil, and not on coal. The advantage of this arrangement of being free from ballast need scarcely be expatiated upon; when the oil is used up, water can be pumped into its place. Both ships will also be fitted with cages and tanks for bringing home live seals and penguins. Moreover, the *Aurora* will have a gyroscopic compass, which will therefore not be affected by magnetism in the ship. The expedition will be fitted with a wireless installation—one of about 500 miles' radius. But more useful still, two sledges driven by aëroplane propellers, with aëroplane engines, and an aëroplane with clipped wings to glide over the ice, are being taken. The team of trained dogs numbers 200. The expedition will be equipped for two years, and is to be known as "The Imperial Antarctic Expedition." The minimum cost is 50,000*l.*, and this amount has been provided by the generosity of a friend. In order to equip the expedition with full efficiency, however, 60,000*l.* or 70,000*l.* would be required. No public appeal is to be made for subscriptions to make up the additional amount, but contributions for this purpose will be welcomed and will be of service.

The following statement as to scientific work contemplated was made by Sir Ernest Shackleton on Monday:—

No one knows whether the great plateau dips gradually from the pole towards the Weddell Sea, and no one knows whether the great Victoria chain of mountains, which has been traced to the pole, extends across the continent and links up with the Andes. The solving of the problem is of intense interest to geographers all over the world, and the discovery of the great mountain range, which we assume is there, will be one of the biggest geographical triumphs of the time.

The geological results will be of the greatest interest to the scientific world. The expedition will at its winter quarters make geological collections, also typical rocks will be taken on the journey if we come across exposed rocks when crossing the mountain ranges. One ship will land parties for the purpose of making geological collections on the west side of the Weddell Sea, and the ship will at the same time trace, if possible, the continuation of Graham Land southwards.

The expedition will take continuous magnetic observations from the Weddell Sea right across the pole, and the route followed will lead towards the magnetic pole and make an ideal method of determining the general dip of the magnetic needle. This magnetic work has a direct bearing on economic conditions, in that an absolutely true knowledge of magnetic conditions is of use to ships in navigable waters. I also propose to set up a magnetic observatory at winter quarters and take continuous magnetic observations throughout the winter. On my last expedition we could only take field magnetic observations, as, owing to lack of money in the first place, I could not afford to provide a large magnetic equipment, though we did important work, as one of the parties reached for the first time the south magnetic pole.

The meteorological conditions would be carefully studied, and would help to elucidate some of the peculiar problems of weather that at present are only dimly recognised as existing. Continuous meteorological observations, both at winter quarters and on the journey across, are of extreme importance, and the results can be correlated with the observations of the last three expeditions in the Antarctic.

Biological work will be thoroughly carried on, and the distribution of fauna and plant life will be studied. Both ships will be equipped for dredging and sounding.

All branches of science will be most carefully attended to, and the net result scientifically ought to be a large increase to human knowledge, but, first and foremost, the crossing of the polar continent will be the main object of the expedition.

NOTES.

THE Academy of Sciences of Bologna has elected Prof. Silvanus P. Thompson as a corresponding member in the class of physical science.

AT the last meeting of the Academy of Sciences in St. Petersburg Sir William Ramsay was unanimously elected an honorary member of the academy; he was previously a corresponding member.

SIR HOWARD GRUBB, F.R.S., has been appointed scientific adviser to the Commissioners of Irish Lights, in succession to the late Sir Robert Ball, who held the position for the past twenty years.

IN a flight from the naval aërodrome at Fréjus, France, on December 27, M. Legagneux, succeeded in reaching a height of 20,300 ft., which is the greatest altitude yet attained with an aëroplane.

THE next grants from the Elizabeth Thompson Science Fund will be made in February, 1914. Applications should be sent to the secretary, Dr. Charles S. Minot, Harvard Medical School, Boston, Mass., before February 1.

WE regret to see the announcement of the death, on December 26, at fifty-three years of age, of Mr. W. Popplewell Bloxam, formerly professor of chemistry in Presidency College, Madras, and the author of a number of reports and papers on the production and chemistry of indigo.

MR. W. LAWRENCE BALLS, botanist to the Egyptian Government, Department of Agriculture, has just left the service of the Government, his agreed term of years having expired, and is returning to Cambridge to work up unpublished data on cotton accumulated since his appointment to the staff of the Khediviaï Agricultural Society as cryptogamic botanist in 1904, and in the post he has now vacated.

MEN who have been trained at the Royal Botanic Gardens, Kew, occupy posts in botanic gardens in most parts of the world. The following new appointments of members of the gardening staff at Kew are announced in the *Kew Bulletin*:—Mr. G. S. Crouch, to be assistant director of horticulture in the Egyptian Department of Agriculture; Mr. T. H. Parsons, to be curator of the Royal Botanic Gardens, Peradeniya, Ceylon, in succession to Mr. H. F. Macmillan, who has been appointed superintendent of horticulture in the department of agriculture, Ceylon; Mr. C. E. F. Allen, to be curator of the Botanic Garden, Port Darwin, Northern Territory, South Australia, in succession to Mr. N. Holtze, deceased.

PROF. E. B. TITCHENER asks us to announce that a prize of one hundred dollars is offered for the best paper on the availability of Pearsons formulæ for psychophysics. The rules for the solution of this problem have been formulated in general terms by Dr. W. Brown. It is now required (1) to make their formulation specific, and (2) to show how they work out in actual practice. This means that the writer must show the steps to be taken, in the treatment of a complete set of data, for attainment in every case of a definite result. The calculations should be arranged with a view to practical application—*i.e.* so that the amount of computation is reduced to a minimum. Papers in competition for this prize will be received not later than December 31, 1914, by Prof. E. B. Titchener, Cornell Heights, Ithaca, N.Y., U.S.A. Such papers are to be marked only with a motto, and are to be accompanied by a sealed envelope, marked with the same motto, and containing the name and address of the writer. The prize will be awarded by a committee consisting of Profs. William Brown, E. B. Titchener, and F. M. Urban.

THE use of distributed inductance in telephone cables which was advocated many years ago by Mr. Oliver Heaviside, and was put into practice more recently by Pupin, has not only resulted in great economies in copper on long-distance telephone lines, but also has enabled submarine telephone cables to be brought into use for far greater distances than formerly. The most recent achievement in this direction is the laying last month of a cable sixty-four nautical miles in length between Nevin, in Carnarvonshire, and Howth, about eight miles from Dublin. Hitherto telephony between England and Ireland has been carried on through a cable twenty-four nautical miles in length between Port Mora (near Portpatrick) and Donaghadee, in connection with long land lines on both sides of the Channel. The new cable, which was manufactured by Siemens Bros. and Co., has four conductors weighing 160 lb. per nautical mile, and insulated with a special gutta-percha with a low leakance, weighing only 150 lb. per nautical mile. At distances of one nautical mile apart, inductance coils are inserted in each of the four cores. These are long narrow double-wound coils, each with an inductance of about 100 millihenrys. Their construction is such that they are enclosed in the gutta-percha covering in the same way as the cable itself, and the armouring is carried right over them.

IN the South American Supplement of *The Times* for December 30, attention is again directed to the possible effects of earthquakes on the Panama Canal. While retracing much of the ground covered in our former Notes on the subject, Prof. J. Stuart refers to several points that are worthy of consideration. The general belief as to the safety of the massive concrete walls of the locks is based on the assumption that the locks have been laid upon solid rock. This is the case with the locks at Pedro Miguel and Miraflores, but those at Gatun are founded on beds of argillaceous sandstones, which were first described as indurated clays. Prof. Stuart points out that the fears as to the Gatun dam being opened by fissures are probably groundless, for the San Leandro dam which stores the water supply of Oakland was uninjured by the San Francisco earthquake. He refers in conclusion to the possible effects of the excavations. More than 200 million cubic yards of material have been removed from the various cuttings and deposited on the dams and elsewhere, and he suggests that this redistribution of stresses in the earth's crust might facilitate the occurrence of earthquakes.

THE English Forestry Association, of which Lord Clinton is president, and Mr. M. C. Duchesne (Farnham Common, Slough, Bucks) secretary, proposes to hold a forest exhibition in London in 1914. The object of the exhibition is to encourage English timber industries. Commercially the private forest owner cannot usually hope to obtain the rate of interest he looks for, on anything but short-rotation copse, and it is exactly underwood that has fallen so disastrously in price. The English Forestry Association has strong hopes of reviving the failing industry in wooden barrel hoops. It seems possible also to get back to better prices for firewood. By burning firewood in a properly constructed stove a heating power can be obtained equal to that of coal in the ordinary domestic fireplace—an open stove with the fire showing, and a healthy mixture of both radiant and convection heat. If such stoves came into use there would be a better demand for firewood. But the experience of other countries shows that it is the working with a large scheme of State forestry that is the saving feature of private forestry, and the forestry exhibition would help to direct attention to the fact that the Development Commission, after three and a half years, has failed to carry out its Act and initiate State forestry in Britain, while the slow progress in Ireland is exciting adverse comment.

MAJOR H. G. JOLY DE LOTBINIÈRE has contributed to *The Quarterly Review* for October a valuable and timely article on the position of forestry in England and abroad, in which he reviews the principal timber resources of the world, and the steps that have been taken in England and elsewhere to provide for the future. As he points out, experts in every country are agreed that the world's supply of timber is rapidly diminishing, and that unless vigorous steps are taken in the afforestation of suitable waste lands a shortage of material must be experienced long before the close of the present century. The author indicates in a general way the lines on which the work of afforesting the sixteen million acres of mountainous and heath land in this country should be proceeded with, and urges the necessity for immediate action.

THE trustees of the British Museum have acquired recently a unique gold coin of extraordinary interest. It is the only known example of the gold coinage of the Anglo-Saxon King Offa (A.D. 757–96); and its value lies in the fact that, though struck by a Christian King, it bears a Mohammedan inscription in Arabic. Offa agreed to pay a tribute in gold of Peter's Pence, and he probably used the predominating gold currency of his day as the best model for his purpose, adding the inscription "Offa rex" to that

already existing on an Arabic dinar which was coined about twenty years before his time.

THE volume of the Transactions of the Bristol and Gloucestershire Archæological Society for 1912 is devoted to a descriptive catalogue of the printed maps of Gloucestershire, 1577–1911, by Mr. T. Chubb, of the Map Room, British Museum. The series begins with the map dated 1577 in Christopher Saxton's "Atlas of England and Wales," published in 1579, and is followed by that by Peter Keer, in his collection of twenty-eight maps of his "Counties of England and Wales," 1599. Thence the series of maps are continuous down to the present day. Among recent catalogues of county maps those by Sir H. G. Fordham for Hertfordshire, Mr. W. Harrison for Lancashire, and Mr. T. Chubb for Wiltshire are the most important. Mr. Chubb's catalogue is an excellent piece of work, and is provided with an admirable series of reproductions of the more important maps. It is to be hoped that other local archæological societies will follow this model in cataloguing the maps of the English counties.

