

THURSDAY, DECEMBER 27, 1917.

EDUCATION AND ORGANISED
THOUGHT.

- (1) *The Organisation of Thought, Educational and Scientific.* By Prof. A. N. Whitehead. Pp. vii + 228. (London: Williams and Norgate, 1917.) Price 6s. net.
- (2) *The Human Worth of Rigorous Thinking: Essays and Addresses.* By Prof. Cassius J. Keyser. Pp. 314. (New York: Columbia University Press; London: Oxford University Press, 1916.)

THESE two collections of essays and addresses by Prof. Whitehead and Prof. Keyser contain much matter of considerable interest to the large number of persons who are at present occupying themselves with the consideration of the many difficult questions, connected with educational reconstruction. Distinguished scientific, or literary, specialists are not always, perhaps not often, trustworthy guides in educational affairs. Their absorption in a special line of thought is apt to produce in them a bias in regard to the relative values of different branches of study, destructive of that keen sense of proportion which a sound educationist must possess. The specialist is apt to live in a sub-universe of his own, without troubling himself much about the social value of his study or its relations with other parts of the world of thought and action. Even in the teaching of his own subject the specialist not infrequently finds it difficult sufficiently to distinguish between that instruction which is directed to special training and that which is appropriate for forming part of a scheme of liberal education. However, when a specialist has sufficient breadth of mind to enable him to overcome the temptations incidental to his own occupation, he is frequently able to make contributions to educational thought which exhibit an insight greater than is possessed by many of those who approach the problem of education without those advantages which accrue from a profound study of some one department of knowledge.

Both Prof. Whitehead and Prof. Keyser have the advantage of being mathematical specialists with a deep interest in the philosophical aspect of mathematics, and both of them very properly select their illustrations in expressing their educational views from the domain most familiar to them. But Prof. Whitehead, at least, has attained to a certain catholicity of outlook in educational matters which makes his detailed expression of views such as will appeal to many even of those who may not agree with some of his opinions.

(1) Of the two authors Prof. Whitehead remains nearer the solid earth; indeed, his whole treatment of educational questions is permeated by a profound conviction of the importance of education as the means of fitting human beings for life itself in all its phases. He regards education neither merely as the provision of a stimulant

to the higher faculties which shall operate as a more or less ornamental and detachable supplement to ordinary life, nor simply as a scheme of training of the kind which aims at producing purely practical efficiency.

One of the most crucial questions which must receive a practical solution in the framework of educational reconstruction is that of the proper relation between liberal or general education and that special or technical study which is necessary in order to fit a student for some definite career. That a failure to make due provision for both these sides of education would be disastrous in its consequences is widely, but, unfortunately, not universally, recognised. Experience has amply demonstrated that a special or technical training is to a large extent a failure unless it is based upon a sound and sufficient general education. The insistence upon this truth has been so frequent that it may be thought to have become a platitude; nevertheless, the pressure of the purely practical side of life is likely to become so urgent in the near future that the danger of education becoming too purely utilitarian in the narrow sense of the term cannot safely be neglected.

In the higher meaning of the expression, Prof. Whitehead is decidedly utilitarian in his view of the aims of education; indeed, the key-note to his ideas about education is struck in his definition of education as "the acquisition of the art of the utilisation of knowledge." Like all statements of a utilitarian flavour, this definition is capable of being interpreted in a narrow or in a broad sense. Its real or apparent defect, that it suggests a too exclusive reference to externality, and lays no stress upon the development of the inner life, may perhaps be held to be removed by means of a sufficiently liberal interpretation of the terms "utilisation" and "knowledge."

In regard to the methods and subject-matter of instruction, Prof. Whitehead emphasises most strongly the importance of not allowing any one branch of study to be treated in such a manner that it is wholly isolated from other departments, and that of exhibiting clearly and continually the relations of all subjects and portions of subjects to one another as parts of a connected and coherent whole; in fact, he holds that "there is only one subject-matter for education, and that is life in all its ramifications." The great practical difficulty in realising such high educational ideals in the actual work of instruction arises from the very insistent demands which modernist methods make upon the skill and energy of the teacher. Failure on the part of a teacher who attempts to teach in accordance with the newer theories is apt to be more disastrous than when the older and more mechanical methods are employed. It is only fair to say that Prof. Whitehead does not attempt to ignore the practical difficulties of this kind which arise when his ideals are carried into the practical domain.

(2) Prof. Keyser, in his essay on "The Human Worth of Rigorous Thinking," and in various other essays on the teaching and philosophy of

mathematics, has much to say which will interest the considerable public whose attention has been arrested by the modern logistic school. His style of writing suffers from being too ornate, and his somewhat overloaded sentences are often a hindrance to a clear comprehension of his meaning.

In their essays on the philosophy of mathematics and on logic both the authors exhibit at times a tendency, common in the school of thought to which they belong, to attach too much relative importance to deductive logic, and even to represent it as being almost the sole form in which rigorous thinking is embodied. Inductive logic, a subject of perhaps greater importance, as lying nearer to the actual modes in which living thought moves, than deductive logic, is apt to be ignored in an estimate of what constitutes rigorous thinking. The reduction of the whole or of parts of mathematics to a purely deductive scheme in which everything flows by chains of syllogisms from a certain body of postulations consisting of existential assumptions and axioms is no doubt of distinct philosophical and æsthetic interest, but it is doubtful whether it can do much to further the progress of mathematics as a living and growing organism.

Mathematical knowledge could not possibly have been discovered by purely deductive processes. The purely deductive form is one in which a mathematical theory can be exhibited only after its completion; it operates as a gauge which tests the exactitude and completeness of what has been discovered by the operation of mental processes of a higher and more subtle kind than those involved in following a chain of syllogisms. Even a purely deductive scheme could not be constructed without the factor of purposiveness in the constructor; in default of a perception of aim, a set of given postulations, definitions, and axioms would be useless. The possession of them would not of itself enable anyone to move a single step in construction, any more than a fount of type would enable a compositor to set up a book if no copy were given to him. It would be unfair to imply that Prof. Whitehead and Prof. Keyser are unaware of these considerations, but at least amongst their disciples of the modern logistic school they are by no means always adequately recognised.

E. W. H.

THE FUNDUS OCULI OF BIRDS.

The Fundus Oculi of Birds, especially as viewed by the Ophthalmoscope: A Study in Comparative Anatomy and Physiology. By Casey A. Wood. Pp. 180+plates lxi. (Chicago: The Lakeside Press, 1917.)

DR. CASEY WOOD is an ophthalmic surgeon with a large practice in one of the busiest cities in America. He is a voluminous writer on subjects connected directly with the science and art of his speciality, and he is the editor of an Encyclopædia of Ophthalmology, of which several volumes have already appeared. It would seem

that in this there was enough to provide labour for more than the ordinary day of any man, yet he has found time to devote himself to the exploration of what may almost be described as an untrodden field of science. It is true that in this country Dr. Lindsay Johnson has done work of a similar kind, but he mainly concerned himself with the ophthalmoscopic examination of the mammalian eye. Dr. Wood is the first to make a systematic examination of the fundus appearances in the eyes of birds, and the present volume, with its beautiful series of illustrations by Mr. A. W. Head, is a sufficient proof that it has been a labour of love. The present writer is not in a position to judge whether the ophthalmoscope will prove to be the valuable aid to the classification of birds and the identification of species that Dr. Wood seems to think, but a strong case has been made out for the use of the ophthalmoscope by the ornithologist. For his benefit two chapters are devoted to a description of the ophthalmoscope and its use; but an hour or two with a friendly oculist in the ophthalmic department of a large hospital would do far more than many pages of description to enable those interested in birds to gain a glimpse of this new field.

The most interesting chapters in the book deal with the relationship between the macular arrangements in the retina and the habits of the bird. In these we have a description of all the variations from the almost human-like owl family with simple binocular vision, through the classes which seem to be capable either of binocular or monocular vision, to the purely monocular type with its nasally placed macula. The author differentiates six types of macular arrangement: (1) The amacular fundus; (2) the nasal monomacular fundus, the commonest type in birds; (3) the temporal monomacular fundus, *i.e.* like the human eye and found almost exclusively in owls; (4) the bimacular fundus, with the nasal fovea usually more deeply marked than the temporal fovea, the latter being used in binocular vision and becoming more deeply marked the more the power of binocular stereoscopic single vision is called into play; (5) the infula-macular fundus, where the area of clear vision takes a band-like form, with a well-defined fovea placed nasally to the disc in some part of the band; (6) the infula-bimacular fundus, in which there is a similar band-like area with two foveæ, of which the nasal is invariably in the band, while the temporal sometimes forms an extremity of the band, but sometimes lies above and apart from it.

It would have added very greatly to the scientific value of this work if Dr. Wood had confirmed his description of the macroscopic appearances of these various types by microscopic sections through the macular areas of the principal types. It is obvious that he himself has grave doubts as to the amacular type, and a description of the histological appearances of one specimen from each of the other types would have more than compensated for the loss of several

pages of description of macroscopic appearances.

It is to be regretted that in a work of this character there should appear several slips due to lack of care in revision. On p. 21 it is stated quite rightly that "in birds with more marked binocular vision—hawks, for example—the *temporal* fovea has the greater depth and the eye becomes more asymmetrical"; and further on, on the same page: "Stereoscopic, binocular, single vision in birds with double foveæ . . . is probably accomplished by the two *temporal* foveæ acting in cerebral unison." Yet on p. 56, speaking of the birds of prey in general and the sparrowhawk in particular, the author states that "the *nasal* fovea is invariably the deeper and sharper of the two, and probably is used when distinct sight and binocular vision are required." On pp. 12 and 44 the author uses the term *neurilemma* where obviously he is referring to the *myelin sheath* of the nerve-fibre, and on p. 22 he uses the same term *neurilemma* for the *pial sheath* of the optic nerve. We believe that some physiological writers of past ages did call the perineurium *neurilemma*, but from the time of Schwann onwards the word has had a definite restriction to the outer sheath of the nerve-fibre, and to that alone.

It is only the interest with which we have read Dr. Wood's book that has led us to note these minor faults, and we must conclude with a note of admiration for the beautifully coloured reproductions of Mr. Head's drawings of the fundi of many different species of birds.

A NATURALIST IN COSTA RICA.

A Year of Costa Rican Natural History. By Amelia S. Calvert and Prof. P. P. Calvert. Pp. xix+577. (New York: The Macmillan Co.; London: Macmillan and Co., Ltd., 1917.) Price 12s. 6d. net.

PROF. CALVERT, after several prolonged journeys to Mexico and other countries, has extended his entomological studies to Costa Rica, in which State he has spent a whole year, from May, 1909 to 1910, accompanied by Mrs. Calvert, likewise a keen naturalist. Their chief purpose was a study of the dragonflies with reference to their seasonal distribution, which necessitated visits to the same localities at different times throughout the year. These special investigations having not yet been completed (Appendix iii. contains a long list of papers based on the collections, written by the authors and other specialists), their results are deferred, and the present book, embellished with some 150 illustrations, mainly of plants and insects, is devoted to the thousands of observations of all kinds of animals and plants as the travellers came across them. Here lies the drawback of the book; although so full of information, there are but few chapters to be enjoyed by the general reader, who, taking the detail, much of which is unavoidably technical, for

granted, would relish some more comprehensive generalised descriptions as characteristic of the country.

Most of their time, about nine months, was spent, off and on, at Cartago, near the capital, San José, situated in the centre of the State, 10° N., at an altitude of some 4700 ft. Cartago is a very important place; there was to have been inaugurated in June, 1910, the "Central American Court of Justice," *i.e.* Carnegie's Peace Palace. From the naturalist's point of view the district was eminently well selected to serve as headquarters, situated as it is on the backbone of the country, at an altitude delightful for a country in the tropics, well watered by numerous streams, well wooded and very fertile, and last, not least, connected by the railway with the Atlantic and the Pacific. Thus they were enabled to make excursions through and into the most diverse kinds of country.

Irazu, the highest volcano, 11,300 ft., now extinct, or rather dormant, like so many Central American volcanoes, is only some ten miles from Cartago. It was visited several times, and on one occasion our naturalists spent a night in the crater with a tent. This chapter, well illustrated with photographs, contains a lively, graphic description of the altitudinal and other charmingly interesting changes.

The Costa Rican Government obliged them by numerous acts of courteous assistance. On several occasions Prof. Calvert was invited to join some Government commission—for instance, to the north-west province—so that he acquired a very satisfactory general knowledge of the middle belt of the country, from the Atlantic to the Pacific.

Costa Rica is a well-to-do farming country; the aboriginal natives give no trouble, and the other mixed and white people have the good sense to keep themselves and their country out of politics. Greatly helped by not a few of the scientific and other residents, everything went smoothly, and there were no stirring incidents of travel to relate until the halcyon year of the conjoint authors was brought to a sudden, catastrophic end.

