THURSDAY, JUNE 22, 1916.

LETTERS AND REMINISCENCES OF ALFRED RUSSEL WALLACE

Alfred Russel Wallace: Letters and Reminiscences. By James Marchant. In two vols. Vol. i., pp. xi+320; vol. ii., pp. vi+292. (London: Cassell and Co., Ltd., 1916.) Price 25*s.* net.

ALTHOUGH Alfred Russel Wallace published a detailed autobiography, a welcome must be given to this book of letters and reminiscences, which contains fresh and interesting information regarding one of whom we wish to know all that is significant. Mr. Marchant, whose work has been a labour of love and veneration, tells us that the original idea was to make a comparative study entitled "Darwin and Wallace," which was also to include an estimate of the present-day position of the theory of natural selection. In this rather difficult task the veteran naturalist, whose courage never wavered, proposed to co-operate, but he died soon after the agreement with the publishers had been signed. Thus the originally projected book remains unwritten, and what Mr. Marchant has done is rather less ambitious. He has made a selection from several thousands of letters, and has bound these together with a sympathetic and well-written biographical commentary. We wish, indeed, that there had been more commentary and fewer letters, for some of these seem to us quite trivial, and others lose in effect because their significance is not adequately indicated. We recognise the value of having "the complete extant correspondence between Wallace and Darwin" (1857–1881), though many of the fascinating documents have been published before; but we cannot repress our judgment that the book would have been twice as valuable if half of it had been left out. It is the old story of the overcrowded picture gallery.

Restrained as Mr. Marchant is in his appreciation of Wallace, for whom he evidently has a reverence as deep as his affection, he gives us glimpses of a well-considered and intellectually balanced hero-worship which everyone will commend. But we are not at all inclined to agree that "up to the present time the unique work and position of Wallace have not been fully disclosed owing to his great modesty and to the fact that he outlived all his contemporaries." The fact is that the merits of Wallace's work have been carefully appreciated by those interested in the personal and historical side of biological progress: moreover, the charm of his personality and the sincerity of his character led both his contemporaries and those who have entered into his labours to a wise and generous inattention to various intellectual idiosyncrasies which would otherwise have blemished the great naturalist's scientific reputation. It remains, unfortunately, a matter of opinion whether Wallace was right in his vigorous dissent from Darwin's theory of sexual selection, but no biologist questions the value of his criticism and of his suggestions; on the other hand, it will be found difficult to maintain that what Wallace said (in his later years) regarding either mutations or Mendelian inheritance was marked by competence, not to speak of wisdom.

It is indicative of the greatness of the man that (as the preface tells us) there was not in all the thousands of letters—published or unpublished—anything that an editor might be inclined to suppress, but our point is that in the volumes before us it is not difficult to find examples of *obiter dicta* which are all very well in a letter, but do not, when read in cold blood, conform with what we know of the writer's sagacity. In illustration we may point to the sentence, "The Piltdown skull does not prove much, if anything," and to the remarks on Bergson and on Bateson. Little things of this sort do not, of course, affect Wallace's scientific reputation, which it would be an impertinence to speak or think of except in terms of the highest respect, but we see little use in seriously chronicling remarks which were based on misunderstanding.

But too much must not be made of the inclusion of material which a more critical editor might have sifted out, for the task of selection must have been exceedingly difficult, and there is no doubt as to the value of even minute details in producing a picturesque impression. It may well be that some of the letters that appear to us without significance will be appreciated by other readers. In any case, we have to thank Mr. Marchant for a picture of Wallace as a man which is firmer and more complete than that previously available. A very lovable and noble picture forms round our memories of him as the appreciation before us recalls his guilelessness, sincerity, kindness, and humility, his eagerness of mind and unlimited range of interests, his adventurous speculativeness, his enjoyment of all aspects of Nature, his continual thought for the welfare of his fellows, and his undimmed vision of the unseen. From first to last we get an impression of magnanimity that makes us proud of our race. As Mr. Marchant well says:—

"Apart altogether from his scientific position and attainments, which set him on high, he was a noble example of brave, resolute, and hopeful endeavour, maintained without faltering to the end of a long life. And this is not the least valuable part of his legacy to the race."

In spite of the general criticism which we have been compelled to make, we heartily congratulate Mr. Marchant on the effectiveness of his tribute to his illustrious friend. The commentary is interesting in style and admirable in its mood; the editing has been done with scrupulous carefulness. The lists of Wallace's works include his letters and reviews in NATURE, arranged chronologically. The illustrations are of great interest, especially the frontispieces to the two volumes and the charming photograph of Wallace's mother.

INTERNAL SECRETIONS.

The Endocrine Organs: An Introduction to the Study of Internal Secretion. By Sir E. A. Schäfer. Pp. ix+156. (London: Longmans, Green and Co., 1916.) Price 10*s.* 6*d.* net.

THE matter in this book represents the substance of the Lane Medical Lectures, given at the Stanford University, California, in 1913. It deals with a subject which is of increasing interest and importance to a large number of readers, and in which Sir Edward Schäfer has himself done pioneer work.

The object of the volume is "to supply a concise account of our present knowledge of the subject for the benefit of students and practitioners who may be desirous of obtaining more information regarding the internal secretions than is afforded by the ordinary text-books of physiology, but have not the time or opportunity to peruse extensive monographs or consult original articles."