THAT the use of coloured photography will prove to be an important addition to the resources of the anthropologist is clearly proved by the admirable series of photographs of the pagan races of the Philippine Islands, illustrating a paper on these people by Mr. Dean C. Worcester, in the November issue of *The National Geographic Magazine*. He gives a useful account of the relations between the American authorities and these primitive tribes, and of the attempts which are being made to bring them within the pale of civilisation by roads, schools, police, and the regulation of trade. The danger is that the process of reclamation may prove too effective, and that as they become civilised they will degenerate and decay. This consideration is no doubt present in the minds of the authorities, and they are unlikely to press our modern civilisation on these races further than is consistent with their preservation.

A REPORT of sleeping sickness in the Island of Principe, by Surgeon-Captain Bruto da Costa, has been translated into English by Lieut.-Col. Wyllie, and published by Messrs. Baillière, Tindall, and Cox. It is believed that neither the disease nor the transmitting fly, *Glossina palpalis*, are indigenous in the island, but that the fly was introduced about 1825 with cattle from the gaboon. Atoxyl was found useless either as a prophylactic or as a cure of the disease; it was useful only as a tonic, prolonging life in animals experimentally infected. It is claimed that a considerable decrease in the incidence of the disease has been effected by measures consisting mainly of draining swamps, felling timber, clearing the undergrowth, and exterminating pigs in the regions infested by the tsetse-flies. It is well known that *G. palpalis* breeds near water, but the author suggests that it cannot do so under exposure to the direct light and heat of the sun, hence the importance of keeping the borders of marshes and brooks free from all vegetation or overhanging shade. The pigs are believed to afford the chief sustenance of the tsetse in the bush, and also to carry the flies about from place to place.

IN a memoir entitled "Botanical Features of the Algerian Sahara," issued as Publication No. 178 of the Carnegie Institution of Washington, Dr. W. A. Cannon gives an extremely interesting account of his observations in southern Algeria and the western portion of the Sahara. The chief object of his tour, which extended over about six months, and included a journey of about a thousand miles through the more arid portions of the country, was to investigate the climatic and soil conditions of this region with special reference to the root-habits of the more striking species of the flora. The author's work on desert plants in North America enables him to draw interesting comparisons between the widely separated arid regions of Arizona and Algeria, and the concluding portion of this valuable memoir, which is illustrated by thirty-six fine collotype plates, gives one of the clearest and most complete accounts of desert vegetation that has yet been published. One of the most striking results of Dr. Cannon's investigations is his demonstration of the fact that, contrary to what might have been expected, the prevailing type of root in desert plants is neither that with a deep main axis (tap-root) nor that which spreads out horizontally near the soil surface (as found in most Cacti), but a generalised type which is adapted to a wider range of conditions. The Algerian desert is more intensely arid than Arizona, and while fleshy plants like the Cacti are a striking feature of the North American deserts, such plants are entirely absent in southern Algeria.

A PAPER by Mr. T. Thorne Baker, read on December 10 before the Royal Society of Arts includes an account of physiological effects of high-frequency currents. It was stated that the upper part of the plant is negative electrically as compared with the roots, and therefore the minute hairs on the leaves and stems would act as collectors to collect atmospheric electricity, which is usually positive in character. The fact that the plant itself acts as a battery, and possesses two poles of opposite sign, was taken to indicate that these feeble differences of potential are of intrinsic use in the natural processes of the plant, and it was stated that increase of growth can be obtained by the electric current. Experiments were described showing the effect of electric discharge on various organisms. The red variety of the American gooseberry blight was not killed by the discharge except where there had been a preliminary treatment with soluble sulphide. Cheese mites, however, were readily killed. Other results were quoted showing the effect of electric stimulus on animal life. It was stated that chickens will grow under such stimulus at about double the normal rate, whilst the mortality is considerably less than usual. Considerable care, however, is necessary in adjusting the ratio of current to voltage, the frequency of oscillations, and the quantity of electricity to the dimensions of the culture house.

THE report of the Behar Planters' Association Indigo Research Station at Sirsiah for the year 1912–13, recently received, possesses the interest of being the last of its series. It includes a brief recapi-

tulation by Mr. C. Bergtheil of the work done at this station during recent years, as well as an account of the work of the year under review, followed by an appendix of much interest by Mr. F. R. Parnell, reviewing the botanical work carried out at Sirsiah since October, 1909, for which he has been responsible. This work, it is explained, has been mainly devoted to the improvement of the plant grown, more especially in the direction of the selection of pure lines of the already cultivated plant possessing greater economic value than the ordinary mixed crop. This review of work done will repay perusal, and the reader will recognise in it a modest record of good work faithfully and conscientiously performed. To those, however, who at a time when the natural indigo industry as a whole is being hardly pressed by the competition of the synthetic indigo-maker, find their sympathies still with the Behar planter, the text of this ultimate Sirsiah report will supply food for thought that is not altogether comforting. Of the two Indigoferas that are mainly grown in Behar—*I. sumatrana*, which displaced *I. articulata* about a century ago, and *I. arrecta*, the introduction of which is a matter of only a dozen years ago—a rather disquieting account is given. As to the former, there is a record of miserable crops traceable, Mr. Bergtheil believes (p. 6), to the sowing of inferior seed; as to the latter there is a disheartening history by Mr. Parnell (p. 24) of "disease," which, so far, it has not been possible to attribute to fungal, insect, or bacterial attack, or to explain as the result of defective culture.

IN the Journal of the Franklin Institute (October, No. 4) appears an important paper by Mr. Frank K. Cameron, of the Bureau of Soils, U.S. Department of Agriculture, on kelp and other sources of potash. After briefly reviewing the fertiliser problems of the United States, Mr. Cameron gives an account, illustrated by many photographs, of the movement recently started to utilise the giant "kelps" of the Pacific coast as a source of potash, which promises to develop into a very large and important industry. These giant kelps occur in numerous beds or groves, often of a vast extent, and are characterised by an exceptionally high content of potassium, five times on the average that of the better-known Atlantic algæ. They are said to form "an ample, perennial possible source of potash for the present needs of the United States." Until recently the harvesting of the kelp on a sufficiently large scale to make it a commercial possibility appeared the chief difficulty, but ingenious mechanical harvesters have been devised to overcome this. The costs of harvesting and utilisation are gone into in some detail, and it is pointed out that several soundly financed companies have already started operations on the large scale from which good results are anticipated.

IN an interesting article contributed to the Proceedings of the R. Academy of Amsterdam (vol. xv.) by Dr. C. Braak an attempt is made to show that by means of the connection perceptible between barometric pressure and rainfall in the Indian Archipelago it is possible to make "a long-range weather forecast for the east monsoon in Java." With respect to deviations of air-pressure, the author states that Java has a special advantage, because the variations of climate there are determined by the variations of pressure in North Australia, the latter being characterised by an extraordinary regularity. A barometric curve plotted for several years for Port Darwin shows some very regular series of waves, from which it appears that the time which elapses from minimum to maximum is one year, from maximum to minimum two years, the period being exactly three years. These regular periods are particularly adapted to forecast air-pressure a considerable time in advance. On the principle upon which the scheme has been based it is claimed that it would have been possible to forecast the sign of the rainfall departure in Java for many of the years dealt with in the investigation. Attention is directed to the fact that in the Port Darwin curve the epoch of the maximum and minimum seems to be entirely controlled by the terrestrial seasons; cosmical influences, instead of causing barometric oscillations, seem to disturb them (namely during the sun-spot maximum).

THE Journal of the Institution of Electrical Engineers for December 15 contains an extremely interesting paper by Mr. S. Evershed on the characteristics of insulation resistance. Mr. Evershed, as the result of a long course of experimental research, has come to the conclusion that the conductance through insulators of the "absorbent" class, such as impregnated paper, fibre, or cloth, is entirely due to the moisture which they contain. Curves are given to show that the insulation resistance falls as the voltage increases—or, as Mr. Evershed puts it, does not follow Ohm's law. If, on the other hand, the material is either perfectly dry or absolutely sodden with moisture, the insulation is the same within wide limits of potential difference. Another interesting fact ascertained is that the conductance through an insulator containing a certain quantity of water is far less than the conductance through the same quantity and thickness of water. To account for this, Mr. Evershed puts forward the hypothesis, supported by an experimental "model," that the moisture is distributed unequally in the dielectric—that there are a number of "blind alleys," and, in fact, only a very small proportion of the absorbed water is utilised in forming the leakage paths. In the discussion, Prof. A. Schwartz suggested that the distribution of the moisture in the dielectric followed a similar law to the distribution of sap in plants.

"LET US HAVE OUR CALCULUS EARLY." Such is the title of an article in the Bulletin of the American Mathematical Society for October by Prof. E. B. Wilson, written professedly as a review of Mr. J. W. Mercer's recent "Calculus for Beginners." Writing of the great decline which has taken place in the sway of mathematics over collegiate education, Prof. Wilson points out that this has occurred at a time when the need of mathematical knowledge in all branches of science and technology is greater than it ever was in the past. "One of the main troubles with us is that we do not select the right subjects to teach in the early collegiate years. There is no sense in giving the freshman a considerable course

in advanced algebra. The subject is abstract, and deals with topics and ideas relatively unimportant for the student. Yet advanced algebra is often taught as a pre-requisite to calculus. It is unfortunate to force the freshman through an extended course in analytic geometry." This latter reference makes one wonder what Prof. Wilson would think of our recent epidemic of "projective geometries," good, bad, and indifferent, which may teach pupils to copy out proofs of stereotyped bookwork like Pascal's or Brianchon's theorems, but will never enable them to attempt a problem in mechanics involving a conic, cycloid, or catenary except by writing down the equation of the curve and becoming involved in hopelessly intractable formulæ from which the answer "may be obtained" —perhaps by the examiner, but with little credit and no educational value to the candidate.

IN connection with the recent International Congress of Refrigeration held at Chicago and Washington, the Smithsonian Institution has directed attention to the first U.S. patent for the manufacture of ice, granted on May 6, 1851, to John Gorrie, of New Orleans, and now on exhibition in the U.S. National Museum. The patent fully describes the method of compressing air to a small part of its bulk, abstracting the heat liberated by a jet of water, allowing the air to re-expand in an engine, whereby the expansion is utilised and helps in the working of the condensing pump, injecting an uncongealable liquid into the engine, and circulating it as a medium to absorb heat from the water being frozen, and to give it out to the expanded air. "The employment of the engine for the purpose of rendering the expansion of the condensed air gradual, in order to obtain its full refrigeratory effects, and, at the same time, render available the mechanical force with which it tends to dilate to aid in working the condensing pump, irrespective of the manner in which the several parts are made, arranged, and operated" is a remarkably accurate description of the method for the time. Short of the actual recognition of the equivalence of work and heat, due to Mayer in 1844, the inventor's ideas could scarcely have been clearer. Gorrie published in 1844 several articles on the subject in *The Commercial Advertiser* of Apalachicola, Fla., a re-examination of which might be of interest from the point of view of the history of the dynamical theory of heat and the law of the conservation of energy. These papers, together with the original of the patent, have been deposited in the U.S. National Museum.