Earthquakes are endemic in Central America, and more or less disagreeable shocks had been not uncommon at Cartago. Within the last 250 years the town had been destroyed several times. On April 13, 1910, there occurred a few severe shocks, increasing to three dozen by the next day and badly damaging the town; but the disturbance was so local that Prof. Calvert, who happened to be only thirty miles away, did not think it worth while to return to his partner, who was at Cartago. They made the best of the ensuing confusion until May 4, when some sudden, terrific shocks laid the town in ruins, including the Peace Palace, and two days later our lucky travellers, themselves unharmed and without any damage to their numerous collections, left for home.

OUR BOOKSHELF.

Elliptic Integrals. By Prof. Harris Hancock. Pp. 104. (Mathematical Monographs, No. 18.) (New York: John Wiley and Sons, Inc.; London: Chapman and Hall, Ltd., 1917.) Price 6s. net.

INSPIRED by Sir G. Greenhill, to whom he makes due acknowledgment, Prof. Hancock has compiled a very useful monograph, compact, well arranged, and apparently accurate. Chap. i. is on elliptic integrals, properly so called, and their reduction to Legendre's normal forms; it is illustrated by appropriate graphs. Chap. ii. is on the sn , cn , dn functions, and gives the period-pavement for each. Chap. iii. gives a well-arranged list of integrals involving elliptic functions. Chap. iv. is on computation, and follows Jacobi and Cayley in the main. It begins with Jacobi's two-circle proof of the addition theorem, goes on to the Landen transformation, and then gives worked-out examples, using the descending scale of moduli (k , k_1 , k_2 , ...) as Jacobi does. The algorithm of the arithmetico-geometric mean is explained and applied, and there is a particularly neat discussion (p. 79) of integrals of the second kind. There are three tables, all to five places: (i) Complete integrals K , E with $k = \sin \theta^\circ$, and 1° step for θ° ; (ii) elliptic integrals $F(k, \phi)$ with k as above, step 5° for θ° and 1° for ϕ° ; (iii) elliptic integrals $E(k, \phi)$ with k, ϕ as for (ii). All these tables were reproduced from Levy's "Théorie des fonctions elliptiques"; they are well printed and properly spaced.

It is unfortunate that restrictions of space prevented Prof. Hancock from giving any formulæ relating to the first-stage functions \wp , \wp' . It is true that in numerical applications we have to use a modulus k instead of two invariants, but in many parts of theory Weierstrass's functions are the proper ones to use. G. B. M.

Farm Forestry. By Prof. J. A. Ferguson. Pp. viii + 241. (New York: J. Wiley and Sons, Inc.; London: Chapman and Hall, Ltd., 1916.) Price 6s. net.

SCATTERED all over the United States, amidst the farm land, there are numerous small woods, which are in most cases remnants of the original virgin forest. These wood-lots, as they are called, are said to cover in the aggregate as many as 200,000,000 acres. Though, as a rule, poorly stocked with timber at present, the wood-lots are of great value to the rural population, as they provide cheaply the fuel, posts, fencing, and timber required on the farm. Under proper care and management their productive capacity is capable of great expansion, and it is estimated that all the timber necessary for the manifold industries of the United States might be grown on the wood-lots alone. Great efforts are now being made by the Department of Agriculture at Washington and by the agricultural experiment stations in each State to encourage the farmer to take a greater interest in his wood-lot.

The importance of forestry as a subject of instruction in agricultural colleges and in high

schools is now universally acknowledged. The present volume is a suitable text-book for agricultural students and for owners of small woodlands, as it covers in a simple way the whole subject of farm forestry. It consists of a series of readable chapters on the economic value of the wood-lot and on the principles of silviculture as applied to small woods.

The Yearbook of the Universities of the Empire, 1916 and 1917. Published for the Universities Bureau of the British Empire. Pp. xvi + 412. (London: Herbert Jenkins, Ltd.) Price 7s. 6d. net.

FOR reasons of economy the Yearbook was not published last year. Since the commencement of the war few changes have been made in the regulations of the universities, and the information regarding the conditions of admission, faculties, degrees, scholarships, and publications of the various universities contained in the 1915 issue continue to be substantially correct and are not repeated here. In view of the fact that there are certain matters to which it is forbidden to refer, the part which the universities have taken in national service of all kinds is not summarised in the Yearbook; this subject is postponed until the conclusion of hostilities. Three appendices added to the present volume give full particulars of the Beit fellowships, the scholarships awarded by the Royal Commissioners for the Exhibition of 1851, and the Rhodes scholarships.

The Yearbook provides a very useful summary of university activities throughout the Empire.

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.]

Labyrinths in English Churches.

As the author of "Amusements in Mathematics," reviewed in NATURE of December 20, says that he does not know of any instance of a labyrinth in an English church, it may be mentioned that one is represented in one of the bosses of the north aisle of the nave of St. Mary Redcliffe, Bristol. The style is Somerset Perpendicular, the date probably about 1420.

C. S. TAYLOR.

Banwell Vicarage, December 21.

An Optical Phenomenon.

In physiological laboratories several routine experiments are in use for demonstrating phenomena of the kind described by Capt. C. J. P. Cave (NATURE, December 13, p. 284). These phenomena all support Hering's theory of the reciprocal after-effects of stimulation (see W. H. R. Rivers in Schäfer's "Text-book of Physiology," vol. ii., pp. 1146-47, especially fourth paragraph, p. 1147). The seat of illusion begins at the retina, but (as hinted in my letter on p. 165, November 1) involves all the intricate labyrinth of nerve tissue from the retina to the highest sensory and motor centres.

The way in which the reciprocal after-effects operate in the cases under consideration cannot be fully dis-

cussed here, but I would make one suggestion. When the objects in a given visual field are moving in different directions, or some of them not moving, the eye usually fixes on one of the objects, regarding it as stationary and treating the others as moving. This requires both a muscular and a nervous effort, involving the co-ordinating mechanism of the higher nerve-centres; and when the stimulus ceases or changes, the reciprocal after-effects in these centres are apparently interpreted as opposite motion; a change of nerve-muscle co-ordination is necessary to accommodate the eye to a changed stimulus. Even very simple sensations may involve complex nerve-muscle co-ordination.

F. J. ALLEN.

Cambridge, December 16.

A TRAVELLER IN LAPLAND.¹

MR. HEDGES BUTLER is a specialist in unusual modes of travel, and may well be proud of his pioneer work in systematic journeys through the air. Most visitors to Lapland would select the long days of summer, when the heat may prove excessive and the mosquitoes are "a veritable plague." Mr. Butler points out that the best time to start is about the end of March, and he gives pictures of Kiruna railway station, and the romantic little platform at Polcirkel, piled about with snow. When he gets as far north as he can by the steamer or

the Narvik railway, he casts aside all British prejudices as to hours of meals and clothing; he dines and dresses like his Lapp companions, sleeps with them in a skin tent when there is no rest-house, and occasionally passes the night in a burrow in the snow. His friendliness with the people smooths away the difficulties of journeys by the boat-like sledges or on skis, and he is always ready to emphasise his happiness rather than his discomfort. In reading his book, we seem admitted to the pleasure of his companionship.

¹ "Through Lapland with Skis and Reindeer, with Some Account of Ancient Lapland and the Murman Coast." By Frank Hedges Butler. Pp. xii+286. (London: T. Fisher Unwin, Ltd., 1917.) Price 12s. 6d. net.

Mr. Butler gives useful details of equipment, which remind us of the delightful "Provision to catch the Whale fish in Russia," published by Hakluyt under the date 1575. He sketches the history of the Lapps, and gives, in chap. vi., a valuable description of the Murman coast and its conditions down to the arrival of the railway at Alexandrovsk. We might reasonably expect, however, some reference to the political and commercial importance of this line, and to the singular revival for London, Hull, and Moscow of the sixteenth-century trading routes. The bibliography of Lapland in Appendix v. begins with Stephanus in 1629; but Englishmen would like some reminder of Willoughby's last journals, and of the tragedy of "the *Speranza*, which wintred in Lappia" in 1553. "Kegor, Pechingo, and Cola" are, moreover, discussed by William Burrough in 1576, and their names were then better



FIG. 1.—Bossekop on the Altenfjord, Norwegian Lapland. From "Through Lapland."

[Photo B. Mesch.]

known to our merchants than they are at the present day. Mr. Butler will do much to introduce this region again to general readers, and we can only regret that they must turn elsewhere for the romance of our early Russian trade. Burrough uses the pleasant terms "Lappians" and "Lappies" for the people, and we commend these to Mr. Butler, who in one place gives us the odd plural "fjeldlappers" as a Norwegian term.

A certain indifference to language, characteristic alike of British travellers and of soldiers at the Front, shows itself in Mr. Butler's work. The Finnish spellings in the vocabulary on p. 48 are

not those usually accepted, nor will Fru Wiig of Bossekop feel happy in appearing as "Mrs. Wiggs." "Gastivare" (p. 125) is neither Finnish nor Swedish, and "kestikievari" would seem to be the word intended. Mr. Butler, however, can drive reindeer, just as he can follow game in Africa, and the main thing is that he accommodates himself so skilfully to his surroundings. Even if we cannot hope to follow him, and may be content to view the wilds of Lapland from Abisko or the top of Kiirunavaara, we feel

statistical mechanics and their applications to the problems of stellar dynamics. Since the positions and motions of individual stars are known only in a few instances, it is impossible to treat the motions of stars by the ordinary methods of classical mechanics, so that statistical methods have to be adopted. Important investigations in stellar dynamics have been made recently on this basis by several investigators, more particularly by Eddington and Jeans. There are two fundamentally different methods of treatment: (a) The



FIG. 2.—Lapp tent and sledge at Jukasjärvi. From "Through Lapland."

[Photo F. H. Butler.]

something, as we turn his pages, of the dry, healthy air and the crispness of the arctic snow.

GRENVILLE A. J. COLE.

STELLAR DYNAMICS AND STATISTICAL MECHANICS.¹

THE five papers referred to below do not form a logical sequence of discussion, but are related to one another in that they are all more or less directly concerned with the methods of

¹ (1) "Statistical Mechanics, based on the Law of Newton," *Lund Meddelande*, Ser. ii., No. 16. (2) "Ueber den Satz von den Gleichen Verteilung der Energie," *Lund Medd.*, Ser. i., No. 79; *Arkiv för Mat. Astr. och Fysik*, Bd. xii., No. 18. (3) "Ueber hydrodynamisches Gleichgewicht in Sternsystemen," *Lund Medd.*, Ser. i., No. 82; *Arkiv för Mat.*, etc., Bd. xii., No. 21. (4) "Conceptions Monistique et Dualistique de l'Univers Stellaire," *Lund Medd.*, Ser. i., No. 81; *Scientia*, vol. xxii., p. 77 (1917). (5) "Eine Studie über die Analyse der Sternbewegungen," *Lund Medd.*, Ser. i., No. 78; *Arkiv för Mat.*, etc., Bd. xii., No. 10. All by Prof. C. V. L. Charlier.

stars may be compared with the molecules of a gas, and the effect of the various encounters considered, the discussion proceeding along the lines of gas theory. (b) It may be supposed that the encounters of stars have but small effect, so that the stars may be regarded as describing orbits under the general attraction of the stellar system as a whole, the discussion then proceeding along the lines of hydrodynamics. Both methods may be expected to give results of value for the general theory.

Prof. Charlier has adopted the first of these two methods in (i), and has worked out a kinetic theory for the stars based upon Newton's inverse square law of attraction; in gas theory the treatment has usually supposed either that the molecules are elastic spheres or that they repel each other inversely as the fifth power of the distance.

The latter law is artificial, but was used by Maxwell because it introduced considerable simplification into the discussion. Where stars are concerned it is necessary to distinguish between real collisions and encounters. The latter occur when two stars approach one another sufficiently closely to produce a relative change in path without actually colliding. The number of collisions will naturally be considerably less than that of the encounters. The fundamental general equation of statistical mechanics is formed, and the effect of the collisions and encounters obtained. The discussion follows closely along normal lines. The integration of the fundamental equation when the solution is a frequency-function of type A is performed, the solution being rather more complicated than for Maxwell's law of repulsion. The time of relaxation, which is a measure of the time taken by the system to reach a steady state, is found to be about 10^{16} years. Jeans had previously obtained, by somewhat different reasoning, a value of 10^{14} years, which is of the same order of magnitude.

In (2) some of the results obtained in (1) are applied to prove the law of equipartition of energy for the stars. The proof is elementary and applies only for translational velocities, any possible energy of rotation not being taken into account. As regards translational energy, recent results indicate that the most massive stars have the slowest velocities on the average, and *vice versa*, which is in the sense required by equipartition. But whether there is anything like real equipartition, even for translational velocities, we do not know; still less do we know to what extent the energy of rotation shares in the equipartition. In any case, we should not expect equipartition to hold unless the system had practically reached a steady state, and other evidence must be adduced to settle this point.