The work is very well got up; there are 104 illustrations, which for the most part are carefully chosen and splendidly reproduced. The space which these demand probably necessitates a large page, which is the only technical fault to be found with the production of the book.

There is rather much new terminology for a volume of the size and scope of the present one. The author proposes, for the internal secretions, the general term *autacoids* (ἀυτός, self, and ἄκος, a medicinal agent), and he divides the autacoids into *hormonic* and *chalonic* autacoids, according as their action is to be regarded as excitatory or depressant. According to this classification, an autacoid is to be called a hormone only if its action is an excitatory one. The idea is doubtless a good one in many respects, but the author is not unaware of the shortcomings of such a classification, and anticipates some of these on page 7 in considering the action of adrenalin in causing excitation in some structures and inhibition in others, by regarding both phenomena as being due to sympathetic stimulation; the adrenalin thus acts as a hormone in both cases, stimulating on the one hand an excitatory mechanism, on the other an inhibitory one. It is not clear why all the so-called chalones might not be regarded in like manner, at all events provisionally, since the evidence for the existence of some at least of them is by no means strong.

Names are also suggested for hypothetical autacoids, *e.g.*, parathyrine from the parathyroids, and insuline from the islet tissue of the pancreas, but these names are, of course, only of a provisional nature.

The best chapters are those dealing with the thyro-parathyroid group and those which treat of the pituitary body and suprarenal. The clinical material introduced is of especial interest.

There is a misprint of importance on page 58, where, in dealing with the synthesis of adrenalin, the words "methyl-acetyl-pyrocatechin" should read "methylamino-acetyl-pyrocatechin."

Investigations connected with the internal secretions are beset with innumerable pitfalls, and it is easy for the zealous to discover what they seek, unless great care is taken not to read too much into the results obtained. The caution required in drawing conclusions is exemplified in the case of the hormones causing "secretion" of milk: such bodies appear to be present, not only in the blood of non-lactating animals (p. 95), but also in the pituitary of the skate (p. 99), which also acts on the uterus, yet does not influence the blood pressure or the kidney.

One feature of the book should make it welcome to a general reader, namely, the reduction of references and conflicting statements to a minimum. In the chapters dealing with the interrelations of the various organs this impression cannot in any case very well be avoided, as extreme conclusions have been pushed by many workers, and conflicting statements are too often the only ones available.

There is no doubt that the book will appeal to a wide circle of readers.

SIR GEORGE DARWIN'S LECTURES.

Scientific Papers by Sir G. H. Darwin. Vol. V. *Supplementary Volume containing Biographical Memoirs by Sir Francis Darwin and Prof. E. W. Brown, Lectures on Hill's Lunar Theory, etc.* Edited by F. J. M. Stratton and J. Jackson. Pp. lv+81. (Cambridge: At the University Press, 1916.) Price 6*s.* net.

THE previous four volumes contain all the papers that Sir George Darwin desired to see reprinted; and, although there remain many scientific reports on geodesy and the tides, the editors of this supplementary volume have adhered to his judgment in excluding them. The chief occasion for adding a fifth volume is in order that Darwin's course of lectures on Hill's lunar theory may be included. These lectures were delivered to his classes of students at Cambridge, and naturally do not contain original contributions to science; indeed, Darwin in his scientific investigations scarcely touched on this subject. But it was through this course that several well-known astronomers were first introduced to Hill's work, who have since greatly developed on these lines our knowledge of the moon's motion. The lectures will now be read by a wider circle, and they thoroughly deserve to be well known. A very clear presentation of the principles of the method is given, and the more tedious analytical development is cut short where necessary with excellent judgment. This volume contains also Darwin's last paper on periodic orbits, published in 1912, too late for inclusion with his other papers on the subject.

The reader will turn with the greatest pleasure to the two biographical memoirs by Sir Francis Darwin and Prof. E. W. Brown. The former gives a vivid personal sketch of his brother. The story of the early life at Down is of interest not only on account of George Darwin, but for the incidental references to his illustrious father.

We read that Darwin's capacity as a mathematician was probably of slow growth; as an undergraduate he did not display any of that colossal power of work and taking infinite trouble which characterised him later. It surprised his friends afterwards that he should have developed the patience for making the laborious numerical calculations on which much of his most original work was based.

Prof. Brown's memoir deals with Darwin's scientific work. A leading characteristic is that he was an applied mathematician in the strict and older sense of the word. He did not undertake investigations for the interest of the mathematical processes, but for the interest of the phenomena. "Darwin belonged essentially to the school which studies the phenomena by the most convenient mathematical methods. Strict logic in the modern sense is not applied nor is it necessary, being replaced in most cases by intuition which guides the investigator through the dangerous places." When the problem seemed intractable to analysis, he had recourse to numerical methods, and never seemed to hesitate to embark on the most laborious computations which might throw light on the phenomena. In his address to the International Congress of Mathematicians at Cambridge (which is also reprinted in this volume) he referred to his methods in the words: "My own work on the subject cannot be said to involve any such skill at all, unless indeed you describe as skill the procedure of a housebreaker who blows in a safe door with dynamite instead of picking the lock."

Prof. Brown gives an admirable review of the ground covered by the papers in the earlier volumes, showing the unity of aim throughout all Darwin's work; his memoir will form an excellent introduction for those who wish to enter on a serious study of the papers.

OUR BOOKSHELF.