PART vi. of vol. xxi. of the Memoirs of the Indian Meteorological Department contains a discussion by Dr. G. C. Simpson of the potential gradient of atmospheric electricity at Simla. The data were derived from a Benndorf electrograph between May, 1907, and May, 1910, with an interruption between October and November, 1908, when the site of the instrument was altered. There are two tables showing respectively the annual variation of the potential gradient, and its diurnal variation for the twelve months of the year, for four quarters and for the year as a whole. Two plates show the results graphically. Use is made only of the days free from large irregular disturbances, numbering altogether 440. Owing to the non-existence of any sufficiently extensive level ground in Simla, it was impossible to deduce absolute values appropriate to a site in the open. The unit employed is thus an arbitrary one. The most remarkable feature is the frequent occurrence of negative potential in fine weather during May and June. This Dr. Simpson attributes to the presence of large quantities of dust in the atmosphere during the warm, dry weather which precedes the setting in of the monsoon. The number of days available, especially in July and August, is scarcely sufficient to give smooth diurnal inequalities for the individual months of the year; but there are obviously as a rule two maxima and two minima, one pair in the forenoon, the other in the afternoon. The morning minimum is usually the principal one, especially towards mid-winter, but in April, May, and June—especially June—the minimum in the early afternoon is the more prominent. On the average of the years included, February gave the highest and June the lowest mean value of the potential.

A NEW method of preparing aqueous colloidal solutions of metals is described by H. Morris-Airey and J. H. Long in the Proceedings of the University of Durham Scientific Society (vol. v., part ii., pp. 68 and 113), which is based on the use of high-frequency alternating currents passing between electrodes of the metal immersed in water. It is possible to vary the range of frequency of the current between very wide limits, and in this way it has been shown that the colour supposed to be characteristic of the colloidal solutions of metals is a result of the special conditions of the discharge. Thus gold, for instance, on altering the frequency, can be made to give a red, blue, or purple solution; in the red solution the particles are negatively charged, and in the blue solution positively charged. The purple solutions contain both kinds of particles. The red solution is converted into the blue by the action of an electrolyte or electric field.

WE learn from *Engineering* for December 26 that Prof. G. Benoit and Mr. Woernle are engaged on an investigation of the strength and durability of wire ropes. The research, which they are conducting in the laboratory for hoisting-machinery of the Technical High School at Karlsruhe, will occupy them for some time, but as the experiments are fairly conclusive regarding the deleterious influences of twisting, the preliminary results have been published. Twisted ropes have been proved by these experiments to be much less safe than the untwisted wires, even if the wires be annealed, thus demonstrating that the twisting leaves considerable strains in wire ropes, and especially on those made of high-class steels, which are chiefly used in mine haulage and winding. The method of experimenting consisted in applying the wires and ropes to a pulley which was turned to and fro through an angle of about 90° at the rate of 1000 turns per hour, thus bending and unbending the wires always in the same direction. Further experiments with alternating bending to different radii, &c., are now being made.

THE report of the Clifton College Scientific Society for the year 1912–13 has been received. It contains information of the work done during the session by the various sections among which the work of the society is divided. We notice among the contents an interesting calendar of bird observations made near Clifton, from January to July, 1913, to which a note is appended, stating that the Royal Agricultural Show enclosures on Clifton Downs greatly interfered with birds and observers during the season.

WE have received from the Carnegie Institution of Washington two volumes prepared under the auspices of the department of historical research. One, by Mr. David W. Parker, is a "Guide to the Materials for United States History in Canadian Archives"; the other, by Prof. Herbert E. Bolton, is a similar guide concerned with materials for the same purpose in the principal archives of Mexico. Both volumes belong to a series, to which we have directed attention on previous occasions, representing a systematic endeavour by the department of historical research to make more easily available for authors and students the materials contained in foreign archives necessary in studying the history of the United States. Volumes have appeared already dealing with Cuba, Spain, Great Britain, Italy, and Germany, and others concerned with the archives of Paris, Switzerland, the Netherlands, and Sweden are in course of preparation.

OUR ASTRONOMICAL COLUMN.

COMET 1913*f* (DELAVAN).—Prof. H. Kobold communicates, in a Kiel Circular, No. 144, dated December 21, the elements and ephemeris of Delavan's comet (1913*f*), the former being based on observations made on December 17, 18, and 19. The elements are as follows:—

Elements.

$T = .914$ March $2{\cdot}3211$ M.T. Berlin.
$\Omega = 126^\circ\ 32{\cdot}6'$
$\omega = 7\ 40{\cdot}1$
$i = 13\ 4{\cdot}6$
$\log q = 0{\cdot}04526$

Ephemeris for 12h. M.T. Berlin.

	R.A. h. m s.		Decl. ° ′		Mag.
Dec. 31	2 54 5	...	−5 18·4		
Jan. 1	53 44	...	5 4·9		
2	53 28	...	4 50·8		
3	53 12	...	4 36·1		
4	53 1	...	−4 20·9	...	10·5

A note in *The Times* of December 24 states that the comet will approach the earth and sun for the next two months, and while its brightness will be considerably increased, the object is not expected to be visible to the naked eye. Its south declination will be maintained until about the middle of January. The positions of the comet are in the constellations of Eridanus and Cetus.

AN AID TO TRANSIT CIRCLE OBSERVERS.—Transit observers are only too well aware of the time occupied in reading off chronograph strips, the work involved, even when assisted by a writer, being equal to that of making the observations themselves. Any suggestion of a method of reducing the labour will be welcomed provided it can be thoroughly relied upon. Prof. E. Grossmann, in *Astronomische Nachrichten*, No. 4701, describes a very practical arrangement which seems very efficient and simple. He adopts the reading apparatus constructed by Th. von Oppolzer, and works this in conjunction with an ordinary typewriter. All the observer has to do is to place the movable thread on the observed signal on the tape and the press of a key is sufficient to write automatically the scale reading underneath. In the paper Prof. Grossmann describes the apparatus in some detail, and accompanies the text with two illustrations. Messrs. Favargar and Co. in Neuchatel were entrusted with the arranging of the complete apparatus.

STANDARD WAVE-LENGTH DETERMINATIONS.—No. 75 of the Contributions from the Mount Wilson Solar Observatory is devoted to the second paper by Messrs. St. John and L. W. Ware, entitled "Tertiary Standards with the Plane Grating: the Testing and Selection of Standards." In this paper the authors have examined the international secondary standards from λ4282 to λ5506 as to their consistency among themselves, and have determined the wave-lengths in international units of a series of 198 lines in the arc spectrum of iron from λ4118 to λ5506. The region from λ5371 to λ5506 is common to the 1912 and 1913 investigations, but an entirely new series of plates was made for the common region. The Pasadena plates were taken with the 30-ft. spectrograph, while the Mount Wilson plates were secured with the 75-ft. Littrow spectroscope used in conjunction with the 150-ft. tower telescope. The communication, which is published in considerable detail, is another example of the high accuracy attained in the Mount Wilson determinations. It is interesting to note that the difference between the heights above sea-level of Pasadena (244 m.) and Mount Wilson (1794 m.) is responsible for changes in relative wave-length determinations at the two stations. Numerous important conclusions are summed up at the end of the paper.

PRIZE AWARDS OF THE PARIS ACADEMY OF SCIENCES FOR 1913.

Geometry.—The Francœur prize to A. Claude, for the whole of his astronomical work; the Bordin prize was not awarded, no memoir on the question proposed having been received.

Mechanics.—The Montyon prize to M. Sauvage; the Poncelet prize to Maurice Leblanc, for his work in mechanics.

Navigation.—The extraordinary prize for the Navy is divided between Le Prieur (1800 francs), Geynet (1800 francs), Violette (1800 francs), and R. E. Godfroy (600 francs); the Plumey prize to M. Risbec, for his work on the propulsion and stability of ships.

Astronomy.—The Pierre Guzman prize is not awarded; the Lalande prize to J. Bosler, for his researches on the sudden variations of terrestrial magnetism and their connection with disturbances in the sun; the Valz prize to Prof. Fowler, for his researches in spectroscopy; the G. de Pontecoulant prize to M. Sundmann, for his researches on the problem of three bodies.

Geography.—The Tchihatchef prize to Col. Peter Kusmitch Kozlov, for his explorations and publications on Central Asia; the Gay prize to Dr. Mocquart, for his memoirs on tropical reptiles.

Physics.—The Hébert prize to Prof. Swingedauw, for his researches on explosive potential and electrotechnics; the Hughes prize to Jean Becquerel, for his work in magneto-optics; the De Parville prize to Prof. Rothé, for the whole of his researches in physics; the Gaston Planté prize to R. V. Picou, for his work in the field of electrical industry; the Kastner-Boursalt

prize to Benjamin Chauveau, for his researches in atmospheric electricity.

Chemistry.—The Jecker prize is divided between Eug. Léger (3000 francs), for his work on vegetable alkaloids, M. Mailhe (2500 francs), for his researches on catalytic reduction, Amand Naleur (2500 francs), for his work in analytical, organic, and thermochemistry, and Fernand Bodroux (2000 francs), for work in organic chemistry; the Cahours prize divided between Mme. Ramart-Lucas Paul Clausmann, and E. Chablay; the Montyon prize (unhealthy trades) to MM. Desgrez and Balthazard (2500 francs), for their work relating to life in a confined atmosphere, M. Henriet receiving a mention (1500 francs), for his memoir on the impurities of Paris air; the Berthelot prize to Ernest Fourneau, for his syntheses of stovaine, novocaine, and other substances of service in therapeutics; the Vaillant prize was not awarded, as no memoir was received dealing with the question proposed.

Mineralogy and Geology.—The Delesse prize to Robert Douvillé, for his important works relating to certain groups of ammonites in France and South America; the Joseph Labbé prize to M. Dussert, for two memoirs dealing with the metalliferous deposits of Algeria; the Victor Raulin prize to J. Blayac, for his paper dealing with the geology of the Seybouse and some neighbouring regions.

Botany.—The Desmazières prize to M. Hariot, for his work on marine flora; the Montagne prize to M. Gain, naturalist on the *Pourquoi-Pas?*, for his memoir on the Algæ of the Antarctic regions; the de Coincy prize to Marcel Dubard, for his researches on the Sapotaceæ; the Grand prize of the physical sciences to Auguste Chevalier, for his geographical study of the flora of western French Africa; the Thore prize to Etienne Foëx, for his publications on the Erysibaceæ; the de la Fons-Melicocq prize to Eugène Coquidé, for his study of the vegetation of the peaty valleys of Picardy.

Rural Economy.—The Bigot de Morogues prize to Gustave André for his work on agricultural chemistry and the chemistry of the soil.

Zoology.—The Savigny prize to Henri Neuville, for his work on the invertebrates of Abyssinia; the Cuvier prize to Charles Oberthür for his studies in entomology and comparative lepidopterology.