In (3) the hydrodynamical analogy is used, the average motion of a small group of stars under the general attraction of the stellar system being considered, neglecting the effects of encounters and collisions on the motion of individual stars. The equation of motion for a steady state is derived from (1) and integrated. The result is obtained that in a star cluster, in which the stars are symmetrically distributed about an axis, in which there is hydrodynamical equilibrium and ellipsoidal velocity surfaces, these surfaces must be spheroids with their axes of rotation perpendicular to the radius vector from the centre of the cluster. The same result had previously been obtained otherwise by Jeans. It was proved by Schwarzschild that the velocity surfaces are approximately spheroids with their rotation axes directed towards the *vertex*. Jeans, through insufficient evidence, had concluded that this direction was not perpendicular to the radius vector. On the other hand, Prof. Charlier, on the evidence afforded by recent investigations at Lund, concludes that the two directions are perpendicular. Jeans has since accepted the evidence on which Prof. Charlier bases this conclusion. The result supports, but

does not prove, the supposition that our stellar system is in such equilibrium, for there are other factors to be taken into consideration.

In (4) Prof. Charlier discusses and compares what he calls the monistic and dualistic conceptions of the stellar universe. According to the former, the universe can be considered as a single system which, if it has not actually attained a steady state, is on the way to doing so. By the latter he means the hypothesis that there are two intermingling star-streams, though it is doubtful whether the originators of that hypothesis ever conceived that there were two streams of stars approaching and passing through one another. Our knowledge of stellar motions is derived almost entirely from the nearer stars, and it would be dangerous to make so sweeping an assertion. Reasons are advanced by Prof. Charlier for supposing that the methods of statistical mechanics as developed in (1) can be applied to the monistic conception, and an endeavour is made to show that the state of motion in our system is comparable with the results given by the kinetic theory. The time of relaxation obtained in (1) was thought by Jeans to be too long for our system to be considered as yet in a steady state. Prof. Charlier brings forward evidence to show that the velocities of the stars are in qualitative agreement with the requirements of the kinetic theory [see (2)], and that red stars are more nearly in statistical equilibrium than the younger blue stars. The results obtained in (3) also supported the idea of a steady state. To Eddington's difficulty of believing that the evidence of scattered clusters of stars moving with a common velocity, such as the Ursa Major cluster, can be explained if the chance attractions of stars passing in the vicinity have an appreciable effect on stellar motions, Prof. Charlier replies that it is possible that such clusters are but the remnants of much larger clusters, most of the members of which have succumbed to encounters with other stars by the way. The sparseness of the stars in these clusters may be held to support this view. Furthermore, Jeans has shown that a compact globular cluster moving through another mass of stars will be spread out into a disc-like arrangement, perpendicular to the direction of motion. The conditions of Jeans's discussion cannot be exactly reproduced in the stellar universe, but it is interesting to note that Turner has shown that the Ursa Major system has approximately this shape.

The fifth paper is a valuable discussion of the various methods which have been used for analysing stellar motions, and forms a convenient summary for purposes of reference. The analysis on the simple hypothesis of a single star-stream, on that of two star-streams developed by Kapteyn and Eddington, on the ellipsoidal hypothesis of Schwarzschild—all of which are based upon the directions of the motions only—and that on the correlation methods developed by Prof. Charlier himself—in which both the magnitude and direction of the motions are taken into account—are discussed and illustrated by application to one particular region of the sky. H. S. JONES.

PROF. FRANKLIN P. MALL.

ALL who are interested in the progress of biology will learn with deep regret of the sudden death of Dr. Franklin P. Mall, of Johns Hopkins University, at the age of fifty-five. It was chiefly owing to his precepts and example that, in little more than a score of years, a complete revolution was wrought in the anatomical departments attached to medical schools throughout the length and breadth of the United States. Dissecting-rooms were changed from places in which routine teaching and perfunctory investigation were carried on to laboratories where exact methods were applied to the elucidation of definite problems. Prof. Mall was thirty-one years of age when he returned in 1893 from a long course of study under the late Prof. His, of Leipzig, to become the first professor of anatomy in Johns Hopkins University, Baltimore. He designed his own department, selecting a slimly built, cheap, brick construction, and settled down with his students to combine study with research. He devoted himself to embryological and microscopic investigations, reconstructing his results in the exact model methods practised by Prof. His. His writings cover the whole field of embryology, every contribution representing a permanent addition to knowledge. His pupils left him to fill the various chairs of anatomy as they fell vacant, and carried to their new departments the methods and spirit they had imbibed from Franklin Mall. He took a leading part in the foundation of the excellent journals which have been established in the United States for the publication of anatomical investigations—the *American Journal of Anatomy*, the *Anatomical Record*, and the *Journal of Morphology*. He pursued the study of human embryology in a more systematic manner than has ever been accomplished by any other man.

Prof. Mall began to collect embryos in the earlier months of development when he settled in Baltimore, and continued year by year to preserve, register, and photograph them; they were cut into serial sections, examined, reconstructed, and methodically stored, so that student after student could use the same sections for researches of quite different kinds. By 1913 his collection of embryos numbered more than 1000, many of them showing early stages of diseases and malformations. When he succeeded in persuading the Carnegie Institution of Washington to establish a National Department of Embryology, he handed over to it the whole of his embryological collection and accepted the post of director of the department. The names of the workers he enlisted in the service of the department, and the great scientific value of the "Contributions to Embryology," issued by the Carnegie Institution, are ample evidence of the success of his last piece of statesmanship.

Prof. Mall was a quiet, kind, and charming man, who had set himself a public-spirited but arduous task, and he lived long enough to see it well begun and to leave behind a band of pupils who are willing and able to carry it on.

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NOTES.

PROF. A. G. NATHORST, of Stockholm, having on November 7 last reached sixty-seven years of age, has, in accordance with Swedish laws, retired from his appointment as keeper of the palæobotanical department of the Swedish State Museum of Natural History (Naturhistoriska Riksmuseum). His successor has not yet been appointed.

THE efforts of Sir Harcourt Butler in developing the mineral resources of Burma have been successful. There are prospects, says the *Pioneer Mail* of November 3, that the production of wolfram in Tavoy will soon be largely increased. One or two mines which until recently were cut off from communications are now being developed, and promise an outturn of 30 to 40 tons per month. Some rich new finds have been made in old blocks, and with the new road to the Pe Valley belt, extensions of present roads, and rumours of the promotion of new companies in England, the prospects of the industry have much improved.

THE council of the National Museum of Wales is devoting special attention to the insect collections. Six thousand specimens, of which a large proportion are Welsh examples, have been classified. Experiments as to the best methods of mounting and preserving small-winged insects and larvæ are being carried out. There are still, however, several groups almost unrepresented, and an appeal is made to collectors to add any specimens of interest, so that Welsh entomology may be adequately represented.

Two pamphlets on the Channel Tunnel have reached us—one by Mr. Arthur Fell, chairman of the House of Commons Committee on the question, the other by Sir Francis Fox. Mr. Fell strongly criticises the Government for refusing to allow any preliminary steps to be taken by the Channel Tunnel Company. He not only dwells on the economic and military value of the tunnel, but also emphasises the political aspect of the problem. Sir Francis Fox's pamphlet is a reprint from the *Geographical Journal*. It deals with the engineering aspects of the tunnel. The tunnel is designed to keep within the grey chalk, except near the two coasts, where for a short distance it passes through the gault. The depth below the sea-bed is to be a minimum of 100 ft. The tunnel will consist of two tubes, each 18 ft. in diameter, with cross-tunnels every 200 yards. It is proposed to form a "water lock," a dip in the tubes, which could, in case of emergency, be filled with water for the length of a mile. The water would not injure the tunnel works, and it could be pumped out only by the machinery at the power station in Kent. Trains could run between London and Paris via the Channel Tunnel in six hours.

WHEN a person feels that the air of a room is dry and oppressive the feeling is generally explained as due to the relative humidity or fraction of saturation of the air being low. The erroneous character of this explanation was pointed out two years ago by Dr. Leonard Hill and his colleagues of the Medical Research Committee in a communication to the Royal Society. They ascribe our sensation to the rate of loss of heat from the skin by evaporation, and have constructed a thermometer with a large bulb covered with moist fabric to measure this rate of loss under different conditions as to temperature, saturation, and speed of motion of the air, the bulb being kept at about the temperature of the human body. The agreement between the instrument and the "feel" of the air is found to be fairly

close. The subject has been carried a stage further by the work of Mr. G. T. Palmer, chief of the research staff of the New York Commission on Ventilation. He finds that our sensation is due, not to the rate of evaporation from the surface of the body, but to the difference between that rate and the rate of supply of moisture from the interior of the body to the skin. His paper will be found in the July number of the *Journal of the American Society of Heating and Ventilating Engineers*.

In the December issue of *Man* Mr. A. C. Breton describes, with a photograph, a curious scene from a painted pot found in a mound in British Honduras, and now in the Liverpool Museum. It represents a group of strange winged creatures which appear to be dancing and singing for joy at the coming of vegetation, represented by a seedling in the corner. The humming-bird was the special messenger of the sun to awake and encourage vegetation, and appears prominently in this group. It would seem a natural result of watching the migrating birds in spring that man should endeavour to imitate them in his ceremonial dances. Similar dances have been noticed in Queen Charlotte Islands, and the gestures of the creatures on this pot may be compared with those on British Columbian totem poles.

CO-PARTNERSHIP in nests, and presumably in the duties of incubation, is known to exist, at any rate sporadically, among many birds. Mr. J. Wigglesworth, in *British Birds* for December, records several cases of this kind among sheldrakes breeding on Steephelm, an island in the Bristol Channel. In one nest which he examined he found the eggs of no fewer than five birds. The frequency of this occurrence on this small island may perhaps be due to the limited nesting accommodation. This record, by so competent an authority, will be welcomed by ornithologists.

WHALERS know well the excellent qualities of whale-meat, but doubtless the general public would need some persuasion to adopt it as a substitute for beef. A writer, however, in *California Fish and Game* for October suggests that, in present circumstances, a trial should be made. He proposes to begin with the Californian grey-whale (*Rhachianectes*), the carcass of which yields about twelve tons of most succulent "beef." Some, both in a fresh state and canned, has already been placed on the market, and it is to be hoped that success will attend the venture, for in this case it may lead to sane methods of conservation. At present whaling is being carried on utterly regardless of the future, so that unless something is done speedily the whales will follow Steller's sea-cow and many another valuable species which has fallen a prey to commercial "enterprise."

DR. EAGLE CLARKE, in the *Scottish Naturalist* for December, continues his most interesting analysis of wild life in a West Highland deer forest. All students of our native fauna will be grateful for this contribution, especially as very little has yet been done in regard to altitudinal distribution. Over the area surveyed the fox is very numerous, at from 900 ft. to 3500 ft., while the badger, which seems here almost extinct, ascends no higher than 1500 ft. A few pairs of otters are to be found on Lochs Ossian (1269 ft.) and Treig, and on the river Ghuilbin. Formerly it frequented Loch na Lap (1930 ft.), but has not been seen there for some years. Many will probably be surprised to learn that the house-sparrow has but recently penetrated to these fastnesses, having followed the iron road into the Highlands. It is now resident at Corroun Station, at the summit of the West High-

land Railway (1350 ft.). Thence it has established further outposts, but it has not yet reached Loch Treig.

AN able history of the bats of Central Africa is given in an article in the *Bulletin of the American Museum of Natural History*, vol. xxxvii., 1917. The authors, Messrs. J. A. Allen, H. Lang, and J. P. Chapin, therein describe the material obtained by the American Museum Congo Expedition. Naturally, a considerable number of new species are described, but the value of the communication rests not so much on this as on the light it throws upon the life-histories of these animals, and the many remarkable structural modifications and secondary sexual characters which the authors have here brought together. Some of these were already known, but the range of these peculiarities has been enlarged by many striking additions. One of the most important of these concerns the air-sacs of that singular creature, the hammer-head bat. But the authors offer no comments on the function of the large cheek-pouch of this animal, though they give an excellent figure indicating its great size.

It has long been known that true bats existed among the earliest Tertiary mammals, but remains are very rare, and nothing has been discovered of the ancestry of the group. An imperfect skull of a new genus, *Zanycteris*, has now been obtained from one of the oldest Tertiary formations (Wasatch) in Colorado, U.S.A., and according to a description of the specimen by Dr. W. D. Matthew (*Bull. Amer. Mus. Nat. Hist.*, vol. xxxvii., pp. 569-71), it seems to represent a highly specialised member of the family Phyllostomatidae, which is still peculiar to tropical America. The skull is only unusual in the length of its slender snout and the comparatively small size of its canine tooth. Numerous comparatively modern fossil remains of bats have also lately been received by the American Museum from the caverns of Porto Rico. Among them one skull is especially interesting as belonging to the genus *Phyllonycteris*, of which only one species is known living in Cuba (H. E. Anthony, *Bull. Amer. Mus. Nat. Hist.*, vol. xxxvii., pp. 565-68, pl. lvi.).