Diseases of Poultry: their Etiology, Diagnosis, Treatment, and Prevention. By Raymond Pearl, Frank M. Surface, and Maynie R. Curtis. Pp. xi+342. (New York: The Macmillan Company; London: Macmillan and Co., Ltd., 1915.) Price 8*s.* 6*d.* net.

THIS interesting and well-illustrated book contains twenty-one chapters and a glossary of technical terms. The chief subjects dealt with are the diagnosis of diseases in poultry, avian *materia medica*, a discussion of the diseases generally found to infect the various organs, poisons, internal and external parasites, tumours, and poultry surgery.

The book is stated to be a compilation, but it is unfortunate that few other than American publications appear to have been used as sources of information. Thus, the use of catechu for white diarrhœa is ascribed to Salmon, who published in 1913, while the treatment was originally set forth by Fantham and employed in England in 1910.

Mention should be made of the very clear and concise exposition of poultry hygiene that is given in the second chapter. Were the instructions detailed therein to be carried out universally there is no doubt that nine-tenths of the losses now experienced among poultry would be saved. The short account on *materia medica* for the poultryman is simple, sound, and eminently practical. Many useful hints on the administration of drugs used in combating such parasitic infections as tapeworms are also given.

The chapter on the recognition of external parasites and the eradication of diseases, such as scaly leg and depluming scabies, is ably written, and the section on skin diseases and their cure is adequately treated. When dealing with diseases of the reproductive organs an interesting account of the various abnormalities observed in eggs, their causation and prevention, is given, attention being directed to the abnormalities of practical importance in egg-production and marketing. There is also a chapter on white diarrhœa, in which the chief American views on the various forms of this disease, coccidial and bacillary, are set forth.

We have pleasure in recommending the book to the attention of the practical poultry-keeper.

F.

A Generation of Religious Progress. Edited by G. Spiller. (Issued in Commemoration of the 21st Anniversary of the Union of Ethical Societies.) Pp. 151. (London: Watts and Co., 1916.) Price 1*s.* net.

A COLLECTION of articles by nine contributors. Sir H. H. Johnston, dealing with science and religion, eloquently sketches the progress of thought from simian times, and has interesting things to say about family affection in apes and savages, and about development of ancestors into local deities. He thinks that "religion, as the conception of a heavenly being, or heavenly beings . . . concerning themselves greatly with the affairs of man, has been abolished [or, later, "put entirely in the background"] for all thoughtful and educated people by the discoveries of science"; but he shows reverence for the teaching of Jesus, and believes true Christianity is primarily concerned with the service of man.

In the remaining essays in the volume Mr. Alfred Martin describes the history and methods of the higher criticism; Mr. William Archer writes on religion and democracy, with Asia and Europe as the fount of each respectively; Miss Margaret McMillan, in her section on woman's mission, is advanced, but sensible, as always; Mr. Joseph McCabe, on the humaner spirit, mentions reforms in the hours of labour, in the sanitation of prisons, in Parliamentary representation, and claims that not science, but humanistic idealism is the greatest phenomenon of modern times; Prof. J. S. Mackenzie writes on educational ideals, Mr. C. T. Gorham on the moral ideal, and Mr. G. Spiller on the future of religion.

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.*]

Elasticity and Entomology.

WHILE Euler's problem of the buckling of elastic rods and shafts under end thrust has received much attention both from mathematicians and from engineers, the importance of the results does not appear to have been appreciated in the entomological world.

I have been recently attempting to rearrange an old butterfly collection mounted in the so-called "Continental" fashion, high up on entomological pins about 1·5 in. long, and I find that except in the case of the thickest pins elastic instability invariably occurs when it is attempted to insert the specimens in the cabinet. This effect causes great trouble and inconvenience even with pins of thickness suitable for mounting average-sized Lyceænidæ. The drawers of my cabinet are lined with peat, coated with a thin layer of cork, and are specially constructed for the purpose, so the resistance is not great.

In the case of brass pins "made in Germany" it is impossible to insert them from above without permanently bending, and often doubling them up. In this case the flexure due to buckling causes permanent "set." Steel pins, on the other hand, are not usually bent beyond the elastic limits, but the result of the buckling is to cause the end of the pin to take a wrong direction when it is driven into the box; consequently, when the forceps is removed, the insect springs back into a position different from that originally intended, not only causing the collection to look very unsightly, but often resulting in the antennæ breaking off in consequence of the momentum generated in them by the vibration. The effect of excessive strain in the case of steel would probably be to break the pin in two.

It is curious that when studying these problems in elasticity nearly thirty years ago the idea never occurred to me to apply the results to account for the incessant troubles and misfortunes which in later years resulted in my abandoning entomology as a hobby. The present experiences, affording as they do a theoretical explanation of the difficulties, prove conclusively that the Continental system of setting butterflies and other insects high up on long German pins is fundamentally wrong in principle, and entomologists would do well to take account of the phenomena of elastic instability in deciding the style in which they mount their future collections.

It would be the easiest thing in the world to calculate the maximum length of pin of a given thickness that could be driven without buckling into a cabinet drawer or store-box offering a given resistance, but the question is so easily decided by trial that a mathematical investigation appears scarcely necessary.

G. H. BRYAN.

Babylon's Sacred Way.