Medicine and Surgery.—Montyon prizes (2500 francs each), to Mme. Lina Negri Luzzani, for her studies on the corpuscles discovered in the nervous system of rabid animals, to L. Ambard, for his memoir on renal secretion, and to MM. A. Raillet, G. Moussu, and A. Henry, for their researches on the etiology, prophylaxy and treatment of distomatosis in ruminants. Mentions of 1500 francs each are accorded to M. Marquis, for his memoir on mercuric chloride in surgery, to M. Legrange, for his work on the treatment of chronic glaucoma; and to Fernand Bezançon and S. L. de Jong, for their treatise on the examination of sputa. Citations are given to Henri Paillard, for his works on pleurisy, Paul Hallopeau, for his memoir on temporary disarticulation in the treatment of tuberculosis of the foot, and A. Sartory and Marc Langlais, for their work entitled dust and micro-organisms of the air. The Barbier prize is divided between Jules and André Boeckel and MM. de Beurmann and Gougerot; prizes of 2000 francs each are awarded from the Bréant funds to C. Levaditi, for works on epidemic acute poliomyelitis, A. Netter and R. Debré, for their memoir on cerebrospinal meningitis, and V. Babès for his treatise on hydrophobia; the Godard prize to J. Tanton; the Baron Larrey prize to A. Dejouany; the Bellion prize to Albert Frouin and Pierre Gérard, for their study of the rôle of mineral salts in digestion; the Argut prize to Claudius Regaud and Robert Crémieux, for their study of the effects of X-rays on the thymoid and the treatment of hypertrophy of this gland by Röntgentherapy; the Mège prize was not awarded.

Physiology.—A Montyon prize (experimental physiology) to Michel Cohendy, for his work on life without micro-organisms; the Philipeaux prize to Louis Lapicque, for his researches on the electric stimulation of nerves, an honourable mention to Samson Levin; the Lallemand prize is not awarded, but A. Barré receives a very honourable mention; the Pourat prize to Th. Nogier and Cl. Regaud, for researches on the comparative action of filtered and unfiltered X-rays on living tissues.

Statistics.—Montyon prizes to Henri Bresson (1000 francs), Albert Quiquet (1000 francs), and M. Thollon (500 francs).

History of Science.—The Binoux prize to M. Molk, for the French edition of the "Encyclopédie des Sciences mathematiques."

General Prizes.—The Lavoisier medal to Ernest Solvay; Berthelot medals to MM. Léger, Fourneau, Desgrez, and Balthazard; the Henri Becquerel prize to Louis Dunoyer, for his researches in physics; the Gegner prize to J. H. Fabre; the Launelongue prize divided between Mme. Cusco and Mme. Ruck; the Gustave Roux prize to M. Montel, for his work on the theory of analytical functions; the Trémont prize to Charles Frémont; the interest on the Leconte prize (2500 francs) to S. Bivort, for the construction of a shorthand machine for the use of the blind; the Wilde prize (4000 francs) to M. Borrelly, for his astronomical discoveries; the Lonchampt prize is divided between Emile Demoussy (3000 francs), for his physico-chemical researches in plant physiology, and M. Agulhon (1000 francs), for his work on the function of boron in living matter; the Saintour prize is divided between Camille Tissot (2000 francs), for his work on wireless telegraphy, and M. Maire, for his studies in the history of science; the Henri de Parville prize to Jean Perrin; the Fanny Emden prize is not awarded, but encouragements are given to Guillaume de Fontenay (2000 francs), and J. Courtier (1000 francs); the d'Ormoy prize to Claude Guichard, for the whole of his mathematical works; the Petit d'Ormoy prize to Jules Lefèvre, for the whole of his scientific work; the Pierson-Perrin prize is divided between Ch. Fabry (2000 francs), H. Buisson (2000 francs), and Rodolphe Soreau (1000 francs); the Parkin prize is not awarded; the Estrade-Delcros prize to Mme. Charles André; the Danton prize to Eugène and Léon Bloch; the prize founded by Mme. la Marquise de Laplace to M. Boutteville; the prize founded by Félix Rivot between MM. Demay, Perrin, Boutteville, and Renaud.

The Bonaparte Fund.

The committee appointed by the Paris Academy of Sciences to allocate the grants from this fund for the year 1913 have made the following proposals:—Out of sixty-three applications the committee recommend twenty-one grants.

3000 francs to H. Caillol, for the publication of his catalogue of the Coleoptera of Provence.

2000 francs to A. Colson, for apparatus required for his work in physical chemistry.

2000 francs to E. Coquidé, to assist him in his study of the means of utilising peaty soil.

2000 francs to C. Schlegel, for the continuation of his researches in the laboratory of M. Delage.

6000 francs, in equal parts, between MM. Pitard and Pallary, for assistance in the continuation of their scientific work in Morocco.

2000 francs to Jules Welsch, for his geological work on the coasts of western France and Great Britain.

2000 francs to Louis Roule, for continuing and extending his researches on the morphology and biology of the salmon in France.

2000 francs to Jean Pougnet, for the continuation of his researches on the chemical and biological action of ultra-violet light.

2000 francs to C. Dauzère for his work on cellular vortices.

2000 francs to Méd. Gard, for the publication of a work and atlas on material left by the late M. Bornet.

4000 francs to Aug. Chevalier, to meet the expense necessitated by the classification of the botanical material arising from his expeditions in Africa.

2000 francs to Paul Becquerel, for the continuation of his physiological researches relating to the influence of radio-active substances upon the nutrition, reproduction, and variation of some species of plants.

4000 francs to Le Morvan, for assistance in publishing the photographic atlas of the moon.

2000 francs to Jacques Pellegrin, to assist him to pursue his researches and publish works on African fishes.

3000 francs to E. Rengade, for a systematic research on the presence and distribution of the rare alkali metals in mineral waters.

3000 francs to Charles Alluaud, for the publication of work on the Alpine fauna and flora of the high mountainous regions of eastern Africa.

2000 francs to Charles Lormand, for the purchase of a sufficient quantity of radium bromide to carry out methodical researches on the action of radio-activity on the development of plants.

2000 francs to Alphonse Labbé, for researches on the modifications undergone by animals on changing from salt to fresh water or the reverse.

3000 francs to G. de Gironcourt, for the publication of the scientific results of his expeditions in Morocco and western Africa.

3000 francs to A. F. Legendre, for the publication of maps and documents of his expeditions in China.

2000 francs to H. Abraham, for the determination of the velocity of propagation of Hertzian waves between Paris and Toulon.

PAPERS ON VERTEBRATE PALÆONTOLOGY.

TO vol. xxii. (pp. 407–420) of the Bulletin of the American Museum of Natural History Prof. H. F. Osborn contributes two articles on the skulls of ungulates from the Wind River Lower Eocene of Wyoming. A very interesting point is that in the members of the family Uintatheriidæ chacteristic of this stage, such as Bathyopsis, the skull lacks the great bony horn-cores of the later types, their place being taken by small knobs. In the perissodactyle Titanotheriidæ it has been found that two phyla of the genus Eotitanops are recognisable, one comprising relatively small, persistently primitive light-limbed species, and the other animals of a larger and more progressive type. Several new species are named.

In the Bulletin of the Department of Geology, California University (vol. vii., pp. 169–175), Dr. J. C. Merriam describes a lower molar of a tapir obtained many years ago from the auriferous gravels of California as a new race of a species described by Leidy from the Pleistocene of South Carolina. To this race (*Tapirus haysii californicus*) is provisionally referred a set of three upper molars from the late Tertiary of Oregon. The species appears to be nearly related to the existing Central American *T. bairdi*.

The skeletons of *Saurolophus osborni*, a duck-billed dinosaur of the family Trachodontidæ, and of *Hypacrosaurus altispinus*, a new genus and species of the same family, both from the Upper Cretaceous of Edmonton, Alberta, Canada, form the subject of two papers by Mr. Barnum Brown in vol. xxxii. (pp. 387–407) of the Bulletin of the American Museum of Natural History. The type skeleton of the former, which measures about 32 ft. in length—the same as that of the contemporaneous *Trachodon mirabilis*—has been mounted on a slab for exhibition. Saurolophus, it appears, is much more numerously represented in the Edmonton beds than its cousin Trachodon. Hypacrosaurus is characterised by the great height of the spines of the dorsal vertebræ, coupled with the presence of nine vertebræ in the sacrum, against eight in the allied genus.

Under the name of *Rutiodon manhattensis*, Prof. F. von Huene describes in the volume last cited (pp. 275–283) the remains of a new species of phytosaur (belodont) from the Upper Triassic of Fort Lee, New Jersey, at the base of the "Palisades," opposite New York. In the opinion of the describer, Rutiodon and the European Mystrisuchus, on account of the taller spines of their vertebræ and the consequently more compressed form of their bodies, were probably better swimmers than the typical Phytosaurus. Both were long-snouted reptiles, of larger bodily size than Phytosaurus, the new species being the biggest yet described.

From the Trias of Heligoland Mr. H. Schroeder (*K. Preuss. Geol. Landesanstalt*) describes a beautifully preserved skull of a large stegocephalian (labyrinthodont) as a new species (*C. helgolandiae*) of the genus typified by von Meyer's *Capitosaurus nasutus* from the Trias of Burnberg.

Mere reference will suffice for supplementary notes on fossil sharks by Messrs. D. S. Jordan and C. H. Beal, published in the Bulletin of the Department of Geology, California University (vol. vii., pp. 243–256).

In the Bulletin of the American Museum of Natural History, vol. xxxii., pp. 437–439, Dr. R. Broom records additional remains of the extinct South African horse described by himself in 1909 under the name of *Equus capensis*. These are stated to indicate a heavily built, short-legged species, standing about fourteen hands, and apparently distinct from all the existing South African members of the genus, as well as from the Arab stock.

In a second communication the same author (*op. cit.*, pp. 441–437) describes a number of remains of South African dicynodont reptiles, many of which are regarded as representing new species of the typical Dicynodon, while others are assigned to new genera. It is interesting to note that a skull described by Huxley as that of a lizard, under the name of *Pristerodon mackayi*, really represents a dicynodont furnished with cheek-teeth. R. L.

AGRICULTURE AT THE BRITISH ASSOCIATION.

THE meeting this year was one of the most successful held since agriculture has been recognised at the British Association, both the quality of the papers and the attendance at the section being exceedingly good. Prof. Wood, in his presidential address, dealt with a problem which has now assumed very great importance. Hitherto the agricultural expert working in the counties and among farmers, has had to demonstrate certain facts which were already known at the experiment stations. One of the most important is the effect of phosphates in improving grassland, an effect so striking that it can be demonstrated without very refined experiments, so that the

"single-plot method" serves the purpose very well. Another fact which had to be demonstrated and where the same method suffices is that in the case of most of the late-cropping varieties of potatoes the use of seed from certain districts in Scotland or the north of Ireland is profitable. But there are many cases where the somewhat crude single-plot method gives only indefinite results, and careful investigation has shown it to be incapable of revealing differences less than 10 or 15 per cent.; more refined methods are needed as soon as quantities of this order are to be dealt with. Prof. Wood went on to deal with some of these new methods and to urge their more general adoption in field work.

The address was followed by a paper by Prof. Fraser Story, Bangor, on methods of German forestry. The five principal trees occurring in the German forests are Scotch pine (45 per cent.), spruce (20 per cent.), beech (14 per cent.), oak (7 per cent.), and silver fir (3 per cent.) The commonest method of regenerating the pine forest is by planting one- or two-year-old seedlings, the scanty foliage of which resists drying in sandy soils better than larger plants. In the case of spruce, on the other hand, transplanting material is used because the tree is grown in hilly or mountainous districts where there is more precipitation and greater danger of suppression by weeds. Beech and silver fir require shade when young, and therefore natural regeneration is resorted to, so that they may receive the shelter they need from the parent trees. Oak is generally raised from the acorn sown by hand, usually in a sheltered wood.