THE fishes of the fresh waters of Panama are described with great care and detail by Messrs. S. E. Meek and S. F. Hildebrand in vol. x., No. 15, of the zoological series of publications of the Field Museum of Natural History, Chicago. Though small collections of the fish-fauna have from time to time been made by tourists and others, no serious survey of the waters of the canal zone had been made until that organised co-operatively by the Smithsonian Institution, the Field Museum of Natural History, and the U.S. Bureau of Fisheries. The present memoir contains the results of this ichthyological reconnaissance. The need for such a survey was urgent, since it was not begun until much work had been done on the canal and natural conditions had already been considerably disturbed, but it was fortunately completed before the species of the two slopes had been allowed to intermingle. Before the survey began the Rio Grande, on the Pacific slope of the canal zone, had been thoroughly cut to pieces, and hence to measure the probable effect of this disturbance it became necessary to extend investigations to other streams east and west of the Rio Grande. As a consequence, data were collected which seem to show that several species have disappeared owing to the unfavourable conditions created by the construction of the canal. Five genera and thirteen species new to science are described in these pages, which, further, are illustrated by numerous excellent plates.

THE Smithsonian Institution has issued an elaborate monograph on "The Comparative Histology of the Femur," by Dr. J. S. Foote, professor of pathology in Creighton Medical College, Omaha, Nebraska (Smithsonian Contributions to Knowledge, vol. xxxv., No. 3, 1916). Prof. Foote's investigations commenced in 1909, when he casually observed, in a section of a turkey's femur, "a type of bone structure quite unlike that usually described." He therefore began a systematic investigation of bone structure as revealed by sections across the femoral shaft. In his monograph he gives descriptions of the sectional appearance of 440 femora—amphibian, reptilian, avian, and mammalian. Prof. Foote is of opinion that we must recognise not one, but three types of architecture in the minute structure of bone. In the type with which most students are familiar the bone is arranged in concentric systems—Haversian systems—in the centre of each of which there is a vascular channel. The Haversian is the commonest system in higher mammals. The more usual system in birds is quite different. In them the bone is arranged in laminae, with vascular channels between the laminae. A more primitive system than either the Haversian or "laminar" is what Prof. Foote describes as the "lamellar"—best seen in the femora of amphibians. In this type the bone is arranged in a series of lamellae surrounding the medullary cavity, but there are no vascular channels either within or between the lamellae, as in the two more highly evolved types of bone.

A LIST of the Hemiptera-Heteroptera of New England has been published by Mr. H. M. Parshley as an "Occasional Paper" (No. 7) of the Boston Society of Natural History. The list is prefaced by some suggestive distributional notes, in which the author points out that most of the species common to Europe and North America appear to be "massed" on or near the eastern seaboard of the latter continent.

WHILE studying the collection of fishes of the Academy of Natural Sciences of Philadelphia, Mr. H. W. Fowler discovered many interesting specimens from New England waters. These he describes in the Proceedings of the Boston Society of Natural History (vol. xxxv., No. 4). Three of these species are new to science, and one of them represents a family and genus hitherto unknown in New England waters. Some excellent text-figures add much to the value of this contribution.

AN interesting paper on recognition among insects is published by Dr. N. E. McIndoo (Smithsonian Miscell. Coll., vol. lxxviii., No. 2), in which he summarises our knowledge of scent-producing organs among insects of different orders, and the responses made by various creatures to such chemical stimuli. A considerable section of the paper is occupied by an account of Dr. McIndoo's own experiments on the characteristic odours emitted by different hive bees—queen, drones, and workers of various occupations. The economic importance of the study of the reactions of insects is pointed out with many apt illustrations in Dr. C. Gordon Hewitt's recent address on insect behaviour as a factor in applied entomology (*Journ. Econ. Entom.*, vol. x., 1917, No. 1). Messrs. E. A. McGregor and F. L. McDonough, in Bulletin 416 of the U.S. Department of Agriculture, on the red "spider" of cotton (*Tetranychus bimaculatus*), give much attention to the mite's means of dispersal and its responses to seasonal and environmental change.

IN part 4 of vol. vii. and part 1 of vol. viii. of the Bulletin of Entomological Research, Prof. R. New-

stead continues his "Observations on Scale-insects," describing several new species, and giving welcome figures of the little-known male of the common *Lecanium hesperidum*. In the latter number the Rev. J. Waterston has a noteworthy paper on a new species of Paraphelinus, a genus of small Hymenoptera, the larvæ of which feed in the eggs of grasshoppers. Drs. A. Ingram and G. W. Scott Macfie give structural details of the pupæ of West African mosquitoes. Mr. Rupert W. Jack, of Southern Rhodesia, brings forward evidence which has convinced him of the occasional transmission of trypanosomiasis by blood-sucking flies other than the tsetse (Glossina), such as tabanids and Stomoxys. There appear, however, to be limits to the spread of disease by such means, as they "have not resulted in establishing trypanosomiasis in any area away from the fly-belts." The *Review of Applied Entomology*, with its invaluable summaries, is now in its seventh volume, and a highly useful subject-index of the agricultural entries in the first three volumes, compiled by Mr. S. A. Neave, has just been published by the Imperial Bureau of Entomology.

A PAPER of special interest, literally "breaking ground" in a direction hitherto little worked in these countries, is Dr. A. E. Cameron's "Insect Association of a Local Environmental Complex in the District of Holmes Chapel, Cheshire" (*Trans. Roy. Soc. Edinb.*, vol. liii., part 1, No. 2). Several American naturalists have lately given attention to the intensive faunistic and associational study of small areas, and Dr. Cameron has done the same kind of work for this small corner of north-western England with great care and thoroughness. The relations between the insects found and the ecological types of vegetation in the two meadows specially examined are pointed out. A feature of agricultural interest was noted in the dominance of crane-fly larvæ as root-feeders in one meadow and of "wire-worms" in the other. The paper represents a vast amount of systematic and statistical work, and it is to be hoped that, as Dr. Cameron has now transferred his activities to Canada, other of our entomologists may be incited to try similar lines of inquiry.

SEVERAL improvements in maps designed to show economic distributions are suggested in a paper by Mr. George Philip in the *Geographical Journal* for December (vol. 1., No. 6). Mr. Philip has attempted, with a considerable measure of success, to give effect to the recommendations of the British Association committee's report on maps for school use. He has avoided peppering the map with symbols or names for the distribution of natural products, commercial commodities, or industries, and has restricted their use to coalfields and a few important natural products. Names are further reduced by giving only the initials of ports. The groundwork colouring is a combination of density of population and the type of vegetation. In the most densely populated regions distinction is made, by two tints of red, between highly developed manufacturing enterprise and horticultural or plantation industries. The other productive regions are shown in shades of green, and undeveloped regions in brown. The map thus indicates the present state of economic development. Only the most important trade routes are shown by land and sea; on the sea by bands the width of which varies with the volume of trade. Mr. Philip proposes a school atlas on these lines, with the continents on a scale of one to forty millions, except Europe, which would have a scale of one to ten millions. A specimen map of Eurasia accompanies the paper. Finer colour printing would improve this striking map.

A PAMPHLET by the late Prof. Henrik Mohn, "Der Luftdruck zu Framheim und seine Tägliche Periode" (Christiania: Jacob Dybwad), deals with the pressure at Framheim, lat. $78^{\circ} 38' S.$, long. $163^{\circ} 37' W.$, the most southerly meteorological station on the earth, established by Amundsen as his winter station during his Antarctic expedition. The observations were taken daily from April 1, 1911, to January 29, 1912, at 8 a.m., 2 p.m., and 8 p.m. local mean time, from a Kew pattern station barometer hung on a wall of the kitchen of the hut. A Richard barograph was also installed close to the barometer, and a Wild-Fuess barometer was kept, but the readings were not used for the computations, as they were not so trustworthy as those of the Kew pattern barometer. The height above sea-level of the barometers was 11.1 metres. Hourly values for each hour of the whole period are given, together with means and deviations. The pressure appears to vary from between about 710 and 765 mm., and the monthly means show a maximum of 753.23 mm. for December and a minimum of 726.60 mm. for October. The figures are also given for harmonic analysis, and the pressures of the different seasons are compared.

KOREA (Chosèn) has developed a thoroughly systematic series of meteorological stations, and recently the results of observations for the lustrum 1911-15 have been compiled at the Meteorological Observatory of the Government-General of the peninsula. The shores are washed by the Yellow Sea and the Sea of Japan, and the geographical surroundings render it comparable in many ways with those of Italy. Observations are published for nine stations, fairly well scattered over Korea, and extending from Syeng-chin in the north to Mokpo in the south. One-half of the stations commenced observing in 1904, so that results are available in these cases for fourteen years. Pressure results at the several stations agree remarkably well *inter se*, which shows great care in the organisation, and the corrected mean for all stations combined, for the lustrum, is about 30 in., which agrees admirably with the mean value for the year given by the Meteorological Office on its mean pressure chart, given in a recently published barometer manual. Practically all meteorological elements are dealt with for the lustrum and for each station. For the several stations the monthly means are given deduced from four-hourly observations, for which the values are also printed for the several elements, so that most valuable details are available. Five-day means are also given for the various data.

THE double compounds of the metallic halides with ether hitherto known are those with glucinum and titanium chlorides and with aluminium, mercuric and stannous bromides. The Journal of the Chemical Society for September contains a description by Messrs. A. Forster, C. Cooper, and G. Varrow of the preparation of double compounds of ferric chloride with ether and with benzyl sulphide. The former compound, $C_6H_5O_2FeCl_3$, obtained by the interaction of anhydrous ferric chloride and dry ether, is a dark red, highly deliquescent solid soluble in benzene, but decomposed by alcohol or water. When heated it evolves pure ethyl chloride. The substance in ethereal solution reacts with dry ammonia, giving brick-red, amorphous compounds of varying composition. Benzyl sulphide ferric chloride, $(C_6H_5)_2S_2FeCl_3$, obtained by mixing ethereal solutions of its two components in molecular proportions and allowing to stand for some hours, forms minute lemon-yellow crystals soluble in chloroform and slightly so in alcohol, but insoluble in ether or acetone. The crystals rapidly become brown

on exposure to moist air, this reaction distinguishing them from tribenzylsulphinium chloride ferrichloride. Benzyl sulphide ferric chloride is slowly decomposed into its two constituents by water; with alkalis the products are benzyl sulphide and ferric hydroxide. If a solution of equimolecular proportions of benzyl sulphide and cyanide in dry ether is added to an ethereal solution of ferric chloride, tribenzylsulphinium cyanide ferrichloride, $(C_6H_5)_3SCN_2FeCl_3$, is formed. This substance is obtained as lemon-yellow crystals insoluble in ether, but soluble in alcohol and chloroform. When treated with excess of ammonia in alcoholic solution the substance gives tribenzylsulphinium cyanide, $(C_6H_5)_3SCN$, which forms large white prisms, m.p. 41° , readily soluble in organic solvents, but only slightly so in water. In contact with water the cyanide completely dissociates in a few hours.

THE solving of formulæ involving more than two variables by means of curves, alignment charts, isometric charts, etc., is now well known, and a good deal has appeared recently on these methods. Special slide rules have also been employed to a large extent, and are designed to solve problems connected with special trades. The first instalment of an article on the design of special slide rules, by Mr. A. Lewis Jenkins, appears in the *Engineering Magazine* for November, and contains much that will be of interest to any who may be called upon to produce a special instrument of this type.

OWING to the failure of several reinforced concrete floors in the United States within ten or a dozen years of their construction, Prof. H. J. M. Creighton, of Swarthmore College, has examined a large number of reinforced concrete structures in which cracks were developing, and gives the results of his investigations in the Journal of the Franklin Institute for November. He finds that in every case the cracks run along the reinforcing rods, and are due to the deteriorating action of salt and brine on the concrete. Solutions of the chlorides react with the lime and the silicates in the concrete, and penetrating to the iron of the reinforcement convert it into oxide and hydrate, which occupy more space than the metal and force the concrete apart. It is therefore necessary to waterproof reinforced concrete structures which will be in contact with brine, to cease to use in the concrete beach gravel which has not been thoroughly washed with fresh water, and never to add salt to the concrete to prevent it freezing during building operations in cold weather.

AN interesting article on gear planers appears in *Engineering* for December 14. The most remarkable advance which has been made in the formation of the teeth of gear wheels is in the substitution of methods of generation for those of form-cutting. The principle is simple, and the results are precise. A master gear, either a rack or a pinion, imparts the correct shapes to the teeth of any gears of the same pitch. The basis tooth is that of the rack, with flanks having a pre-determined pressure angle. This may be embodied in a worm-like hob; or a rack tooth can be used to generate a master pinion; or the tooth may be employed directly as a cutter; or several teeth can be included in a length of rack, sufficient in number to make contact with all the teeth that can be in mesh with the largest wheel to be generated in the system. The relative movements of the cutter and the blank are identical with those that will occur in the actual rack and its generated gear. Wheels produced thus will engage correctly with the rack and with each other, and require no corrections or easing. The cutter is fed

tangentially to the gear blank in the intervals of the reciprocations of the cutter across the face of the blank. This is the principle adopted in the Sunderland generating spur-gear planer, manufactured by Messrs. J. Parkinson, of Shipley, and the article cited contains a fully illustrated description of this machine.