THE discovery of the Sacred Way, or Procession Street, of Babylon is one of the results of excavations carried out by Dr. Robert Koldewey on the site of this ancient city. This Sacred Street extended approximately north and south through Babylon so far as the south-east corner of a level quadrangular enclosure wherein was situated the famous Tower of Babylon. Here the Sacred Way turned sharply westward towards the Euphrates, where the stone piers of the bridge which spanned the river have been found. All the temples of Babylon, including those of the goddess Ishtar and of Marduk, the lord of Babylon, have been found in the vicinity of this Sacred Way on either side. The street was extended slightly west of north and east of south, and the temples were similarly oriented, the southward aspect being approximately S.S.E. Apparently no attempt has been made to ascertain the azimuth of any of the temples, or of the Procession Street. Prof. Leonard W. King, in his recently published "History of Babylon," states that "Nebuchadnezzar boasts that he paved the street of Babylon for the procession of the great lord Marduk, to whom he prays for eternal life" (p. 59).

The foundation of the Sacred Way was laid with burnt bricks. The pavement throughout its entire length was constructed of square slabs, those in the middle being "a fine hard limestone," those along each side being of "red breccia veined with white"; but along that part of the Sacred Way between the royal palace and the main entrance to the enclosure of the Tower of Babylon the pavement was formed entirely with slabs of breccia. A plate facing p. 60 of the "History," showing part of the Procession Street uncovered, makes it appear that the slabs were about 18 in. square. They were held firmly in position by being laid on bitumen, which also filled the interstices between the slabs.

Dr. R. Koldewey thinks the limestone may have been obtained from Hit, on the Euphrates. Prof. L. W. King has informed me, in reply to an inquiry, that "it is not yet known whence the breccia for the Sacred Way was obtained, though at the time of its discovery Dr. Koldewey consulted more than one geologist on the subject."

Inscriptions on the edges of the slabs record that the pavement was constructed by Nebuchadnezzar (604–561 B.C.); but it is recorded on many of the slabs of breccia that they had formed part of an earlier pavement which had been the work of the great Sennacherib (688–681 B.C.) during the Assyrian domination. It would be interesting to know from what quarries the breccia and the limestone were obtained.

By his extremely valuable "History of Babylon," Prof. L. W. King has placed archæologists and all interested in ancient civilisations under a heavy debt of obligation. The long chapter dealing with the most recent discoveries, with numerous plans and illustrations, is a treatise in itself of thrilling interest.

H. KIDNER.

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P.S.—Since the foregoing letter was in type I have made a closer examination of the plans of the city and of its temples, published in Dr. King's "History of Babylon."

The plans on pp. 74 and 83 show that the part of the Sacred Way leading to the Euphrates branched from the main street at an angle of about 87°. This part of the street was oriented about 10° to 12° N. of E. and S. of W. The street passed alongside the eastern and southern wall of the peribolos of the Temple Tower, and in this latter part of its course towards the river it had the tower on the right (N.) and the Temple of Marduk on the left (S.). Prof. King states that the main street doubtless also continued southwards to a gate in the southern wall of the city.

The temples are quadrangular structures enclosing one or more courts open to the sky, and they all agree in having the eastward side more or less north of east, the western side facing south of west. But the orientation varies considerably. Thus while the Temple of Ishtar is oriented almost due N. and S. and E. and W., facing only about 4° N. of E., the Temple of Ninib faces about 20° N. of E., and the Temple of Ninmakh some 25° N. of E. This latter temple has its entrance on the northerly side, and the shrine on the southern, whereas the Temple of Ishtar has entrances on the E. and S. sides, and the shrine on the W. The figures given are approximate only.

Dr. King is now at work on the third volume of his "History," each volume treating of a separate period, and being to some extent independent of the others. When completed the work will be of lasting value, although each year adds fresh knowledge from new discoveries. Dr. King teaches us much, but he also makes us feel how much there is to learn. What principles, for instance, guided the Babylonian architects and builders in the orientation of their temples?

June 12. H. K.

"Ptolemy's Catalogue of Stars."

MAY I point out that your reviewer of "Ptolemy's Catalogue of Stars" (June 1, p. 282) is mistaken in suggesting that a mere confusion between the uncial alpha (=1) and the uncial delta (=4) will account for Ptolemy's assignment of the first magnitude to what is now the third-magnitude star, θ Eridani?

The star, called "the last in the River," whence the Arabic name of Achernar, is expressly described in the catalogue as "brilliant," λαμπρός, an epithet applied to no other in the group. And in another work of Ptolemy's, the Φάσεις, in which the risings and settings of thirty "fundamental" stars, fifteen of the first magnitude and fifteen of the second, are calculated for several parallels of latitude, "the last of the River" takes its place among those of the first magnitude.

Moreover, the same star is mentioned several times by Hipparchus in his one surviving work, the commentary on Aratus, and in each case it is described as the brightest in the constellation of the River, which it could not have been had it been of the fourth magnitude only.

Again, the star is of the first magnitude to Al Sûfi, whose catalogue was drawn up, 800 years after Ptolemy, for the express purpose of revising the magnitudes given in the Almagest. Al Sûfi adds some particulars as to its position which alone would suffice to refute the wild suggestion that the star meant was, not θ, but the modern α Eridani, Achernar, a star invisible to Greek and Arab astronomers.

There can be no reasonable doubt that θ Eridani has declined in lustre, from the first magnitude to the third, in the interval between Al Sûfi and the days when, during the early Portuguese voyages, it again was seen, after many centuries, by European eyes. That Ulugh Beg, 1437, should still make it a first-magnitude star is remarkable, but not conclusive, as his work was a revision of the places only, not the magnitudes, assigned to the stars by his predecessors. E. J. WEBB.