Mr. Collinge followed with a description of a peculiar disease of cereals and roots and the action of sulphur and lime. The disease is known as "Maysick," and it is most evident on wheat. Mr. Collinge considered it is due to bacteria which interfere with the nutrition of the plant. Sulphur and unslaked lime are found to be successful remedies.

The growing of linseed as a farm crop was next discussed by Mr. Duncan Davidson. Experiments made in this country during the last three years show that the crop can be successfully grown, that 10 to 15 cwt. of linseed per acre can be obtained on medium land at a cost of about 6*l*., while the present price of the same quantity of linseed meal is 10*l*. The climate both of England and Wales is found to be quite suitable for the crop, and any soil of good texture and depth and not likely to dry out is suitable. The best time for sowing seems to be from the middle of April to the middle of May, but the seed at present obtainable is quite unsuitable owing to its mixed origin, impure condition, and low vitality. There is also some difficulty about the thrashing; there is no market as yet for the straw.

Prof. Barker and Mr. Gimingham gave a further account of their work on the fungicidal action of Bordeaux mixture which they attribute to the solvent action exerted by the fungus cells on the insoluble compounds of the spray fluid. They found that germinated spores and the thin-walled cells of the fungus hyphæ exert a definite solvent action and are killed by the absorption of the dissolved copper. Similar results are obtained with root hairs and the roots of germinating seedlings. The cuticle of the upper epidermis of apple leaves, however, seems to be practically impermeable during spring and summer; at any rate, no injury follows spraying so long as the cuticle is unbroken. In autumn, however, the cuticle is more permeable and death results more easily.

The second day was devoted to a joint discussion with the Botanical Section on the problems of barley production. Mr. E. S. Beaven opened with a very good account of the experiments he has been carrying out for some years at Warminster on the selection of barley for productivity. In the case of cereal crops the produce of dry grain on unit area is the sum of the following factors:—(*a*) number of plants surviving on the area at harvest; (*b*) the average dry weight per plant, which is the sum of the average number of stems per plant and the average weight per stem; (*c*) the ratio of the dry matter of the seed to the dry matter of the plant. These factors have been very fully investigated by Mr. Beaven, and a considerable interest attaches to the third, which he calls the migration factor, and which relates to the rate of transfer of material from the stem, leaf, and root to the seed. Mr. Beaven finds that this factor is high in the good yielding varieties, and in good seasons, and he has got evidence that it is a definite character. It will be extremely interesting to follow up this migration factor and see in what way it is related to the other properties of the plant.

This paper was followed by three others dealing with Irish barley experiments. These were commenced in 1899 with the intention of improving the Irish barley crop. It was soon found that the varieties in common use were inferior to the best known elsewhere, and experiments were begun with other varieties, two of which turned out to be very useful, "Archer" and "Goldthorpe." "Archer" is a narrow-eared barley, not usually grown on heavy soils or in late districts, but on light soils and in early districts, the result of its natural tendency to ripen late. "Goldthorpe," on the other hand, is a typical wide-eared barley ripening about a week earlier than "Archer," and therefore more suitable on heavy land. Mr. Bennett showed that the strain of "Archer" raised in Ireland is just as good as that imported from elsewhere. By careful selection improvements have been effected, not only in cropping capacity, but also in quality.

Mr. Hunter described the continuation of these experiments and the method of selection now in use at Ballinacurra. For the past two years a large number of plots on a very small scale are set up, and consequently a number of pure lines can be investigated.

Dr. Hackett discussed the results from a statistical point of view.

Another joint discussion dealing with live-stock problems is reported in the account of the Physiological Section, and need not be further dealt with here (see NATURE, December 18, 1913, p. 462).

"The Utilisation of Sewage in Agriculture" formed the subject of a paper by Dr. Grossmann. He attributed the unsatisfactory results obtained in farming with sewage sludge to the fatty matter invariably present, and described a process whereby the dry sludge is mixed with a small percentage of acid, and subjected to the action of superheated steam, which carries off the fatty matters, whereby an inodorous brown powder is obtained, containing on an average 1–5 per cent. of nitrogen, 3 per cent. of calcium phosphate, 0·5 per cent. of potash, and 30–40 per cent. of organic matter. It was stated that good results had been obtained by the use of this material as manure. The author considers that the process removes one of the great difficulties in dealing with sludge; hence the sewage engineer may now aim at producing more sludge than before.

A group of three papers on soil followed. Dr. Hutchinson described experiments made in conjunction with Mr. McLennan showing that a partial sterilisation effect, intermediate in character between that exercised by heat and mild antiseptics, could be brought about by treating soil with quicklime. In the cases presented somewhere about 1 per cent. of lime was necessary; after a certain incubation period the soil bacteria then began to multiply rapidly and

yield large increases in the amount of ammonia and of nitrate.

This was followed by a paper by Mr. Goodey describing his investigations on the protozoa of the soil. The first forms investigated were the ciliated protozoa, particularly Colpoda. Evidence was adduced to show that this organism probably exists in the soil as cysts, though it must have had some active existence some time because of the large numbers in which cysts occur. Another investigation dealt with the effects of partial sterilisation on two old soils which had been stored in bottles for many years at Rothamsted, one since 1846 and the other since 1870. The 1870 soil behaves normally on partial sterilisation, giving an increase in bacterial numbers and also in ammonia and nitrate, showing that the limiting factor present in ordinary soils was also present in this soil; amœbæ and flagellates also occurred.

The 1846 soil, however, behaved entirely differently and showed the phenomena of a soil already partially sterilised; there was no evidence of any limiting factor being present, and no amœbæ, flagellates, or other protozoa could be found.

In the discussion that followed Prof. Gamble expressed the opinion that amœbæ and flagellates could probably be found in an active condition in the soil although the ciliates probably were not.

A third paper dealt with the nitrification in some pasture soils, and was presented by Mr. Gimingham. It is known that nitrification is reduced to a minimum in pasture soils rendered acid by the continued use of ammonium salts as manure, and an investigation was therefore made of a soil intermediate in character between the true moor and the true fen soil. This contains 30 to 40 per cent. of organic matter and only traces of carbonate, but the water is neutral in action. The soil was found to be capable of bringing about rapid nitrification of peptone, a remarkable feature being the great amount of action directly the peptone was added. Ammonium sulphate also quickly nitrifies, but the soil in this case takes on a feebly acid reaction.

Prof. Bottomley described experiments in which peat was treated with certain aërobic soil bacteria, and then became converted into a blackish-looking powder of distinct manurial value. It was also stated that the substance conditioned fixation of nitrogen in the soil.

A paper was presented by Miss Taylor on the life-history of *Eriophyes ribis*. When *Ribis nigrum* is the host-plant the embryonic true leaves of the bud are attacked by the mite and the bud develops into a "big-bud." No injury is caused, however, to the foliage of the tree. The migration of mites from infested buds is carried out mainly by the wind. On the other hand, when *Ribis grossularia* is the host-plant the scales leaves of the bud only are attacked and no big-bud is formed. Apparently the mite cannot penetrate the true leaves of the bud, and injury is confined to the foliage. Distribution by wind is not general, migration being mainly due to the mite crawling from the infested bud to the expanding leaves.

Dr. Winifred Brenchley summarised her investigations on the weeds of arable land. On clay soils the weed flora is less rich in species than on light loam, and though several plants have a distinct preference for heavy land no species can be said to be symptomatic of clay, occurring on such soils and nowhere else. Sandy soils possess a much more characteristic weed flora, as they are colonised by a great diversity of plants, a number of which are distinctly associated with light soils. Such plants as spurry, corn marigold, sheep's sorrel, and knawel appeared to be characteristic of sandy soils which are deficient in chalk; in other words, "sour" soils. Chalk provides a peculiar habitat for weeds, and the weed flora is very rich in species, some of which are markedly characteristic. There is evidence now that a distinct association exists between the species of weed and the soil in which they grow. This association may be local, when the weed is symptomatic of the soil in one district, but not exclusively associated with it in another. On the other hand, it may be general, when a certain species is symptomatic or characteristic of the same type of soil in different districts. The nature of the crop also plays a part in determining the weed flora.

A note was presented by Miss Armitage on the two varieties of corn spurry. *Spergula arvensis* is a rather frequent weed on the red sandy loam in Herefordshire, but the author never observed it in such development as to cause injury to crops. *Spergula sativa*, as she had seen it in Cheshire, is a terrible pest, causing marked injury both to roots and clover. It would be interesting to know whether this was always more harmful than *S. arvensis*.

The section concluded with a very interesting and important paper by Sir Richard Paget on the possibility of partnership between landlord and tenant. A form of agreement has been drawn up on this basis and was distributed at the meeting. An interesting discussion followed, which, however, is rather of general than of purely scientific interest.

PSYCHOLOGY AT THE BRITISH ASSOCIATION.

A SEPARATE Subsection of Psychology was formed this year at the British Association for the first time. The experiment was even more successful than had been anticipated. The general attendance was large and often crowded. Almost every experimental psychologist in Great Britain either attended the meetings or else sent or promised papers. The contributions received were so numerous that four meetings were held during afternoons.

The proceedings of the subsection opened on Thursday with a series of papers, for the most part philosophical in character. The first paper was one by Dr. Wildon Carr, upon "The Absurdity of Psycho-physiological Parallelism even as a Hypothesis." Dr. Carr suggested that in considering the relation between body and mind, parallelism was not the only alternative to interaction; the relation might be solidarity of function, in which two independent realities are united. Mr. McDougall's paper upon laughter aroused especial interest. Taking the chief theories of laughter hitherto propounded, he claimed that they did not account for all varieties of laughter, and, further, that they did not even seek to answer the most fundamental problem, namely to what end did the human species acquire this capacity for laughing? The conditions exciting laughter he endeavoured to reduce to (1) situations that are mildly unpleasant, except so far as they are redeemed by laughter; (2) those things which would excite a feeble degree of sympathetic pain, if we did not actually laugh at them. The effects of laughter he described as consisting especially in an increase of the general and pleasurable sense of well-being. He added that the appearance of laughter seemed especially associated with the development of social life. From these considerations he argued that laughter proper (as distinguished from the smile, which in the adult has become secondarily associated with it) is a protective reaction which shields us from the depressing influence of the shortcomings of our fellow-men. Laughter, in short, is the antidote to sympathy.

In the afternoon Dr. Watt gave a careful exposition of "Some Main Principles of Integration." Prof. Carveth Read followed with an analysis of "The Conditions of Belief in Immature Minds." The chief relevant characteristic of the mind of the savage and the child, he pointed out, is the unusual influence of illogical inferences, or imaginations, and of non-evidentiary causes of belief. This characteristic depends upon (1) an unusual vividness of imagination; (2) an absence of exact knowledge as a standard; (3) an inability to make comparisons, either because of the influence of desires, or because of the imperfect development or education of the mind; the mind is consequently in a state of incoordination, and its beliefs form relatively isolated systems.