OUR ASTRONOMICAL COLUMN.

COMETS.—*Popular Astronomy* for November contains particulars of the appearance of Wolf's comet during the autumn. On October 15 it was readily visible in a 5-in. finder, with a small central non-stellar condensation of the 12th magnitude.

Prof. V. M. Slipher photographed its spectrum at Flagstaff on August 25 and 26. The spectrum was chiefly continuous, even the strongest cometary emissions being faint; traces were seen of the cyanogen band at 3883, and of the hydrocarbon band at 4737. The spectrum was too narrow and faint to show the solar lines, but it was evident that the comet was shining almost entirely by reflected sunlight. This is not surprising, considering its great distance from the sun.

Mr. Viljev has made the unexpected discovery that the object photographed in September, 1916, which was announced as Encke's comet near aphelion, was not really that comet; there are thus at least three occasions (January, 1908, September, 1916, September, 1917) when a faint object was detected, nearly in the right position for the comet, and with nearly the right motion, and yet proving to have no connection with it. It brings forcibly before us what a large number of unknown faint objects (comets or minor planets) exist in the solar system. Mr. Viljev has taken over the computations relating to this comet that were formerly in Prof. Backlund's hands.

The following ephemeris has been calculated from Mr. Viljev's approximate elements. Perihelion passage will be 1918 March 24.313 G.M.T. E is the eccentric anomaly.

G.M.T.	E .	R.A.	Decl. N.	$\log r$	$\log \Delta$
1918		h. m. s.			
Jan. 1.416	-70	23 0 54	3 24	0.1976	0.2223
6.086	68	23 5 8	3 41	0.1804	0.2221
10.574	66	23 9 44	4 1	0.1627	0.2210
14.880	64	23 14 36	4 23	0.1446	0.2188
19.008	62	23 19 40	4 48	0.1261	0.2156
22.961	60	23 24 55	5 15	0.1070	0.2113
30.357	56	23 35 46	6 11	0.0676	0.2003

UNION OBSERVATORY, JOHANNESBURG. — Circular No. 39 of the Union Observatory includes a series of micrometric measures of Eros made between May 15 and May 28 of the present year, and a discussion of the advantages of ruling star photographs with lines of right ascension and declination, as compared with the rectangular rulings of the Carte du Ciel. Another excellent example of the photographic maps now being issued from this observatory is included with the circular, and it is shown that from these the places of stars can be obtained with an accuracy which will suffice for most purposes. A further list of nearly 200 proper motions found and measured with the blink-microscope is also given; about fifty of them exceed 20" per century, and many of the displacements are towards the solar antapex. Many of the centennial proper motions deduced, and believed to be trustworthy, are under 10", and one is only 3.2".

NEW ZEALAND ASTRONOMICAL TABLES.—For general information, the Government Astronomer of New Zealand has issued a series of astronomical tables calculated for the meridian of the Hector Observatory

(*New Zealand Gazette*, No. 141). They give the sun's apparent right ascension and declination, and the Greenwich mean time at apparent noon, as interpolated from the Nautical Almanac, together with the Greenwich date. With the aid of auxiliary tables previously published, the G.M.T. at apparent noon may readily be deduced for any other meridian in New Zealand, and also the approximate times of sunrise and sunset.

DEVELOPMENT AND USES OF THE STATIC ELECTRICAL MACHINE.

A VERY great advance was made in the earliest form of electricity generator by the late James Wimshurst in the year 1882. At that time several forms of the Holtz and Voss machines were in use, but their behaviour was most erratic, the slightest moisture in the atmosphere rendered them useless, and under most favourable conditions the output of electricity was small indeed.

Wimshurst succeeded in producing a machine that would "excite" with certainty under almost any atmospheric condition, and by combining a number of plates was able greatly to increase the output. Since then many manufacturers of electrical apparatus have attempted to improve upon it and to convert it into a practical and mechanically efficient generator of electricity. The Medical Supply Association has now placed upon the market what appears to be a thoroughly trustworthy and strong British-made machine that will give, at a moment's notice, a continuous and powerful static discharge.

The mechanical construction of the machine is simple and very sound. Special attention has been devoted to the plates, which are of vulcanite. By an ingenious method of construction each plate is formed of three sheets of different qualities; this entirely stops any tendency to warp, and enables the outer surface to be formed of a very good quality brittle vulcanite that in itself would not bear the high speed of rotation. The whole machine is built upon a cast-iron table, and is run by an attached motor or by any other convenient means; it is not covered in any way, as the perfection of construction is such that electricity is generated immediately on rotating the plates even in the dampest weather.

The uses of the machine are very numerous. It has been employed with success in agricultural experiments, where greatly increased plant growth under the influence of the static discharge has been recorded. In electro-therapy its value is fully recognised, and the static discharge is now in constant use in many hospitals. For the production of X-rays the machine has advantages over the induction coil, the current being unidirectional and continuous. For fluoroscopy or screen work this is a great gain, as the image is bright and absolutely free from flicker. Except where very short exposures are necessary, as in the case of instantaneous radiography, it will do the work as well as, or even better than, a coil. The twelve-plate machine is run at 900 revolutions per minute, and gives a good discharge between balls 8 to 10 in. apart; currents from $\frac{3}{4}$ to 1 milliampere can be passed through a suitable tube.

One great convenience of the machine is the complete absence of complicated resistance coils, meters, and other accessories; no electrical knowledge is demanded in its use; it is always ready, and it only needs rotating to produce the current. The cost of running with an electro-motor works out at $\frac{3}{4}$ d. per hour.

The machine can be seen at the rooms of the Medical Supply Association, 228 Gray's Inn Road, London, W.C.1.

THE ASIATIC SOCIETY OF BENGAL.

THE publications of the Asiatic Society of Bengal are fully abreast of those of the learned societies of the European world. To the Indian they are reminiscent of a glorious past, and give a forecast of the Asiatic world that is advancing by leaps and bounds into the domains of commerce, industry, art, and science. They breathe to-day not only of the society's great founder, Sir William Jones, but of a new Asiatic life. In the founder's first presidential address (delivered in Calcutta in 1784) we read: "Whether you will enrol, as members, any number of learned natives, you will hereafter decide." It is a somewhat curious paradox on these words that the present membership is not only very largely "learned natives," but that many of the recent articles of conspicuous merit are from the pens of Asiatic writers. Indians are, in fact, pressing forward in every department of thought and research, and are practically clamouring to write the too long neglected history of their country. There are eighty-seven important articles in the Journals (placed in our hands), and of these forty-seven are written by native gentlemen. In this connection it may be mentioned that the "Centenary Review" of the society (published in 1885) was written in three separate chapters, the authors of which were two native gentlemen and a German. But to revert to the founder, Sir William was no lover of systematic natural history. He lived in Sanskrit lore, and could see no merit in, or necessity for, systematic studies. The direction was thereby given for the future life of the society, and to-day were one to seek out themes of adverse criticism the most obvious would be that the volumes on our table denote a disproportionate treatment of zoology and botany as compared with philology, ethnography, mythology, anthropology, numismatology, archæology, and history, each no doubt important, but not more so than either zoology or botany, to the new life of India.

The first botanical paper published by the society appeared in 1785, and was on the *mahua* tree (*Bassia latifolia*). We are there not only given a botanical description and an instructive plate, but a full account of the economic uses of that most valuable tree, which to-day is of exceptional interest as a source of food, oil, and spirits. In vols. iii., iv., and v. of the Memoirs, now before us, there is not a single botanical article. The corresponding Journals contain remarkably few botanical papers, and those that are given are short and deal as a rule with structural adaptations to environment or to fertilisation. "Grafting the Mango Inflorescence," by Dr. W. Burns and Mr. H. Prayag, is, however, interesting and suggestive. To what may be called the general rule there are two exceptions—"The Materials for a Flora of the Malayan Peninsula" and a "Synopsis of the Dioscoreas of the Old World." The former, started by the late Sir George King, has now run into its fourth volume, and is being ably continued by Mr. J. Sykes Gamble, late of the Indian Forest Department. The title of that great work is far too humble, since it is literally an exhaustive flora of the Malayan Peninsula, and it very possibly has suffered considerably by its production intermittently as an appendage to the Journal of the Asiatic Society of Bengal. The second paper is by Sir David Prain and Mr. I. H. Burkill, and deals with an exceedingly difficult genus of plants, many of the species of which are of considerable economic value.

Zoology has in India always taken a more favoured position, a circumstance possibly due to the closer association of the Indian Museum, than the distant Botanic Gardens, with the home of the Asiatic Society. Dr. Annandale has communicated numerous papers

(some written for him by experts) on the "Biology of the Lake of Tiberias," as also "The Distribution and Origin of the Fauna of the Jordan System." Lt.-Col. J. Manners-Smith has furnished useful information regarding the Shous, or big-horned deer of Tibet. Mr. F. C. Gravelly has contributed a paper on the "Evolution and Distribution of the Indian Spiders belonging to the Sub-family Aviculariinae." Mr. J. Hornell gives an excellent account of the "Pearl Fishery in Palk Bay." This would appear to be a new bed hitherto unsuspected, which, but for the war, would have given greater results than have been attained. Mr. Hornell records it as his opinion that, in the future, cultural operations directed to the inducement of pearls in a comparatively limited number of oysters, kept in captivity, must supersede production in natural beds. Capt. R. B. Seymour Sewell, surgeon-naturalist of the *Investigator*, contributes a valuable report on the results of his biological investigations. Dr N. Annandale, Mr. J. Coggin Brown, and Mr. F. H. Gravelly have furnished the results of their joint investigations of "The Limestone Caves of Burma and the Malay." Mr. Gravelly further contributes a paper on "The Evolution and Distribution of certain Indo-Australian Passlid Coleoptera."

Mr. R. D. Banerji, of the Indian Museum, under the title of "The Pālas of Bengal," gives a history of Bengal and Bihar from A.D. 800 to 1200. Many obscure points regarding the Pāla kings have, through Mr. Banerji's researches, been cleared up, while the photographs he furnishes of inscriptions and colophons should facilitate verification. In another paper Mr. Banerji analyses the evidence and conclusions of the four inscriptions regarding the "Lakshmanasena Era"; and again discusses the "Edilpur Grant of Kesavāsena," originally translated by Prinsep in 1838; and in still a further paper deals with the "Four Forged Grants from Faridpur." Rai Monmohan Chakravarti Bahadur gives a learned and exhaustive "Contribution to the History of Smṛti in Bengal and Mithilā." To the historical student the works translated by Mr. Chakravarti are of great importance. They furnish a mass of information bearing on the social and religious life of the people of Bengal in former times. In another contribution Mr. Chakravarti deals with "The History of Mithilā," during the pre-Mughal period, and this versatile writer next discusses the geography of Orissa in the sixteenth century, and in still another paper exhibits "The Genuineness of the Eighth Canto of the Poem of Kumara-Sambhavam," by Kalidasa.

Mr. Nundolal Dey furnishes an account of the ancient Anga, or district, of Bhagalpur, one of the most ancient countries of northern India.

Dr. L. P. Tessitori gives "A Progress Report on the Preliminary Work done during the Year 1915 in connection with the Proposed Bardic and Historical Survey of Rayputanam." In the Memoirs the Rev. H. Hosten, S.J., narrates his discovery in Calcutta of the original MS. of "Father A. Monserrate's 'Mongolica Legationis Commentarius'"—in other words, Monserrate's account of the first Jesuit mission to the Emperor Akbar, in 1580-83. After an interesting discussion of the history and movement of the MS., Father Hosten reproduces the Latin text and gives, in an appendix, useful explanatory notes. He further contributes to the Journals, among others, three papers:—(1) "The Twelve Bhuiyas or Landlords of Bengal"; (2) "Fr. Jerome Xavier's Persian 'Lives of the Apostles'"; and (3) "Notes on Father Monserrate's 'Mongolica Legationis Commentarius.'" There are numerous papers on anthropology and ethnology; one of special interest deals with the Abors and

Galongs. This is written by Capt. Sir George Duff-Sutherland-Dunbar and is beautifully illustrated.

To mention by name even all the more interesting papers given in these Memoirs and Journals would occupy many pages; as already suggested, they give abundant evidence of a new life in our Eastern Empire. The suggestion might be offered, however, that the division of these publications into at least three sections, each with its own separate volume, would be both an economy and a convenience.