Noke, Islip, Oxford.

THE suggestion was not made by the reviewer, but is made in the work under review (p. 110), where it is stated that "it is most probable that in a very ancient manuscript the delta=4 was erroneously taken to be an alpha=1, of which the present investigation shows numerous examples." As regards the statements of Hipparchus, Ptolemy, and Sûfi, the facts are:—

		θ Eridani		
	Lat.	Decl.	Zen. dist.
	°	°	°
Hipparchus, Rhodes ...	+36	−50	86
Ptolemy, Alexandria ...	+31	−48	79
Sûfi, Bagdad	+33	−45	78
Shiraz	+30	−45	75
Teheran	+35	−45	80

Sûfi, on account of the low altitude, took the magnitude from Ptolemy. That θ Eridani was of the first magnitude for more than a thousand years, and from the time of Halley (1677) to the present day of uniform brightness (3 or 4 mag.), without sign of variability, will scarcely be accepted by astronomers.

THE REVIEWER.

Meteorological Conditions of a Blizzard.

YOUR correspondents are entirely right in their contention that, in this country, the word "blizzard" is used as a rule quite wrongly. I have protested many times in the past against this misuse.

For various reasons, a true blizzard cannot occur in Britain. In the first place, as several correspondents have already pointed out, the necessary climatic conditions are lacking; for a wind of extremely high velocity never occurs here in conjunction with sufficiently intense cold, producing fine dry powdery driving snow. Secondly, a wind-velocity sufficiently high to produce a blizzard is seldom or never attained, except in a region marked by an immense extent of level surface, little broken by trees and other obstructions, and there is no such region in Britain. All the necessary conditions, both climatic and physical, exist, however, in that true home of the blizzard—the vast plains and prairies lying to the east of the Rocky Mountains, in Central North America, especially in Dakota and Manitoba. Even the great English snowstorm of January 18, 1881 (which I remember very well indeed), bore little resemblance to a true blizzard, for the intense cold and high wind-velocity characteristic of a blizzard were both absent.

Those interested in the subject could not do better than refer to a little work, "Manitoba Described," which I published in 1885, after a visit to that country. Therein will be found (pp. 57-58) an excellent description of a Manitoban blizzard, written by my friend Mr. Ernest Thompson Seton, then living there. It was, I believe, the earliest description ever published, at all events in this country. Moreover, its graphic style has never been, and could not be, excelled.

It may be worth mentioning—though the point is of etymological rather than of scientific interest—that the use of the word "blizzard" in the above-mentioned article (1885) marked, I believe, its first appearance in permanent literature in this country, though there are instances of its use three or four years earlier in English periodical literature. Earlier than that the word cannot have been used anywhere in the sense in question; for it did not make its appearance, even in American journalism, before the winter of 1880-81.

MILLER CHRISTY.

Broom Wood Lodge, Chignal St. James,
Chelmsford, June 13.

THE OVER-FISHING OF THE NORTH SEA.[1]

THE problem of over-fishing of the North Sea was stated in general terms by several committees of inquiry during the latter decades of the last century, and particularly, in regard to the fishes of which the plaice is the type, by the International Council for Fishery Investigations about ten years ago. Since then a large amount of scientific and statistical research has been carried on in this and other European countries with the object of providing data for international schemes of fishery regulation. A series of reports recently published by the English Board of Agriculture and Fisheries forms what is obviously a very important contribution towards the settlement of these very difficult questions. The series includes three papers on the routine work dealing with the age, growth, and sexual maturity of the North Sea plaice, with the food of the fish in different areas and at different times, and with the distribution of the sexes. These reports have been prepared by Dr. W. Wallace, Mr. R. A. Todd, and Mr. A. E. Hefford. Miss R. M. Lee reviews an extensive series of commercial trawler statistics dealing with plaice, soles, and haddock; and Lieut. H. J. B. Wollaston gives an account of investigations undertaken with the object of delimiting the positions of plaice-spawning grounds in the North Sea. These two latter papers are distinguished by much originality of treatment, clear and orderly presentation of the facts elicited, and readable discussions of the trend of the data. They contain some noteworthy results: interesting cases of high statistical correlation between the density of plaice and haddock on the various fishing grounds of the North Sea, established by Miss Lee; and details of some novel methods of plankton investigation devised by Lieut. Wollaston.

The main problem is discussed by Dr. A. T. Masterman. Is there evidence of indubitable over-fishing of the North Sea? In its inception the problem was an international one, and it has, to some extent, been treated as such. But the English trawl-fisheries are so predominant as to make it apparent that the statistical data obtained by the Board of Agriculture and Fisheries must form the main mass of material to be considered. The returns of plaice landed at English ports during the period 1906–1912 are therefore those dealt with by Dr. Masterman. Nevertheless the report to the International Fishery Investigations Council prepared by Dr. Heincke, and published in the seventeenth volume of "Rapports et Proces-Verbaux," should also be seen by readers of the present papers.

Dr. Masterman's report is difficult to read because of the great mass of detail considered. The statistics are complicated rather unnecessarily (in the meantime at least) by the rather minute subdivision of the North Sea into statistical areas, nineteen in all. If the areas are considered individually the fishery statistics of other North Sea nations must be included, and this has not been attempted—perhaps it is impracticable. Now the period of time covered by the investigations, 1906–1912, is far too short to enable us to decide whether over-fishing has actually occurred. There are fluctuations during this period, and these "maximal and minimal years" are not the result of statistical "accidents," for they are demonstrated independently by Miss Lee's data. But they are fluctuations most probably dependent on, or to be associated with, meteorological cyclical events, and do not bear on the question of over-fishing.