On Friday the subsection held a joint sitting with Section I (Physiology). In the morning Prof. R. M. Ogden (of Knoxville, Tennessee, U.S.A.) gave an account of "Some Experiments on the Localisation of Visual Images." The images were suggested by a series of fifty words. It was found that the images of memory tended to be located at their proper place and distance, while the images of imagination tended to be placed upon the disc fixated during the introspections.

Dr. Myers described "Experiments on Sound Localisation," carried out in the sound-proof room of the new psychological laboratory at Cambridge. The sound was usually a fundamental tone of 200 vibrations, accompanied by overtones separately emitted; these were led into the sound-proof room by a tube ending in a movable funnel carried by a noiseless perimeter. In the end, timbre and loudness proved the only trustworthy criteria whereby his subjects localised the sounds; laterality and medial incidence, exploited at first, were eventually abandoned. Alteration in the intensity of the several overtones, and in the loudness of the whole sound, increased very distinctly the number of erroneous localisations. In the case of a medial sound, just as in the case of a lateral sound, the spatial (and, sometimes, tactual) impressions seemed illusory. In reality they appeared to be of auditory origin. And in each case the spatial experience seemed to be a cue leading to a head movement, whereby the sound is more correctly localised.

Miss E. M. Smith described a series of observations, carried out in the same laboratory, upon "Habit Formation in Guinea-pigs." The tests used—(1) labyrinth test, (2) a new sensory test discrimination test—formed part of a larger scheme to test inheritability of learning, &c., and incidentally brought to light hitherto unrecorded points of interest concerning the behaviour of guinea-pigs. Miss May Smith reported results yielded by tests of Bergson's two forms of memory. The correlations tended to show that rote memory is distinct from pure memory (recognition) and more closely allied to physiological memory or habit. Dr. Shrubsall briefly discussed "The Relative Fertility and Morbidity of Defective and Normal Stocks." On examining the family histories of several thousand children, he found that the correlation between the size of the paternity and the number dead is much higher in defective stocks than in normal. In spite, therefore, of the notorious fertility of defective stocks, by adult age the disparity in size of family has, owing to higher morbidity, almost disappeared.

In the afternoon papers upon "Variations in the Spatial Threshold" and "A Simple Method of Demonstrating Weber's Law" were read by Mr. Godfrey Thomson and Mr. Shepherd Dawson respectively. Two important contributions to the study of fatigue were given by Miss May Smith and Mr. J. H. Wimms.

On Monday a joint meeting was held with Section L (Education). The morning was chiefly occupied with a discussion of spelling. A full report of the proceedings has appeared in the account of the work of the Education Section (December 25, 1913, p. 491).

The appeal of Dr. Kimmins (chief inspector, L.C.C.) for educational research may be mentioned as of special interest and importance. In the afternoon Mr. Valentine gave a paper on the phonic method of teaching reading, Mr. E. D. Lewis upon analytic and synthetic methods in learning, and Mr. Burt upon the mental differences between the sexes.

On Tuesday the greater part of the morning was occupied with papers on tests of intelligence. Dr. McIntyre and Miss Rogers described "The Application of the Binet-Simon Scale to Scots Children," and Mr. Moore and Mr. Winch described some "Tests of Reasoning" carried out at Liverpool and London. Mr. Fox recounted a series of experiments upon "The Conditions which arouse Mental Imagery in Thought." Imagery, it was found, appeared to arise chiefly when thought was momentarily hindered or obstructed.

In the afternoon the president of the Economics Section (Rev. P. H. Wicksteed) appealed for a study of "The Psychological Basis of Economics." Mr. Pear followed with an "Analysis of Some Personal Dreams," and Dr. Brown with a discussion of "Psycho-analysis." Dealing with the psychological doctrines of the school of Freud, the afternoon's discussion perhaps aroused a more general interest than any other.

On Wednesday morning the chief feature was a couple of papers by Mr. Pear and Mr. Wyatt upon testimony. Mr. Pear described the chief "Modern Experimental Investigations of Testimony," and emphasised their legal significance. Mr. Wyatt described experiments upon normal and defective school children in Manchester and Liverpool. He found that normal children, when uninfluenced by cross-examination and the personality of the questioner, can give testimony of a high degree of accuracy, but of small range; the testimony of defective children differs in quality more than in degree, but the difference is not very abrupt.

The chief impression created by the meetings of the subsection was a sense of the great and varied activity now going on in the various psychological laboratories recently established throughout the country, and the eagerness of the public and of the Press to recognise the "new" science and to emphasise (often to over-emphasise) its possibilities of development. The interest in practical applications was marked. But it was equally clear that the applications already attempted themselves pointed to the urgent need of further work the character of which shall be more purely scientific.

CYRIL BURT.

ON THE HIGHEST UNIVERSITY EDUCATION IN GERMANY AND FRANCE.[1]

IN the beginning of the nineteenth century Napoleon crushed the spirit and power of the Germans for a time, but the nation soon recovered from the blow through the stirring appeals which their great men, many of them professors in the universities, made to them, and their politicians and wise men, men of deep thought and strong will, deliberated earnestly in what way they could rescue their country from the depression under which it lay and restore it to independence and to a high place amongst the nations of the earth. They became convinced that one of the most effective means for this purpose was education, and

[1] From an address delivered at the University of St. Andrews on October 13, by Principal Sir James Donaldson.

they formed the following plan of carrying out this education. Their eyes were fixed on the young men of the country and they thought the best way to train them for civil and political life, and for the discharge of all the highest duties of statesmanship, was to divide their education into two periods. Thus arose the gymnasium and the present form of their universities. The idea of the gymnasium was that the boys should remain at school from eleven years of age until they were about twenty, under the strict discipline of the schoolmasters and be guided by them in all their studies. In these schools the young men were to be instructed in all the important knowledge which previous generations discovered and acquired. It was deemed that young men up to that age should not be invited to specialise. They were to be the recipients of the best ideas and methods which had come down to them through tradition.

The universities were to be the means of educating the young men from twenty to twenty-three, twenty-four, or twenty-five. It was at once seen that the method of education must be different. The experience which had been carried out successfully in the University of Halle gave the cue to the new work of the universities. This work assigned to the universities was to give a scientific education to all the young men who were fit to receive it. Science is the keynote of the system. There can be no good scientific training except on certain conditions. First of all the professors or teachers must themselves be men who pursue the scientific method of study and are advancing the boundaries of scientific knowledge. They must show in all their lectures the scientific spirit. Then there must be no restriction in the liberty to teach. Every man who is following the scientific method with adequate acquirements and capacity must be invited to teach; and, finally, the teacher must be untrammelled in his scientific investigations. He must search for truth solely for its own sake, and he must be allowed to express the conclusions to which he comes, whatever they may happen to be. This is what the legislators called Lehrfreiheit—the freedom of the instructor and the instruction. But along with these there must be Lernfreiheit—the freedom of learning and the learner. The learner must be free to choose the professors whose lectures he is to attend. There must be no restriction. The parents may advise him, but the State imposes no limitations. He goes where he has reason to believe that he will get what will stimulate him and guide him best. Of course, it was only those young men who had shown ability to whom a continuance of study would be profitable. They must be the best young men of the nation. Then these young men were no longer to be under the discipline of schoolmasters, but were to be free to choose for themselves how they were to study. No compulsion was to be used, but they were to select for themselves the teachers that would suit them, and the State was to supply them with all the best teachers or professors who could be found willing to teach and to lecture.

All this was done nearly 100 years ago. The plans of Humboldt and others were carried out consistently, and they now continue to the present day. The uniform opinion in Germany in regard to them is that the universities thus conducted have been of infinite benefit to the State, and have been along with the secondary schools a most important element in Germany's acquisition of extraordinary intellectual influence amidst the nations of the world, and in the building up of a great empire. I have adduced in proof of this in my previous addresses the testimony of eminent witnesses, such as Savigny, Stotzner, Max Müller, and I now adduce the opinion of Paulsen, the best authority on the subject. His little book, "The German Universities," is admirable, and deserves the attention of all who are interested in this subject. "Whoever understands youth," he says, "and knows the circumstances of German universities, will not doubt that all attempts to help along devotion to study by more or less mild expedients would be vain and harmful; vain, because only the semblance of such devotion, not the thing itself, can be forced; and harmful, because they weaken the sense of independence and responsibility. Forced study implies a scholastic system and scholastic relations between teacher and pupil, of the sort which existed in the mediæval universities. Such a condition is to-day inconceivable in the German universities." . . . "In the first place, the relations between student and instructor would be disturbed. At present these relations are throughout most satisfactory, resting as they do on a basis of freedom and mutual confidence, and every attempt to increase attendance on lectures by any other means than the attractiveness of the lectures would necessarily impair their charm. Who could endure to face a circle of hearers to whom he could not say at all times: 'Whoever thinks he does not find here what he wants, is under no compulsion to come'? Again, the student's attitude towards science herself would be altered. She, free herself, must be sought and loved by free men; if forced upon us, she would be detested by all—not only by those whose nature keeps them from intimacy with her, but by those also who now follow her of their own inclination.

"He who is not convinced of this from his knowledge of human nature may learn it from the experience of such measures gained everywhere and always."

No other universities for a long time adopted the methods of the German universities, but in recent times a considerable number of them made approaches without rigorously carrying out the ideal either of the gymnasium or the ideal of the university. In our own country we do a part of the higher work done at a German gymnasium at our universities, and for continuing this state of matters a powerful argument can be drawn from the circumstance that it is advisable that the passage of the boy from the strict discipline of the school to the unrestricted freedom of the university should be gradual and not too abrupt and difficult, as it is believed to be in Germany. In our universities also we have classes where the element of research is important; and so it is with some universities in England and America. But nowhere has there been the distinct difference between the education that treats the lad up to twenty as receptive and the young man of twenty and upwards as following out the desires of his own mind in the search for truth, responsible for his own development and free to do what he deems best for his intellectual and moral progress.

A remarkable start, however, has quite recently been made. From 1870, the French have been firmly convinced that one of the modes in which they can recover most effectively the position which they lost in the Franco-Prussian War is by devoting their attention to education at every stage, but most especially to the higher education. Gradually the French have come to believe that the German ideal is sound and their method of accomplishing it the best, and so they have now set it forth as that by which they are to work. This conviction was brought about by a slow process. It did not spring from a wish to imitate the Germans, but was borne in upon them by their own experience of university work. M. Liard, who has been the most prominent agent in creating the revolution in the French universities, has thus expressed

these ideas:—"This sympathy and help has been found, this action has been forthcoming, and it is possible to-day to say that in spite of some remaining hesitation, inevitable so long as the revolution in progress is not finally carried out, the French universities are fully conscious of their three-fold function, or rather, of the three stages of their functions, in regard to learning. The first stage is to be a centre of general culture, the second to prepare for professions and careers, and, at the top, for picked students, to give opportunity for learned research. It is these ideas which have inspired the new regulations for examinations that have been submitted to the faculties. The best programme for a university is not to have one. The best regulations for professors is full liberty to teach, and for students full liberty to choose, at their own risk, out of the varied teaching of the university, according to their tastes, their aptitudes, and their plans for the future. In France, such a state of affairs is impossible, at least for many long years."