NEW FRENCH MAGNETIC CHARTS.¹

IN France terrestrial magnetism is included in meteorology, and the actual survey upon which the present work is largely dependent was made by M. Moureaux, director of Parc St. Maur Observatory, then the central magnetic station for France. Prof. Angot, who is director of the French meteorological service, was responsible for the last magnetic charts relating to the epoch January 1, 1901. Whether fresh charts will continue to be published every ten years appears as yet to be undecided. Two methods were considered of obtaining the secular change data, necessary to derive results for January 1, 1911, from those for 1901. The first consisted in taking fresh field observations in a sufficient number of places, and some observations having this end in view were taken by M. Eblé in 1912 and 1913. These have served to some extent as a control, but the second method was that actually depended on. It consists in utilising the secular change data published by observatories in France and adjacent countries, including Potsdam, De Bilt, Valencia, Greenwich, Kew, Falmouth, Val Joyeux, Munich, Pola, Naples, Coimbra, and San Fernando. The ten-year secular changes at these stations were plotted in a map, and curves of equal secular change drawn, from which were deduced the secular changes appropriate to each station. The method is obviously more suitable for France than for the British Isles. But even in the case of France, in the absence of positive knowledge that secular change is unaffected by local disturbance, it is doubtful whether it will be universally admitted that the method is altogether satisfactory for the deduction of charts showing the local anomalies. It is obviously simpler, however, than the carrying out of observations at a large number of repeat stations.

The values deduced for the epoch January 1, 1911, for declination, inclination, horizontal and vertical force, north and west components, and total force are given for from 500 to 600 stations, arranged alphabetically under the several departments. The declination, inclination, horizontal force, and vertical force data are also embodied in four charts. Omitting a few incomplete or obviously disturbed stations, the remaining 538 were arranged according to geographical position in twenty groups or areas. Taking any one group, the mean of the observed values of, say, declination was assigned to an imaginary station, the geographical co-ordinates of which were the mean of those of the actual stations. In this way values were found, practically free from accidental irregularities, for twenty different points. It was then assumed that these twenty values could be represented by an expression, $a + b\phi + c\lambda + d\phi^2 + e\phi\lambda + f\lambda^2$, where $\phi + 47^\circ$ and $\lambda + 2^\circ$ represent the latitude and easterly longitude of any station. The constants were determined both by least squares and by Cauchy's method, with very satisfactory results, showing that a simple quadratic expression suffices to give normal magnetic values with high accuracy for the whole of France.

¹ "Réseau magnétique de la France et de l'Afrique du Nord (Tunisie, Algérie, Maroc) au 1^{er} janvier 1911." By Prof. Alfred Angot. Ann. du Bureau central météorologique de 1911, tome i., pp. 59-95+4 charts.]

Tunis, Algeria, and Morocco are treated by themselves (pp. 86-95). The available data consisted of observations taken by Moureaux at thirty-three stations in 1887, and of recent results obtained by the observers of the Carnegie Institution of Washington. The latter had observed at thirteen of Moureaux's stations, thus obtaining data for secular change which were supplemented by results from the observatories of San Fernando, Coimbra, Tortosa, Naples, and Helwan. A six-constant formula of the type already described seems to fit the observations reasonably well. Prof. Angot would like, however, to have fresh observations throughout North Africa, at a considerably larger number of stations. Declination, inclination, and horizontal force charts, representing normal values for North Africa as given by the interpolation formulae, appear in the text, but on a reduced scale as compared with that adopted for the French charts, which show the actual anomalies. C. CHREE.

RAINFALL IN NORWAY DURING 1916.¹

THE director of the Norwegian Meteorological Institute has, with commendable promptitude, published the twenty-first annual volume of rainfall data, viz. that dealing with last year's returns. The daily rainfall is given *in extenso* for about 200 stations, additional information regarding the nature of the precipitation, whether in the form of rain, snow, or sleet, being afforded by the international symbol affixed to the reading when the downfall was other than rain. A monthly summary shows, for each of 476 stations, the actual precipitation, the maximum daily fall, and date of occurrence, along with the number of days with more than 0.1 mm. and more than 1.0 mm. of rain respectively; the mean depth of snow is also given and the greatest depth recorded. The monthly and annual rainfall expressed as a percentage of the average is shown for sixty-four stations.

No general summary of the results appears, but there is an excellent large-scale map in two sections showing the distribution of the annual rainfall for 1916 by isohyetal lines drawn for each 200 mm. The maximum rainfall, shown by the isohyet of 3000 mm. (118 in.), appears in three small patches close to the coast, between lat. 60° and 61° N., the highest rainfall, 3127 mm. (123 in.), being at Indre Matre (height 15 m.), in lat. 60° N., long. 6° E. The smallest rainfall, about 200 mm. (8 in.), occurs in several areas of no great extent north of the Arctic Circle, the most extensive being an oval patch about eighty miles long and fifteen miles broad, situated due south of Hammerfest. The isohyets in some districts near the coast are very crowded, especially in areas contiguous to the wettest spots where the rainfall in rather less than forty miles falls off from about 120 in. to 32 in.

As compared with the average, the rainfall of 1916 on the mean of sixty-four stations was 5 per cent. in excess, but individual stations varied from 51 per cent. above to 41 per cent. below the average. Rainfall was much above the average at most stations to the south of lat. 63° , but north of Trondhjem (lat. 63.4° N.) there was a pronounced deficit, ranging in general from 15 to 40 per cent. The only marked exceptions were at Gjesvair and Vardo, stations to the north of 70° and far to the east. In no month did the rainfall show a general excess or defect over the whole country, although March and August were dry, and January wet nearly everywhere. In February, June, and October to December there was a pronounced tendency to rainy conditions in the south, while a drought was experienced in the north of the country.

¹ Nedbøriagttagelser i Norge, utgit av Det Norske Meteorologiske Institut. Aargang xxi., 1916.

In September, on the other hand, the opposite distribution prevailed.

From an examination of the detailed summaries it would appear that the greatest daily rainfall, 140 mm. (5.51 in.), occurred on April 1 at Livastøl, a station in lat. 59° N., long. 6° E. Only nine daily falls exceeding 4 in. were reported in the year under notice, and, with one exception, these all occurred in the south. A very useful table is given showing the height above sea-level and geographical co-ordinates of all the stations, which can thus be readily identified on the map.

R. C. M.

PLANT DISEASES IN THE WEST INDIES.

VARIOUS root diseases which cause serious loss in crops of cacao, coffee, limes, and arrowroot in the West Indies have been investigated by Mr. W. Nowell, whose conclusions are published in the West Indian Bulletin (vol. xvi., No. 1). In all cases the roots are attacked by the mycelium of species of *Rosellinia*, a cosmopolitan genus of fungi which has long been known to include several parasitic species. In most cases the source of infection has proved to be either the forest stumps left to decay when the land was originally cleared, or, in the case of cacao, the stumps of shade trees, such as bread fruit and avocado pear. The fungus establishes itself on the dead stumps as a saprophyte, and from these the mycelium spreads to the healthy roots of the crop. The general conditions which favour the spread of the parasites and the most suitable methods of isolating the infected area and controlling the disease are carefully discussed.

In the West Indian Bulletin (vol. xvi., Nos. 2 and 3) Mr. W. Nowell gives a first report on an investigation of the internal disease of cotton bolls in the West Indies. The young lint is badly stained, and in severe cases more or less completely rotted, by the action of bacteria or of certain specific fungi, which are described in the first of the two papers. Four distinct species of fungi have been isolated and studied in culture. They appear to be all closely related, and are probably to be referred to the genus *Nematospora*. Further investigation is needed, however, to determine the systematic position of the genus. The results of the experiments recorded in the second bulletin show that infection results from the attack of certain cotton-stainers, bugs, *Nezara viridula* and *Dysdercus spp.*, which puncture the ovary walls in order to reach the seeds. The damage caused by the bugs includes the death of a certain proportion of the seeds, and possibly a localised discoloration of lint in young bolls; they are, however, the agents by which the fungi and bacteria are introduced into the ovary, and there produce the characteristic boll disease.

MINERAL NOMENCLATURE AND COLOUR.

A PAPER by Mr. Edgar T. Wherry on "The Nomenclature and Classification of the Native Element Minerals" (Journ. Washington Acad. Sci., vol. vii., p. 447, August, 1917) is remarkable for its advocacy of the use of adjectival prefixes for varieties, rather than special or compound names, which involve, as may be remarked, an additional tax upon the memory. This attitude is so very rare among scientific men that the attention of all naturalists may be directed to it. Mr. Wherry thus gives us "mercuriferous silver" for one end of the amalgam series and "argentiferous mercury" for the other, while the former name swallows up arquerite, bordosite, and kongsbergite. "Rhodiferous gold" replaces rhodite and "feriferous nickel" awaruite, josephinite, octtbehite, and souesite. The realisation that time is very often lost and

not gained by the use of technical names instead of descriptive word-groupings will make mineralogists regard Mr. Wherry's work with favour. His paper, however, is much more than a revision of nomenclature, since the element minerals are critically reviewed, with a number of valuable references to recent work.

Messrs. T. L. Watson and R. E. Beard have made a careful study of "The Colour of Amethyst, Rose, and Blue Varieties of Quartz" (Proc. U.S. Nat. Museum, vol. liii., p. 553, 1917), and they conclude that amethyst is coloured by manganese, probably distributed as submicroscopic colloidal particles of an oxide; that the colouring matter in rose quartz is organic; and that the blueness of quartz, as seen in many igneous rocks, is due to the behaviour of light on minute hair-like inclusions of rutile, as previous writers have suggested. No explanation is proposed for the absence of a purple colour in certain examples of rose quartz which show on analysis quantities of manganese in excess of those in ordinary amethyst; the point seems worth raising, since the authors reject the idea that the colour in amethyst depends on the state of oxidation.

A VILLAGE COMMUNITY IN PAPUA.

IN the thirty-ninth volume of the Transactions of the Royal Society of South Australia Dr. B. Malinowski, Robert Mond travelling student in the University of London, gives a valuable account of the people living on the seaboard of south-eastern Papua between Cape Rodney and Orangerie Bay.¹

The most important native village is Mailu, on a small island near the coast, the inhabitants of which take a prominent place in the trade of southern Papua, and in certain industries, such as pottery and canoe-building, are more advanced than the mainland people. Dr. Malinowski's descriptions refer principally to Mailu itself, but the people of the mainland district, who call themselves Magi, are occasionally noticed.

Following Dr. Seligman in his account of the "Melanesians of British New Guinea," Dr. Malinowski regards the Mailu as the most eastern branch of the western Papuo-Melanesian population, the Bonabona division of the southern Massim being in contact with their eastern border. The sociology and culture of the Mailu are of the same type as those of the Koita, so fully described by Seligman. Like the Koita, too, they speak a non-Melanesian language, though this is not explicitly stated by Dr. Malinowski, whose information was obtained by means of the Motu language, which is understood by most Mailu men.

The unit of social life is the village community. The village is a compact group of houses regularly built on land. The houses, on piles, face each other on each side of the village street, with their backs to the sea and the gardens. The men's club-houses, or *dubus*, have now almost died out. The community was the joint owner of the land and fishing rights, and within certain limits of hunting rights. In legal arrangements, institutions, and warfare the community acted together. It is divided into clans, and the wife comes from outside and moves to the home of her husband. Children belong to their father's clan.

Dr. Malinowski gives details of the household, with diagrams of the building. A genealogical census of Mailu village was made to obtain the kinship system and names. Personal names of elders were found to

¹ "The Natives of Mailu: Preliminary Results of the Robert Mond Research Work in British New Guinea." By Dr. B. Malinowski, Cracow, Robert Mond Travelling Student in the University of London. Transactions and Proceedings of the Royal Society of South Australia, vol. xxxix., Adelaide, December, 1915, pp. 494-706, plates xxvi-xliii.

be taboo. The daily life of the natives is described, first as to the individual (toilet, dress, ornaments, and food), and then with regard to the community (seasonal occupations, courtship and marriage, children and their play, public law and the restrictions of taboo, warfare, economics). The sections on agriculture and hunting are illustrated by plans and diagrams. Fishing, trade, and industries are similarly illustrated.

In magic and religion a very prominent feature is belief in the *Bara'u*, a living man who can make himself invisible and prowls about in the night working evil magic. Some suppose him to be invisible in front, though he can be seen from behind. He can be heard, travels like the wind, and injures his victim in various ways. The ghosts, or *Bo'i*, who dwell in the preserved skulls of the dead, are not so feared. Their spirits go to a distant place.

The author deals fully with maleficent and beneficent magic and with feasting and ceremonial, both in joy and sorrow. He concludes with an account of burial customs, art, and knowledge.

Dr. Malinowski's long paper is a fine piece of work, and an extremely valuable and interesting contribution to the ethnography of New Guinea. It is abundantly illustrated by diagrams in the text, by thirty-four pictures from the author's photographs, and by a map. The paper is a credit to the society which has found such ample space for it in its Transactions.

SIDNEY H. RAY.

OIL PROSPECTS IN THE BRITISH ISLES.

MR. W. H. DALTON read a paper upon the above subject before the Institution of Petroleum Technologists on November 20. He deals in the paper with actual liquid petroleum only, and not with the potentialities of distillation from so-called oil shale, from coal, peat, or any other carbonaceous solids. He regards the widespread conception of a store of petroleum of commercial value lying intact within the limits of the British Isles as wholly untenable. Nature seems at all times since the initiation of organic life to have evolved hydrocarbons, in very variable quantity, sometimes for prolonged storage, often for rapid dissipation. In a rapid summary, in geological order, of all recorded appearances of oil or tar within the kingdom, the Carboniferous series receives most attention, chiefly from the extensive mining operations, which have revealed pockets of oil where none is seen at the surface. Those occurring in the Scotch oil shales are presumably due to natural distillation by the heat of intruded igneous rock. Others, in the Yorkshire and associated coalfields, are assigned to the alternations of terrestrial with marine conditions.