Perhaps over-fishing has been demonstrated by Dr. Masterman as the result of the consideration of the "trade-categories." Plaice landed in England are subdivided into "large," "medium," and "small." The variation in the total annual quantities of all plaice landed during 1906–1912 is not significant, but there is a significant decrease in the quantity of "large," and a compensatory increase in the quantity of "small." These variations in the quantities belonging to the various classes may be unreal, for there are apparently no statistical descriptions of the "categories," and it is not impossible that these have not always been the same throughout the period considered. The terms are trade ones, and the classification is a trade convention made independently of the system of statistical collection. Nevertheless it is most probably true that modern trawl-fishing has diminished the stock of large plaice inhabiting the North Sea: Dr. Masterman's discussion indicates so much. The composition of a natural fish-population inhabiting this very extensive area has been affected by artificial means. In other words, the "mean after-lifetime" of a plaice inhabiting the North Sea, at the time when it is big enough to be caught in a trawl-net, has been reduced as a result of the development of the British steam-fishing fleets.

The problem is thus one of the eliciting of facts rather than of the provision of remedial legislative measures. It is highly unlikely that such will be attempted for some time to come, but the thing to be immediately considered is the recommendation made to the various Governments, in 1913, by the International Fishery Investigation Council. This suggested a minimum size-limit upon plaice landed of 20 cm. during the winter months, and of 22 cm. in the summer months. Now one must consider rather carefully what is meant by "over-fishing." The natural problem that confronts sea-fishery authorities is to get as great a quantity annually of *marketable plaice* from the North Sea as this area will afford without progressive depletion of its resources. The commercial value of this annual yield must not alone be considered, nor the relative value of one fraction of it (large plaice) as against another fraction (small plaice). Other questions incidental to the general one, such as the effect of the proposed legislation upon the commercially unorganised smaller inshore fisheries, must also be considered. These considerations are, of course, not relevant to Dr. Masterman's discussion, but they ought to be in the minds of readers of these important papers. J. J.

[1] Board of Agriculture and Fisheries. Fishery Investigations. Series II., Sea Fisheries. Vol. ii., Nos. 1–5; Vol. iii., Nos. 1–2. (London: H.M. Stationery Office, 1915.)

INHERITANCE IN ROVING AND IN ROMANTIC TYPES.[1]

IN his interesting study Dr. Davenport deals first with those not unfamiliar types who cannot settle down, who run away from home and school, who disappear suddenly and are next heard of at the ends of the earth. When the impulse is well-marked those whom it sways are known as rovers, and the periodic or prevailing domination of life by the wandering impulse may be called nomadism. It occurs in various forms and degrees, but the term nomadism should not be used too widely if it is to be of any use. Thus Meunier's classification includes legitimate nomads (like peddlers and missionaries), delinquent nomads (like fugitives from justice), nomads of ethnic origin (like gipsies and crusaders), as well as nomads of morbid origin (who are "rovers" in the strict sense). But this net has been too widely cast, and the suggestion that the rovers are necessarily morbid is unfortunate. The truant may become a scholar-gipsy and the stowaway a great explorer.

According to Dr. Davenport, "nomads, of all kinds, have a special racial trait—are, in a proper sense, members of the *nomadic race*. This trait is the absence of the germinal determiner that makes for sedentariness, stability, domesticity." From the data of a hundred family histories (some of which seem to us far from convincing as illustrations of true roving), the investigator concludes that

> nomadism is probably a sex-linked recessive monohybrid trait. Sons are nomadic only when their mothers belong to nomadic stock. Daughters are nomadic only when the mother belongs to such stock and the father is actually nomadic. When both parents are nomadic, expectation is that all children will be.

The wandering impulse is frequently associated with various kinds of periodic behaviour, such as depression, migraine, epilepsy, and hysteria, but Dr. Davenport is probably right in concluding that these merely permit the nomadic impulses to assert themselves. We do not feel at all convinced, however, by the argument that nomadism in man is of the same order as the regularised restlessness of migratory birds, or that it is the reassertion of a fundamental human instinct, normally inhibited by the conditions of civilisation.

The second study deals with the inheritance of temperament, more especially of the "romantic" and "classic" types, that is to say, the quickly-reacting and the slowly-reacting, the feebly-inhibited and the strongly-inhibited. In the old terminology the choleric and nervous were contrasted with the phlegmatic and melancholic; in the new terminology the "hyperkinetic" are contrasted with the "hypokinetic." Politically, Dr. Davenport tells us, the contrast spells radical and conservative; in any case, the dualism runs through our whole population.

The investigator is well aware that our temperamental outlook is profoundly affected by a complexity of conditions, such as the secretion of the suprarenal bodies, the blood-pressure, the state of the arterial walls, the adequacy of digestion and toxin-elimination, the state of the eyes (as Gould's well-known studies show), as well as by such unconsidered trifles as an ambition, a passion, an enthusiasm, an ideal; but he is not afraid to launch the hypothesis that there is in the germ-plasm a factor, E, which makes for excitability, while its absence means calm; that there is another factor, C, which makes for cheerfulness, while its absence "permits a more or less periodic depression."