The difficulty, however, of attaining the highest aim in the French universities has not been found so great as might have been expected. In the first place, there has always been a considerable number of students in Paris continuing at their work until twenty-four or twenty-five or even longer, and, secondly, those who are now elected professors, are nearly all men who have devoted themselves to research, have gained the highest distinctions in their researches, and are therefore well able to inspire students with a love of scientific inquiry. It is fifteen years since M. Liard's paper was printed. During that time the University of Paris has made great efforts to carry out the ideal which he proposed, and there is no doubt that it has been strikingly successful.

Thus these two great nations have come to the conclusion that this is the best way to educate the men who are to have the highest influence in the State and the nation.

In Germany every professor has to deliver public lectures for which no fee is demanded. The French go beyond this, and many of their best professors deliver lectures suitable for the general student who may not wish a degree but simply a knowledge of the subject discussed, and, of course, they can also attend the classes which have been arranged for the qualified students. Now surely if this is the way in which two great nations believe that they can best educate their highly endowed citizens, is it not time that we should attempt something of the same kind? I have again and again said that there would be no great difficulty in accomplishing this in the University of St. Andrews. We have many students who are eager to continue their studies at the University. In fact, the great majority of those who have obtained the highest honours would gladly remain behind if their studies could have been so arranged as are the studies for the doctor of philosophy of Germany or the doctorat d'état of France, and in this way we could bring up some of our men to reach the highest excellence in the comprehension of the various problems which arise in the government of the people and in the amelioration of society. The same remarks could be made in regard to the other three Scottish universities.

But a very serious question emerges when we think not of Scotland alone, but of the British Empire. Are the universities of England and of the British Dominions to remain in a position unquestionably inferior to that of Germany and France? Is our Empire to fail in providing the culture requisite for the highest minds? Are we to take no means to supply the most perfect training to those who are to exercise supreme influence on the mass of men in the nations under our sway—the teachers, the legislators, the governing officials, and the literary men who guide the Press? Surely something is far wrong, if we do not at once look into this matter with the view of establishing at least an equality with Germany and France.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—A memorial fund raised by the friends of the late Humphrey Owen Jones, F.R.S., fellow of Clare College, who, with his wife, was killed in the Alps in August, 1912, has been gratefully accepted by the University, and a Humphrey Owen Jones lectureship in physical chemistry has been established. The General Board of Studies will shortly proceed to appoint a lecturer. The stipend arising from the memorial fund is about 150*l*. Candidates are requested to send their applications to the registrary of the University on or before January 17.

IN connection with the development of the forestry department in the University of Edinburgh, a second lectureship has been founded, and Mr. J. Lyford-Pike has been promoted to the post.

A COURSE of five advanced lectures on generating stations will be given by Mr. W. H. Patchell, at the Battersea Polytechnic, London, S.W., on Mondays, at 7.30, beginning on January 19. Admission to the lectures is free, and no ticket is required.

THE council of the Society of Engineers (Incorporated) may award in 1914 a premium of books or instruments to the value of 10*l*. 10*s*. for an approved essay on "The Status of the Engineering Profession." The competition is open to all, but, before entering, application for detailed particulars should be made to the secretary, 17 Victoria Street, Westminster. The last date for receiving essays is May 30, 1914.

COURSES of lectures in science and in literary subjects will be given in the University of Leeds on Tuesday, Wednesday, and Thursday, January 13–15. These lectures are intended primarily to meet the needs of teachers who find it difficult during the school term to keep in close touch with the most recent developments of thought in regard to their subjects. The courses will, however, be open not only to teachers, but to all students, whether former members of the University or not. Among the subjects of the courses are:—"The Rôle of Enzymes in Plant Metabolism," Prof. J. H. Priestley; and (1) "Artificial Parthenogenesis," (2) "Regeneration in Animals," W. O. Redman King.

THE Bulletin of the Massachusetts Institute of Technology, Boston, for December, 1913, contains a catalogue of the officers and students of the institute, a statement of the requirements for admission, and a description of the courses of instruction. In the account given of the facilities for research particulars are included of the Hawaiin Volcano Observatory. A gift to the institute in 1909 made provision for special research in seismology and other branches of geophysics. On January 1, 1912, the Hawaiin Volcano Research Association cooperated with the institute to establish an observatory and laboratory at the volcano Kilauea. Investigations are carried on by a resident staff, and properly qualified investigators are received at the observatory for special studies. A limited number of advanced students engaged in research dealing with the problems of volcanology and seismology are received also, and the work is described as specially suitable to candidates for the doctorate. Among topics suggested as thesis subjects we notice the spectroscopic study of volcanic flames, collection and analyses of volcanic gases, and optical pyrometry applied to molten magma in the field.

At the Headmasters' Conference, held on December 23 and 24, at Reading School, Sir Alfred Ewing, director of naval education, gave an address on the scheme of special entry for public schoolboys into the Navy. This scheme of special entry was introduced last year at very short notice, and the number of candidates who came forward was probably not at all so great as may be expected in the future. The candidates numbered ninety-two, and forty-one were taken for the training. Sir Alfred Ewing said hitherto the naval tradition has been unbroken which has required that officers shall join the service at so early an age that they can owe little or nothing to public school training and influence. Now, for the first time in British history, the Navy has said to the public schools, "Send us of your finished product." He asked the cooperation of the headmasters because anything which affects the supply of officers for the Navy, whether the volume of the supply or its efficiency, is a matter of profound national concern. By the scheme of special entry public schoolboys may enter the service at the age of eighteen, and undergo a brief period of professional training for eighteen months, after which they become midshipmen. The qualification desired in naval cadets entered in this way is substantially a good general education not specifically classical, but an education in which, apart from the more humane elements, there is a considerable bias towards mathematics, physical science, and mechanics. The reason of the bias is that these subjects form so much of the professional knowledge which a naval officer has to possess, and so what is substantially the Woolwich entrance examination, without one or two features of the present examination, has been adopted. In taking the public school boy and giving him a brief professional training, it would be very hard to give all the practical mechanical knowledge which the naval officer ought to possess in so short a time, unless there was initially some foundation for such knowledge or at least some aptitude for practical mechanics on the part of the candidate. Therefore the Woolwich list of examination papers is supplemented by introducing a paper on very elementary engineering—a paper intended rather to test the aptitude than the training of the candidate. This is an attempt to attract those who have a special bent towards engineering. Other subjects discussed at the conference were the Teachers' Register and several points in connection with classical education.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Meteorological Society, December 17.—Mr. C. J. P. Cave, president, in the chair.—R. C. **Mossman** and Mr. C. **Salter**: The great rain storm at Doncaster, September 17, 1913. On that day during a period of disturbed weather, a very heavy and local fall of rain took place in the vicinity of Doncaster. The storm lasted fourteen hours, and in that time more than 4 in. of rain fell at six stations, of which four had more than 5 in. The small area embraced by the heavy rain is shown by the circumstance that more than 4 in. fell over only sixty-one square miles, while more than 0·50 in. fell over 2336 square miles. Over the latter area 47,330 million gallons of water were precipitated. No adequate explanation of the storm can be offered, and the phenomenon affords an opportunity for special investigation.—Dr. J. E. **Church**, Jun.: Recent studies of snow in the United States. The author first gave a description of the snow sampler and weigher, which is an instrument he has designed for quickly measuring the depth and the water content of snow upon mountains. He then referred to some of the phases of the snow problem which were susceptible of solution by the aid of this instrument, and showed that the evolution of the snow leads directly to the practical problem of the relation of mountains and forests to the conservation of snow. This is of vital interest wherever irrigation is essential to agriculture, as in the western portion of the United States and in Australia. It is also closely related to the problem of stream control.—C. E. P. **Brooks**: The meteorological conditions of an ice sheet and their bearing on the desiccation of the globe. As the regions occupied by extensive ice-sheets at the present day, viz. Antarctica and Greenland, are the centres of permanent high-pressure areas, with slight precipitation, the author infers that the regions occupied by similar ice-sheets in the glacial period were likewise occupied by permanent anticyclones. The maximum extent of glaciation occurred at about the same time in different regions of the globe, and also coincided with the maximum of the pluvial period, or period of greater rainfall than the present, in the unglaciated regions. But a general decrease in temperature should lead to a decrease, not an increase, in the amount of evaporation, and hence of precipitation. The explanation of the paradox lies in the different distribution of the precipitation.

EDINBURGH.

Royal Society, December 4, 1913.—Prof. Hudson Beare, vice-president, in the chair.—Dr. W. N. **Shaw**: Principia atmospherica—a study of the circulation of the atmosphere. Section I. consisted of five axioms or laws of atmospheric motion, viz. the relation of motion to pressure, the computation of pressure and of the application of the gaseous laws, the law of convection, the law of the limit of convection, and the law of saturation. Section II. contained two lemmas or postulates regarding the relation between temperature and pressure in the stratosphere and in the troposphere, and the average horizontal circulation in the northern hemisphere. In Section III., which formed the bulk of the address, Dr. Shaw laid down for discussion six propositions, three of which had been already dealt with in a communication recently made to the Scottish Meteorological Society and published in the journal of the society for 1913. The remaining three were then considered in some detail, viz.: (1) the conditions necessary to maintain a steady atmospheric current; (5) the calculation of the distribution of pressure and temperature in the upper air from the observations of structure represented by soundings with a pilot balloon; (6) to account for the general circulation of the atmosphere in the northern hemisphere.—Sir William **Turner**: Observations on the auditory organ in the Cetacea. The paper was in two parts, in which were treated respectively the external auditory meatus and ear-wax, and the tympano-petrous bones. One of the specimens of ear-wax exhibited was about 20 in. long, and had been obtained from a blue whale near the South Shetland Islands. Sir William Turner also read a note upon a siliceous sponge of the order Hexactinellida, consisting of white delicate thread-like spicules collected into two tufts or bundles.

December 15.—Prof. James Geikie, F.R.S., president, in the chair.—Prof. C. R. **Marshall**: The pharmacological action of tetra-alkyl ammonium compounds—part ii., the action of tetra-ethyl-ammonium chloride; part iii., the action of methyl-ethyl-ammonium chlorides. Tetra-ethyl-ammonium chloride resembles tetra-methyl-ammonium chloride in inducing paralysis by an action on the myo-neural junctions. It needs, however, much larger doses. Unlike tetra-methyl-ammonium chloride, it has no action on vagal terminations, and it is difficult to produce with it temporary cessation of the respiration. Trimethyl-

ethyl-, dimethyl-diethyl, and methyl-triethyl-ammonium chlorides produce actions, speaking broadly, intermediate to those of tetra-methyl- and tetra-ethyl-ammonium chlorides. None of these compounds stimulate the vagus endings.—Miss Dorothy **Court**: Enzymatic peptolysis in germinating seeds. Parts i. and ii.—Prof. A. H. **Gibson**: The kinetic energy of viscous flow through a circular tube. In the experiments, which were arranged to test the theory, the upper end of the tube projected into the reservoir, and the head loss at entrance to the tube was represented by the expression $cv^2/2g$, where the factor c is unity for very thin-walled tubes, and 0·5 for thick-walled tubes. The experiments gave, for three cases, values of c varying from 0·54 to 0·71, and these could be represented with fair accuracy by the formula

$$c = 1/(2-n^2),$$

where n is the ratio of the inner to the outer diameter.—L. N. G. **Ramsay**: Polychæta of the family Nereidæ collected by the Scottish National Antarctic Expedition. These worms are poorly represented in Antarctic and sub-Antarctic regions. One new species was found near the Falkland Islands.