It must be borne in mind that the roof of a coal seam *ipso facto* implies a change of conditions, from terrestrial vegetation to subaqueous deposit of sediment, and this was in not a few cases brought about by subsidence, the sea often invading an area previously supporting terrestrial growth. In the Staffordshire coalfield many such marine invasions have been detected, and several in Derbyshire and Nottinghamshire. The coeval deposits of Yorkshire and Lancashire would doubtless furnish similar evidence if fully studied in this respect.

If petroleum is principally due to marine organisms, whether vegetal, animal, or of the neutral character at the bottom of either scale, such invasion furnishes at once a wider area for occupation, and abundance of dead vegetation as nutriment. Consequently, the roof of a coal seam is a watery paradise for the development of oil-making organisms, and if the deposited

sands or clays are of suitable character for storage and cover, there is a chance for the formation of oil, but in no case has there been found a store of high commercial value.

Besides abundant exposure at the surface, the British geological series has for centuries been subjected to penetration by mines and borings practically throughout its thickness, and no extensive area has escaped the test of drill or pick.

It is much to be doubted whether in any part of the Secondary rocks or of the subjacent Palaeozoic series there exists any deposit of petroleum of a commercial value commensurate with the cost of wild-cat search (for such it must needs be) and subsequent exploitation. Yet the Kelham and Norton instances, in the Millstone Grit and Yoredale beds respectively, demonstrate the possible occurrence of oil in deep-seated portions of series of which the wide areas of outcrop yield no similar indications. In view of our ignorance of the tectonic structure obtaining in these older rocks to the eastward of proved points, the term wild-cat is not too strong; for, although the overlying rocks indicate various tectonic movements—presumably influenced in depth by pre-existing structure—we do not know the degree of that influence, still less the extent to which the older rocks have been brought within reach of denuding agencies to form the floor on which rest the newer rocks; an anticline in the Secondaries may be "posthumously" along one of older date—it may be oblique or directly transverse to flexures that would control the accumulation of Palaeozoic oil, if such exists.

It is demonstrated, then, that in the British Isles—as in other parts of the world—oil-forming conditions have frequently recurred, but to a very limited extent; and although conditions favouring its accumulation, and tectonic structures capable of conserving it from escape, are also of frequent occurrence, the conjunction of the latter essentials with original formation has generally failed. Our reservoir rocks are full of water, demonstrating the absence of liquid hydrocarbons. The curves of our anticlines and synclines serve to enhance the beauty of our landscapes, and their formation has, under favourable conditions, resulted in ore-bearing veins, but to reduce that ore, as generally for heat, illumination, and motive-power, we must continue to depend upon solid minerals of native source, and fluid combustibles imported from abroad.

The feeble and short-lived flows which our rocks exhibit necessarily conform to the same hydrostatic laws as the vast bulks of other regions, but whether from defect of original formation, of space accessible for accumulation, or of adequate seal from escape, the total result is, from a practical commercial point of view, valueless, except possibly in the one or two cases mentioned above. To geologists, negative evidence in respect of petroleum would be accompanied by so much of interest and value in other directions that their trivial share in the cost would be gladly borne, but owners who looked for royalties would be less complacent under their disappointment. Hope is more easily excited than regrets are consoled. It is scarcely necessary to say that the drill and pump constitute the final court of appeal, but the charge of hoarding petroleum is not one at all likely to be substantiated.

EXPERIMENTS ON TRIBO-ELECTRICITY.

IT is strange that tribo-electricity—that is, the subject which deals with the production of charges by rubbing together unlike materials—has been so greatly neglected by experimentalists during the last century. A dozen branches of electricity have, during

that period, been developed to the dignity of voluminous quantitative sciences, whilst this section of the subject, which is of great antiquity, can be dealt with on a page or two of a text-book, and consists of incoherent qualitative facts.

A recent paper by Dr. P. E. Shaw (Proc. Roy. Soc., November, 1917) discloses interesting results, and indicates that this neglected field of research is being developed. Throughout the experiments described the conditions of the surfaces used were varied systematically—by rise of temperature before and during friction; by treatment when flexed; and by previously grinding or polishing, and so on. It is well known that there are condensed films on the surfaces of many solid materials. Little is understood as to the nature or depth of these adsorbed layers, but they have proved a veritable stumbling-block to the investigator of certain phenomena—*e.g.* surface-tension and photo-electricity. But these films have little influence on tribo-electric effects, for here there is always a rough impact of solid on solid, the films are penetrated, and the true solid surfaces bear on one another.

The tribo-electric series consists of thirty-six places in order from the extreme + at top to the extreme - at bottom. The outstanding feature of the present results is the readiness with which a solid changes its place in the series when its surface condition is changed by heat, abrasion, flexure, and the like. Thus ordinary soda-glass drops from place 5 to place 21 when made matt, and to place 26 when its temperature has been raised to 245° C. Mica, which normally occupies place 6, drops to place 18 when matt, and to place 26 when heated to 270°. On the other hand, ebonite rises from place 28 to place 27 when matt, and to place 21 when heated to 100°. The remarkable character of these changes is that they are not erratic, but follow a simple law, as follows: All materials in the series above place 14 fall when rendered matt or after heating; but all materials in the series below 14 have the contrary tendency, and rise when heated or made matt. Thus the tendency is for the two ends of the series to come together as a result of these changes of condition. The temperature at which the change by heat occurs is quite definite for each material, and has been found for some sixteen metals and non-metals. It ranges from 70° C. to 300° C.

Dr. Shaw considers that this diametrically opposite behaviour in the + and - groups of the series indicates the existence of two kinds of atom or atomic group, one kind for each group, the difference between the two kinds being fundamental. But whatever form the theory of these effects may take, these new facts can scarcely fail to be of great importance. The research provides an explanation of the well-known readiness with which materials change their tribo-electric character. It should now be possible to avoid, in great measure, the confusion and irregularity which have hitherto characterised the subject.

Physiological chemistry (m)

THE RELATION BETWEEN CHEMICAL CONSTITUTION AND PHYSIOLOGICAL ACTION.¹

THE relation between chemical constitution and physiological action occupies a definite and important place in the study of drugs. Chemical investigation of a drug begins with the attempt to isolate the principle to which its action is due. Then follow the determination of its constitution and the syn-

thesis of a number of substances related to the parent compound, and comparison of their physiological action.

The wideness of the term "physiological action," covering as it does any action on the living organism, renders its discussion difficult. It is impossible, for instance, to compare the bactericidal action of phenol with the hypnotic effect of diethylbarbituric acid, or with the anæsthetic action of cocaine, for the same superficial signs of physiological action may be due to widely different causes. Examples of physiological action are not wanting. Compounds of similar constitution generally possess a characteristic group-smell, whilst each member may have a specific odour. Sense of taste also provides an occasional means of discrimination not only between side-chains of different length, but also in certain cases between stereoisomerides.

Stereochemical influences often exercise profound effects, particularly on nerve-endings. Thus *l*-hyoscyamine has about a hundred times the mydriatic action of *d*-hyoscyamine, and *l*-adrenine many times the pressor effect of the dextro-compound. Asymmetry of a nitrogen atom may also condition a difference, as in the case of the α - and β -methochlorides of *l*-canadine. The cause of this variation still remains in doubt.

The influence of physical properties, such as solubility in different media, may be of importance, and it has been shown that for a particular series of aliphatic compounds their narcotic effect on tadpoles was proportional to the partition-coefficients of their solubilities in oil and water.

As an indication of the effect of chemical properties, it has been shown that whilst certain basic dyes stain the grey nerve substance, their sulphonic acids do not. This difference suggested that bases, liberated in the blood-stream by alkalis, are extracted by the nerve substance, whilst their sulphonic acids remain in solution as alkali salts.

In the case of alkaloids it is a general rule that the introduction of a free carboxyl group profoundly modifies the physiological action. Benzoyl ecgonine, of which cocaine is the methyl ester, has no local anæsthetic action; whilst quinine, obtained from quinine by oxidation of the vinyl group, is non-toxic. Formation of quaternary salts has also a considerable effect. For instance, papaverine has a strychnine-like action which is missing in its methochloride, and reappears in its reduction product laudanosine.

In the many cases in which members of a group of compounds of similar constitution resemble one another in physiological action it is of interest to observe the effect of slight chemical alterations. The following four pieces of work were then outlined:—(1) *Tropeines* (acyl derivatives of the amino-alcohol tropine); (2) *aminoalkyl esters* (formed by the esterification of an acid with an alcohol containing an amino-group); (3) *adrenine and the amines* (adrenine is the active principle of the suprarenal gland); (4) *protozoacidal drugs*. The results of experiments that have been made on the relative toxicity to infusoria of a number of cinchona derivatives, with a view to their employment in the treatment in malaria, indicate that ethylhydrocupreine was the most active, but they do not admit of any certain conclusions as to the relation between their chemical constitution and protozoacidal action.

Experiments have also been made on the relative toxicity of the ipecacuanha alkaloids to amœbæ, and they indicate that the full amœbacidal action characteristic of emetine is exhibited only when the nucleus is intact.

¹ Summary of a lecture delivered before the Chemical Society on December 6 by Dr. F. L. Pyman.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—The University has gratefully accepted an offer received from Mrs. King, of Worthing, to give 100*l.* 5 per cent. War Stock for the establishment of a scholarship for research work on fevers, in memory of her daughter, Nita King, a member of a Voluntary Aid Detachment, who died of cerebro-spinal fever in France.

LONDON.—Prof. Bernard Pares, professor of Russian history, language, and literature in the University of Liverpool, has been appointed the first incumbent of the chair of Russian which has been established by endowment from the London County Council, and will be tenable at King's College.

The degree of D.Sc. (Economics) has been conferred on Mr. A. D. Smith, an internal student, of the London School of Economics, for a thesis entitled "The Development of Rates of Postage."

DR. ARNOLD EILOART has been appointed assistant lecturer in chemistry, and Mr. J. T. Westwood assistant lecturer in mechanical engineering, at the Technical College, Huddersfield.

MISS E. C. TALBOT, of Margam, has presented to the council of University College, Cardiff, a benefaction amounting to about 30,000*l.*, which will produce a salary of 1500*l.* per annum for the purposes of a chair in preventive medicine. The first occupant of the chair is to be nominated for election by the council by an expert board, of which Sir Wm. Osler is to be chairman.

PARTICULARS of a novel form of technical instruction have reached us from America. A winter school for the training of librarians is to be held at the Riverside Public Library, Riverside, California, from January 7 to March 2 of next year, and the services of numerous experts in library administration have been secured as lecturers and demonstrators. Among the subjects of lectures included in the attractive programme offered to intending students are:—The library as a museum, high-school libraries, library mechanics and handicraft, cataloguing and classification, office filing and indexing, and binding and repair work.

THERE is evidence that the need for improved technical education in France is engaging the attention of the authorities. The question was first raised a year ago by a paper by M. Léon Guillet in the *Bulletin* of the French Society of Civil Engineers for October-November, 1916. The meeting at which the paper was read was presided over by the Minister of Commerce and Industry, and out of the discussion which arose a committee was formed for the purpose of submitting recommendations to the Minister mentioned. Discussion was invited from persons not members of the society, and the results are published in the *Bulletin* of the society, January-April, 1917, and the *Revue de Métallurgie*, May-June, 1917. A summary of the committee's recommendations also appears in the September-October number of the *Bulletin de la Société d'Encouragement pour l'Industrie Nationale*.

THE Committee on the Neglect of Science has published an article by Sir Ray Lankester on the new scheme of examination for Class I. of the Civil Service. This is of considerable interest to those concerned with the position to be occupied by science in secondary-school and university education in the future. An admirable summary of the report of the Government Committee under the chairmanship of Mr. Stanley Leathes is embodied in this statement, and Sir Ray Lankester frankly admits that the new proposals are a great advance in the direction desired by the Neglect of

Science Committee. The Government Committee, in its report, has, however, contented itself with attempting to secure equality of opportunity to all branches of learning, and considers that the schools and universities should do the rest. Whether the theoretical advance will prove of practical value remains to be seen, for the older universities and great public schools are, without exception, dominated by the "classics." In the concluding sentence of Sir Ray Lankester's article the position is summed up as follows:—"Mr. Stanley Leathes's Committee, instead of rescuing education from the professional vested interests of the classical schoolmasters, hands back the victim, after many professions of good will, to the tender mercies of those who are banded together to starve, torture, and discredit her, and remorselessly to maintain the domination and the pecuniary allurements of the 'classical system.'"