This hypothesis is supported by an analysis of the pedigree-charts of eighty-nine families. There is interesting evidence of similarity of temperament in "identical twins." As regards marriage it is pointed out that "these twain" rarely have "the same zygotic temperamental formula," which is doubtless providential. As regards suicide it is shown that the hyperkinetic and the hypokinetic types are consistent even to the end, for they keep to their distinctive methods. The factorial hypothesis seems to work well in certain cases, but we must confess that the theory of a factor C, "which makes for normal cheerfulness of mood," appears to us an incredible simplification of the facts of life.

[1] "The Feebly Inhibited: Nomadism, or the Wandering Impulse with Special Reference to Heredity. Inheritance of Temperament." By C. B. Davenport. Pp. 158. (Washington: Carnegie Institution, 1915.)

PROF. SILVANUS P. THOMPSON, F.R.S.

THE sudden and unexpected death of Prof. Silvanus Thompson will be deeply regretted by a large and distinguished circle of personal friends, as well as by the many engineers, electricians, and others who, either directly in his classes, or indirectly through his books and writings, have come under the influence of his teaching. A many-sided, cultivated, and highly gifted man of untiring industry, possessed of an almost unique knowledge, not only of the highways and byways of science itself, but also of its history and the history of its creators, Prof. Thompson held a distinguished position in the scientific world.

During the past three centuries scientific facts have been accumulating so rapidly and on so vast a scale that no one could to-day honestly pretend, with Francis Bacon, that he took all knowledge for his province. Nor would it be possible nowadays for any single individual to be, like Leonardo da Vinci, the master, not only of every branch of science and engineering, but also of literature and the arts. Prof. Thompson, however, if he fell short of reaching the unattainable, was a real master in many separate intellectual fields. In the sciences of electricity, magnetism, and optics, and in other branches of physics, he made discoveries and did original work of his own, besides much other work in the way of elucidating and popularising what was done by others. Gifted with a peculiar charm of manner, a pleasantly resonant voice, great clarity of diction, and an immense facility for finding the proper words and expressions, his lectures were always a pleasure to listen to, particularly as, in addition to his

powers of locution, he was also exceedingly successful with his experiments. His speeches, whether prepared or extempore, were always models of lucidity, and when moved he was capable of attaining to real eloquence. From a combined scientific and literary point of view he possessed not a few points of resemblance with Tyndall, though very different himself in other ways from Tyndall as a man.

The late Sir William White, himself a very fluent and effective speaker, and himself a no mean judge of oratory, once told the present writer that he had heard Prof. Thompson deliver an address at a religious meeting in the Friends' Meeting House at York, and that it was the best sermon he had ever heard in his life. Nor were Prof. Thompson's powers of speech limited to his own language, as he was equally at home both in conversation, and when speaking in public, in the French, German, and Italian languages. In his writings also he showed himself to be a master of English. If the subject was scientific his language was always extraordinarily clear and to the point, which explains the remarkable success of some of his books. His treatise on "Dynamo Electric Machinery," for example, which was first published in 1884, has run to seven English editions and has further been translated both into French and German. Again, his "Elementary Lessons in Electricity and Magnetism" has been translated into French, German, Italian, Polish, and Japanese, and, in addition, has had a circulation of more than one hundred and fifty thousand copies in this country; while other of his technical books, such as his "Electro-Magnet," his "Polyphase Electric Currents and Motors," and his "Light, Visible and Invisible," together with many of his other scientific writings and lectures, have met with world-wide success.

To turn to Prof. Thompson's efforts of a more purely personal character, his fine literary style was turned to good use in his life of Faraday, his biographical notice of Philip Reis and his telephone, and his recent two-volume "Life of Lord Kelvin." Then, again, he was always keenly alive to the historical side of science, particularly from a romantic point of view, as is seen from the large amount of time and labour that he devoted to old books, such as the "De Magnete" of William Gilbert of Colchester, physician to Queen Elizabeth, which book he assisted to translate. He also devoted attention to, and reprinted, some of the seventeenth-century works on magnetism of Robert Boyle. Mention should also be made of the translation he made from the original Latin of the epistle on magnetism of Peter Peregrinus, written in the year 1269 by a soldier in the trenches during a siege, which translation he caused to be privately printed, ornamenting the coloured initial letters with his own hand. For, in addition to being a man of science and a man of letters, Prof. Thompson was also an artist who was able himself to draw the portrait of Faraday that illustrates his life of that great man, and whose water-colours of Alpine scenery have appeared on the walls of the Royal Academy.

As a man Prof. Thompson was a genial and interesting companion of wide general interests and sympathies. He lived up to the high standard of the Society of Friends, of which he was a life-long member, and was, indeed, a very good and true friend to many, to whom he tendered a helping hand in his quiet unostentatious way. Perhaps his chief characteristic was his amazing industry, and it is to this that is due the vast amount of work that he accomplished, though, passing away as he did at less than sixty-five, he has not attained even to the three score years and ten of the Psalmist, much less to the four score years which are now so commonly surpassed by many of our grand old men of science.