PARIS.

Academy of Sciences, December 22, 1913.—M. P. Appell in the chair.—Remarks by the President on the proceedings of the fifth general meeting of Weights and Measures, held at Paris and at Sèvres, October 9–17.—G. **Humbert**: Indefinite binary quadratic forms.—Ch. **Lallemand**: Remarks on the second conference concerning the international map of the world on the scale of 1 : 1,000,000, held at Paris, December 10–17.—Arnaud de **Gramont**: The band spectrum of aluminium and its presence in the flame spectrum of certain minerals. The mineral was heated in an oxy-acetylene flame, giving a temperature well above the melting point of iridium. Metallic aluminium or its haloid salts give a mixed line and band spectrum, details being given. The spectrum is not given by the oxygen compounds of aluminium in the oxy-acetylene flame; but this generalisation does not seem to hold with all minerals, some giving the spectrum and others not.—M. Edmond **Perrier** was elected vice-president for the year 1914.—Ernest **Esclangon**: Observation of the Delavan comet made with the large equatorial of Bordeaux Observatory. Positions given for December 19, on which date the comet was of the 11th magnitude.—J. **Guillaume**: Observations of the Delavan comet (1913*f*) made with the *coudé* equatorial at the Observatory of Lyons. Position for December 19. Comet as a whole 11th magnitude, stellar nucleus 13th magnitude.—M. **Giacobini**: Observations of the same comet made at the Paris Observatory. Three positions determined, December 19 and 20.—P. **Chofardet**: On the same. Observations at Besançon on December 19 and 20.—Emile **Belot**: The extension of a theorem of Faye with application to the mode of formation of the planetary system.—St. **Chevalier**: The effect of atmospheric dispersion on the diameter of photographed stars.—Georges **Darmois**: Algebraic curves of constant torsion.—M. **Tzitzéica**: Networks with equal invariants.—B. **Hostinsky**: Closed curves of constant torsion.—A. **Chatelet**: Complex multiplication.—Ernest **Esclangon**: Mean quasi-periodic functions, deduced from a quasi-periodic function.—Kampé de **Fériet**: The development of a function in a series of ultra-spherical polynomials.—Kyrille **Popoff**: Fredholm's equations of the first species.—G. **Bouligand**: Correction to a note on the problem of Dirichlet presented to the meeting of December 8.—Jean **Chazy**: The singular points of the general integral of the problem on n bodies.—Th. de **Donder**: The movement of heat in a body opaque to heat.—J. M. **Crafts**: General comparison of vapour pressures. If T and T′ are the boiling points of any substance under pressures P and P′, T″ and T‴ are the boiling points under the same pressures of a standard substance (naphthalene), and C is a constant, it is shown that the relation $T-T'=(T''-T''')C$ holds for numerous substances of very varied nature.—Pierre **Weiss**: The molecular field and a law of action inversely as the sixth power of the distance.—Paul **Sélényi**: The existence and observation of non-homogeneous spherical light waves.—G. **Sagnac**: The proof of the reality of the luminous æther by the experiment of the rotating interferograph.—M. de **Broglie**: The continuous photographic registration of the spectra of Röntgen rays. The spectrum of tungsten. The influence of thermal agitation.—F. **Bourrières**: The observation of the Brownian movement with linear magnification above 20,000. In this work the ordinary eyepiece of a microscope was replaced by another complete microscope. Under these conditions the Brownian movement proved to consist of a double motion; the first with an amplitude of the order of a micron, the other about 1/50 of this.—V. **Schaffers**: The law of currents producing glow discharge in cylindrical fields.—R. **Marcelin**: The expression of velocities of transformation of physico-chemical systems as a function of the affinity.—M. **Gompel** and Victor **Henri**: The absorption of ultra-violet light by alkaloids of the morphine group and by phenanthrene.—Maurice **Nicloux**: The laws of absorption of carbon monoxide by the blood. The hæmoglobin of the blood corpuscles, put in contact with mixtures of carbon monoxide and oxygen, combines with both gases in proportions defined by their partial pressures in the mixture and in accordance with the law of mass action.—F. **Bodroux**: Catalytic esterification in the wet way. The production of esters in presence of dilute mineral acids. The ordinary theories of esterification by mineral acids fail to explain the catalytic action of these acids in very dilute solutions at 100° C. The author suggests the possible formation of an addition compound of the organic and mineral acids as an explanation of the action.—Charles **Staehling**: A supposed separation of radium D from lead in active lead by means of Grignard's reaction. The author has repeated the work of Hofmann and Wolff, and has been unable to obtain the positive separation indicated by these authors. The results are absolutely negative, and it is concluded that it is impossible to separate radium D from lead in active lead by the tetraphenyl-lead method.—J. **Riban**: Concerning the action of carbonyl chloride upon phosphates and oxides. Remarks on a recent paper by Barlot and Chauvenet.—Gabriel **Bertrand** and H. **Agulhon**: A method for estimating extremely small quantities of boron in organic materials.—Amé **Pictet** and Maurice **Bouvier**: Vacuum tar. A chemical study of the tar obtained by the distillation of coal at 450° C. under reduced pressure (15 mm. to 18 mm.). After separating alcohols and unsaturated hydrocarbons, two naphthenes, $C_{10}H_{20}$ and $C_{11}H_{22}$, were isolated, identical with two hydrocarbons obtained by Mabery from Canadian petroleum.—M. **Lespieau**: True acetylene derivatives obtained from dipropargyl compounds.—E. E. **Blaise**: Syntheses by means of the organometallic zinc compounds. The preparation of the α-ketonic acids.—Marcel **Sommelet**: A method of synthesis of benzyl chloride and its homologues. A new general method is described based on the following reaction,

$$RH + ClCH_2.O.R' = R.CH_2.OR' + HCl,$$

which takes place at −10° C. in carbon bisulphide or carbon tetrachloride solution in presence of $SnCl_4$.—

Paul **Gaubert**: Mixed liquid crystals.—Albert Michel **Levy**: The effects of the granitic metamorphism in the carboniferous eruptive tufas in the neighbourhood of Mâcon.—Pereira de **Sousa**: Contribution to the petrographical study of the north of Angola.—Marcel **Delassus**: The influence of the size of seeds on the general development and anatomy of plants.—Raoul **Combes**: The conversion of an anthocyanic pigment extracted from red autumnal leaves to the yellow pigment contained in the green leaves of the same plant. The yellow pigment is obtained by oxidising the red pigment with hydrogen peroxide. The change in the colour of leaves in the autumn is due to a process of reduction.—L. **Blaringhem** and E. **Miège**: Studies on the straw of wheat.—Armand **Viré**: Experiments on the divining rod. A detailed account of the successful use of the divining rod.—R. **Robinson**: The physiological localisations of the encephalus contrasted with extensive destruction of this organ.—I. G. **Garfounkel** and J. **Gautrelet**: Contribution to the study of the action of colouring matters on the heart and blood pressure.—Emile **Yung**: The vertical distribution of plankton in the lake of Geneva.—A. **Gruvel**: The anchovy (*Engraulis eucrassicholus*) on the western coast of Africa.—Ch. **Gravier**: The incubation of Mopsea and Rhopalonella from the Antarctic.—Adrien **Lucet**: The influence of agitation of the broth cultures on the development of *Bacillus anthracis* and some other micro-organisms.—Henri **Coupin**: Zinc and *Sterigmatocystis nigra*.—J. **Wolff**: The catalytic action of iron in the development of barley.—A. **Fernbach** and M. **Schoen**: Pyruvic acid a life product of yeast.—Emile **Haug**: The geology of the southern slopes of Sainte-Baune.—J. **Blayac**: Relations between the sands of the Landes and the terraces of the Garonne.—A. **Bigot**: The structure of the Bocain zone.—P. **Idrac**: The inequalities of the distribution of terrestrial magnetism.

BOOKS RECEIVED.

Letzte Gedanken. By H. Poincaré. Translated by Dr. K. Lichtenecker. Pp. vi+261. (Leipzig: Akademische Verlagsgesellschaft m.b.H.) 4.50 marks.

The Madras Presidency, with Mysore, Coorg, and the Associated States. By E. Thurston. Pp. xii+293. (Cambridge: University Press.) 3*s*. net.

Plant Life. By T. H. Russell. Pp. 71. (Birmingham: Cornish Bros., Ltd.) 2*s*. 6*d*. net.

Royal Horticultural Society. Four Essays, written by Students at Wisley, 1913. Pp. 72. (London: Royal Horticultural Society.)

The Story of Plant Life in the British Isles. By A. R. Horwood. Pp. xiv+254. (London: J. and A. Churchill.) 6*s*. 6*d*. net.

Water: Its Purification and Use in the Industries. By W. W. Christie. Pp. xi+219. (London: Constable and Co., Ltd.) 8*s*. 6*d*. net.

Transmission Line Formulas for Electrical Engineers and Engineering Students. By H. B. Dwight. Pp. vi+137. (London: Constable and Co., Ltd.) 8*s*. 6*d*. net.

DIARY OF SOCIETIES.

FRIDAY, JANUARY 2.

GEOLOGISTS' ASSOCIATION, at 8.—The North Sea Drift and Certain Brick-Earths in Suffolk: P. G. H Boswell.

MONDAY, JANUARY 5.

ARISTOTELIAN SOCIETY, at 8.—Philosophy as Co-ordination of Science: H. S. Shelton.

SOCIETY OF CHEMICAL INDUSTRY, at 8.—The Viscosity of Oils: J. L. Strevens.—The Oxygen Content of Gases from Roasting Pyrites: L. T. Wright.—The Electrical Conductivity of Milk During its Concentration, with Suggestions for a Practical Method of Determining the End Point in the Manufacture of Sweetened Condensed Milk: L. C. Jackson, L. McNab, and A. C. H. Rothera.—Monazite from Some New Localities: S. J. Johnstone.

RÖNTGEN SOCIETY, at 8.15.—Histological Changes Produced by X-rays on Animal Tissues; Destructive and Hyperplastic Action of X-rays; Practical Consequences in Regard to Radio-Therapy and Protection of the Radiologist: Dr. J. Clunet.

WEDNESDAY, JANUARY 7.

GEOLOGICAL SOCIETY, at 8.—The Ordovician and Silurian Rocks of the Lough Nafooey Area (County Galway): C. I. Gardner and Prof. S. H. Reynolds.—The Geology of the St. Tudwal's Peninsula (Carnarvonshire): T. C. Nicholas.

AËRONAUTICAL SOCIETY, at 8.30.—Wind Gusts and the Structure of Aërial Disturbances: Dr. W. N. Shaw.

THURSDAY, JANUARY 8.

CONCRETE INSTITUTE, at 7.30.—Factory Construction: P. M. Fraser.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—The Development of Electric Power for Industrial Purposes in India: H. R. Speyer.

FRIDAY, JANUARY 9.

ROYAL ASTRONOMICAL SOCIETY, at 5.

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