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, December 13.—Sir J. J. Thomson, president, in the chair.—Prof. B. Moore: The formation of nitrites from nitrates in aqueous solution by the action of sunlight and the assimilation of the nitrites by green leaves in sunlight. Dilute solutions of nitrates exposed either to sunlight or to a source of light rich in light-energy of short wave-length (such as light from mercury vapour arc enclosed in silica) undergo conversion of nitrate into nitrite. There is an uptake of chemical energy in this reaction transformed from light-energy, as in the formation of organic carbon compounds in foliage leaves; it is to be added to the relatively small number of endothermic reactions induced by light. When green leaves are immersed in nitrate solution comparatively little nitrite accumulates, indicating that nitrites are rapidly absorbed by the green leaf. Nitrates taken up by plants from soil would, in presence of sunlight, be changed to nitrites, which are much more reactive than nitrates. This indicates that the early stages of synthesis of nitrogenous compounds are carried out in the green leaf and aided by sunlight. Rain-water collected for a considerable time contains no nitrites, all having been oxidised to nitrates, but if exposed to bright sunlight or ultra-violet light for a few hours a strong reaction for nitrites is always obtained. There is no hydrogen peroxide or ozone in air at surface level. The fresh odour in open air, commonly referred to as "ozone," is probably nitrogen trioxide, which at high dilutions has the odour of ozone. The oxides of nitrogen are probably formed by the action of sunlight, rich in ultra-violet rays, in upper regions of the atmosphere upon air and aqueous vapour.—J. R. Moir: The transition from rostro-carinate flint implements to the tongued-shaped implements of river-terrace gravels. Seven flint implements, exhibiting a beak-like profile, have been found, associated with early Palæolithic, in certain ancient valley gravels. The implements described exhibit certain characteristics of form only before seen in the rostro-carinates discovered beneath the Pliocene Red Crag and in other pre-Palæolithic deposits in East Anglia. They show also by the nature of their flaking and provenance that they are of early Palæolithic age. The dual character of these specimens is very marked and points to the conclusion that the knowledge of the manner in which to make a palæolith was acquired by long experience in producing rostro-carinates. This view finds support in the experiments in flint-flaking which have been carried out. The specimens have been recovered from a wide area in southern England, and it seems reasonable to regard them as presenting transitional types linking the rostro-carinates with the earliest palæoliths.

Physical Society, November 23.—Mr. W. R. Cooper, vice-president, in the chair.—Prof. J. W. Nicholson: Some problems of stability of atoms and molecules. The paper is mainly concerned with the possible existence and stability of atoms, and of molecules formed after the manner suggested by Stark, the link between the atoms in a molecule being provided by a stationary electron on the molecular axis. Atoms on the Rutherford model, though dynamically unstable, are stable for the simple vibrations ordinarily excited; but it is shown in the paper that atoms with such a stationary electron have a much more limited degree of stability. Moreover, they cannot exist even in an undisturbed state unless they are endowed with a negative charge, for no steady motion is possible, and this conclusion extends even to atoms regulated according to a dynamics such as that of Bohr. Stark's conclusions do not, therefore, survive a quantitative treatment, and molecules cannot be formed in the manner he supposes. The paper also discusses the more symmetrical problem, in which there are two such stationary electrons in an undisturbed atom, and it is shown that systems with a transitory existence, which are known by their spectra to occur in the solar corona, are apparently unaccompanied by the still more transitory systems which would be formed by the attachment of an electron after the manner of Stark. This is a further argument against the possibility that two atoms in a molecule can be linked by a single electron, or by two electrons, which attract both atoms.—T. H. Blakesley: Uses of certain methods of classification in optics. This consisted of an account of the additions which, in the course of the intervening years, the author had been enabled to make in the general diagram of optical properties, first communicated by him to the Physical Society in the year 1903 (Proceedings, vol. xviii., p. 591).

Geological Society, December 5.—Dr. Alfred Harker, president, in the chair.—E. Heron-Allen and J. E. Barnard: Application of X-rays to the determination of the interior structure of microscopic fossils, particularly with reference to the dimorphism of the Nummulites. Mr. Heron-Allen said that in the year 1826 d'Orbigny published among the *nomina nuda* that compose his "Tableau Méthodique de la Classe Céphalopodes" the name *Rotalia dubia*. G. Berthelin was the first investigator to make use of the "Planches inédites" which had been partly completed by d'Orbigny for the illustration of his unpublished work upon the Foraminifera. Berthelin made for his own use careful tracings of 246 of A. d'Orbigny's unfinished outline-sketches; among them was the sketch of *R. dubia*. On the death of Berthelin the tracings passed into the possession of Prof. Carlo Fornasini, of Bologna, who reproduced them all between the years 1898 and 1908. Fornasini's opinion was that the organism depicted by d'Orbigny was probably referable to the Ostracoda. Messrs. A. Earland and E. Heron-Allen, while examining the material brought by Dr. J. J. Simpson from the Kerimba Archipelago in 1915, discovered undoubted Foraminifera of an unknown type, which resembled Berthelin's tracing. Prof. Boule sent the d'Orbigny type-specimen to London, and the Rhizopodal nature of *R. dubia* was established. It is not a *Rotalia*, and it must await determination until more specimens are obtained. It has been named provisionally *Pegidia papillata*. Mr. Barnard experimented with the object of ascertaining the interior structure of the shell by means of the X-rays. A skiagraph of the dense test of *Biloculina bulloides*, d'Orb., shows the arrangement of the earlier chambers as clearly as it is indicated in Schlumberger's sections. The application of X-rays to the dense imperforate shells, *Cornuspira foliacea* (Philippi),

produced skiagraphs showing the dimorphism of the shells. The skiagraph of *Astrorhiza arenaria*, Norman, shows the internal cavities that contained the protoplasmic body. Two arenaceous forms, *Botellina labyrinthica*, Brady, and *Jaculella obtusa*, Brady, are distinguished at once by skiagraphs. Mr. Barnard afterwards experimented on still more difficult material. *Operculina complanata*, DeFrance, the umbilical portion of which is obscured by secondary shell-substance, furnished a skiagraph that showed curious distortions of the internal septa. The determination of the Nummulites, depending on a knowledge of the internal structure, is facilitated by the application of X-rays.

Optical Society, December 13.—Prof. F. J. Cheshire, president, in the chair.—J. W. French: Proposed standard system of optical notation and sign convention. The author pointed out that owing to the non-existence of standards, confusion often arises in the interpretation and use of optical formulæ, due to indefiniteness as to the sign convention employed in their construction. The suggested scheme, which contained about one hundred clauses, dealt with the notation for points, lengths, and angles and the sign convention for lengths and angles. Certain of the quantities were dealt with historically, as, for example, the substitution of the Greek letter " μ " for " n ," to represent a refractive index. It was suggested that the more controversial clauses might be discussed by a committee which would issue supplementary lists that would ultimately cover all points, including the definition of terms and other standards.—T. Smith: Optical nomenclature and symbolism. The author dealt with the definitions of fundamental quantities, and conventions for positive directions, angles, curvatures, and powers. The necessity for a number of new symbols was shown; a special symbolism was required for oblique pencils. The new symbols proposed for frequently recurring quantities were explained.

Linnean Society, December 13.—Sir David Prain, president, in the chair.—Capt. A. W. Hill: Seeds enclosed in a stony endocarp and their germination. In certain genera the seed or seeds are protected by inclusion within a stony endocarp. In such cases it is found that definite provision is made during the development of the fruit for the liberation of the seeds on germination from their stony envelope. In the case of Prunus and similar normally one-seeded fruits splitting apart of the two halves of the endocarp takes place, but in such three- to five-seeded fruits as Canarium, Sclerocarya, Dracontomelon, Saccoglottis, Aubrya, etc., special fenestræ or opercula are provided which are pushed away by the germinating embryo. In *Davidia* not only are special fenestræ removed, but also portions of the intervening skeletal structure of the endocarp. The remarkable fruit of *Pleiogynium* encloses several seeds which germinate without any disintegration of the endocarp.—Mrs. Haig Thomas: Skins illustrating results obtained in crossing species of pheasants. The cross between silver pheasant (*Gennaenus nyctemerus*) and Swinhoe's pheasant (*G. swinhoei*) gave a remarkable series of segregating forms in the F_2 generation. Amongst these were birds scarcely distinguishable from *swinhoei*. The F_1 form was a combination very distinct from the parental types; and, judging from the frequency with which some of the new forms occurred in F_2 , it was evident that they behaved as dominants and likely that they could have been bred true. The cross *Phasianus versicolor* \times *P. formosanus* had been made reciprocally. Crosses involving several pairs showed that there were consistent differences according to the way in which the cross was made.

Royal Meteorological Society, December 19.—Major H. G. Lyons, president, in the chair.—P. Bolton: The computation of wind velocity from pilot balloon observations. In this problem the required wind velocities occur as the bases of a succession of triangles in which two sides, a , b , and the included angle C are obtained by simple calculations from theodolite observations. To solve such triangles *directly* by the ordinary slide-rule method, the two numbers a , b on the logarithmic scale must be brought into coincidence on the logarithmic sine scale with two angles differing by the magnitude of the angle C . When this has been done the other elements of the triangle can be read off directly. The paper suggests a means of reducing the labour of setting the scales. A prepared chart of logarithmic sine curves is used, which in effect takes the place of the logarithmic sine scale of the slide rule. The other scales are rearranged with the view of reducing the arithmetical work involved in the complete solution of the problem.—E. G. Bilham: The use of monthly mean values in climatological analysis. The objects of the paper are:—(1) To determine to what extent computations based on calendar monthly mean values are vitiated by the fact that the latter are of unequal length; and (2) to provide means of applying numerical corrections on account of errors arising from this cause. The mean month is defined as an exact one-twelfth division of the year, or 30.437 days, and that period is used as the standard to which the results derived from the actual months are reduced. The matter is of special interest in connection with the computation of Fourier coefficients to represent the seasonal variation of a meteorological element such as temperature. Regarding the year as a cycle of 360° , errors arise from the fact that the monthly mean values will in general differ by small amounts from the ordinates of the curve corresponding with 15° , 45° , etc. The corrections to be applied to the original monthly means and to the Fourier amplitudes have been determined. The use of these corrections is suggested as an alternative to the employment of five-day means in cases where special accuracy is required.

CALCUTTA.

Asiatic Society of Bengal, November 7.—Sir Charles Elliot: Zoological results of a tour in the Far East. *Mollusca nudibranchiata (ascoglossa)*. The author describes a new species of Stiller remarkable in the possession of pointed oral tentacles and tentacular prolongations of the foot. The species was found in pools of brackish water at the edge of the Talé Sap, or inland sea of Singgora, in Peninsular Siam.—S. Kemp: Zoological results of a tour in the Far East. Decapoda and Stomatopoda. In the course of his tour in Japan, China, and the Malay Peninsula Dr. Annandale obtained eighty-five species of Decapoda and Stomatopoda. Considered as a whole, the main interest of this large collection lies in the fact that all the species were obtained in fresh or brackish water. Little attention has hitherto been paid to the habitat of Decapoda, and, as a rule, no indication is to be found in the literature as to whether a species inhabits fresh, brackish, or salt water. Dr. Annandale's collection supplies precise information on this point, and shows that a surprisingly large number of forms have been able to establish themselves in water that is fresh or of greatly reduced salinity.—Karm Chand Mehta: Some observations and experiments on the rust on *Launea asplenifolia*, D.C. The cause of rust on this plant is *Puccinia butteri*. The author has had diseased plants under his observation for a year. He describes the habit and behaviour of the parasite and host, and discusses some microscopic details of the parasite.

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BOOKS RECEIVED.

Creative Psychics: The Art of Regeneration. By F. Henkel. Pp. 81. (Los Angeles: Golden Press.) 25 cents.

A Text-book of Inorganic Chemistry. Edited by Dr. J. Newton Friend. Vol. iv., Aluminium and its Congeners, including the Rare Earth Metals. By H. F. V. Little. Pp. xx+485. (London: C. Griffin and Co., Ltd.) 15s. net.

The Cause, Prevention, and Treatment of Cancer and other Diseases. By Lt.-Col. W. H. Hildebrand. Pp. viii+163. (London: Cole and Co.)

James Geikie: The Man and the Geologist. By Dr. M. I. Newbigin and Dr. J. S. Flett. Pp. xi+227. (Edinburgh: Oliver and Boyd; London: Gurney and Jackson.) 7s. 6d. net.

DIARY OF SOCIETIES.

SATURDAY, DECEMBER 29.

ROYAL INSTITUTION, at 3.—Electricity and Electric Currents: Prof. J. A. Fleming.

TUESDAY, JANUARY 1.

ROYAL INSTITUTION, at 3.—The Electric Current as a Heater and Chemist: Prof. J. A. Fleming.

THURSDAY, JANUARY 3.

ROYAL INSTITUTION, at 3.—Electricity as an Illuminator and Doctor: Prof. J. A. Fleming.

CHILD STUDY ASSOCIATION, at 5.30.—Discussion: The Education of the Clever Child: Openers: G. F. Daniell and Miss M. Berryman.

SATURDAY, JANUARY 5.

ROYAL INSTITUTION, at 3.—Electric Dynamos, Motors, Transformers, and Railways: Prof. J. A. Fleming.

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