Few of the many who attended the service "For Worship," in memory of Prof. Thompson, on Friday last, in the Friends' Meeting House, St. Martin's Lane, will readily forget that remarkable and moving occasion. Many of the veterans of British science were there assembled, and the complete absence of any approach to form or ceremony, and the austere simplicity of the proceedings, were very impressive and carried one back to the days of the Puritans. Such was a fitting finale to a strenuous and distinguished career, by the close of which science has lost an enthusiastic leader and an illuminating exponent. Amongst those who knew Prof. Thompson personally all will deplore the departure of a trusted and very sincere friend—one who will not readily be forgotten.

A. A. CAMPBELL SWINTON.

WHAT SCIENCE SAYS TO TRUTH.

AS is the mainland to the sea,
Thou art to me:
Thou standest stable, while against thy feet
I beat, I beat!

Yet from thy cliffs so sheer, so tall,
Sands crumble and fall;
And golden grains of thee my tides each day
Carry away.

WILLIAM WATSON.

NOTES.

WE regret to see the announcement of the death on June 18 of Dr. R. H. Scott, F.R.S., superintendent of the Meteorological Office from 1867 to 1900.

THE longevity of men of science has often been brought under notice. On Saturday next, June 24, the Rt. Hon. Henry John Moreton, Earl of Ducie, F.R.S., enters on his ninetieth year, having been born in 1827. His lordship is the senior fellow of the Royal Society in point of election to that body, this dating from 1855. When Lord Moreton, he obtained from the Jurassic limestone of Burford the fossil species of star-fish named by Prof. Edward Forbes *Solaster moretoni*, in honour of the finder. In connection it may be mentioned that Sir Robert Palgrave, F.R.S., entered on his ninetieth year in the early part of this month, while Sir William Crookes attained the age of eighty-four on Saturday last, June 17.

DR. AXEL GAVELIN has been appointed director of the Swedish Geological Survey.

THE Sulitelma Company has made a grant of 20,000 kronen (about 1100*l.*) to assist geological research in Norway.

A CORRESPONDENT of *Svenska Dagbladet* states that in the Berlin Zoological Gardens carnivores are fed no longer on horseflesh, but on general offal obtained in the slaughter-houses, especially those of large preserving factories, and other places. Animals formerly fed on oats are now given various roots, and it is found that they appreciate these much better when boiled.

THE special correspondent of the *Times* at Port Stanley (Falkland Islands) reports that the ship sent by the Uruguayan Government for the relief of the members of Sir Ernest Shackleton's expedition on Elephant Island left there on Saturday, June 17.

AT a recent meeting of the Optical Society the president (Mr. F. J. Cheshire) stated that it had recently been discovered by a well-known London optician that the apochromatic systems of Carl Zeiss often, if not always, contained a strong negative lens made from ordinary potash alum. This lens had also been found in combination in such systems with a lens made from fluorspar.

A SCIENTIFIC lawyer writes:—"In the legal profession the axiom that 'a man who gets his law for nothing feels that he has got his money's worth' has assumed the purple among accepted facts." On this principle the best way to secure appreciation for the expert knowledge which men of science are continually giving gratuitously to Government departments would be to require reasonable payment for it.

THE death is announced, in his sixtieth year, of Mr. C. Sooysmith, consulting engineer, of New York, who introduced into the United States the so-called freezing process for excavating, and took out many patents for its application to the building of subaqueous tunnels. He also inaugurated the pneumatic caisson method for constructing the foundation of high buildings, and constructed the foundation for a number of large bridges, including the bridge over the Schuylkill River at Philadelphia and the Harlem River bridge at New York.

AT the annual meeting of the American Association for the Study and Prevention of Tuberculosis it was announced that it had received from the Metropolitan Life Insurance Co. a gift of 20,000*l.* for a "community experiment," with the idea of proving that tuberculosis can be controlled. First, there is to be selected a suitable community, of a character as nearly typical American as possible. In this community will be placed a staff of experts, who will get in touch with every person living within its boundaries who either has tuberculosis or has been exposed thereto. The staff will then, it is hoped, get every case under supervision, and control the disease in that particular town. The experiment is to last three years.

THE President of the Board of Trade has appointed a Committee to investigate the principal causes which have led to the increase of prices of commodities of general consumption since the beginning of the war, and to recommend such steps, if any, with the view of ameliorating the situation as appear practicable and expedient, having regard to the necessity of maintaining adequate supplies. The Committee is constituted as follows:—Rt. Hon. J. M. Robertson, M.P. (chairman), Mrs. Pember Reeves, Mr. W. C. Anderson, M.P., Prof. W. J. Ashley (professor of commerce, University of Birmingham), Mr. John Boland, M.P., Mr. T. Brodrick, Sir Gilbert Claughton, Bart., Mr. J. R. Clynes, M.P., Mr. R. E. Prothero, M.P., Mr. T. Shaw, J.P., and Sir W. Capel Slaughter. Mr. E. C. Ramsbottom, of the Board of Trade, will act as secretary to the Committee.

THE death is announced on June 13 of Commander C. B. Neate, R.N. Commander (then Lieutenant) Neate was the head of the British expedition to Rodriguez, in the Indian Ocean, for the observation of the transit of Venus in 1874. Three stations in the island were occupied, Lieut. Neate himself being at Point Venus, where all contacts were successfully observed. The "black drop" was seen, both at ingress and egress. At ingress the whole planet was distinctly seen outside the sun's limb, the following limb of Venus being bright, "like a very young moon." The observations are fully described and illustrated in the volume edited by Sir G. B. Airy, and published in 1881. Lieut. Neate was also a member of the expedition for the transit of 1882, being stationed at Bermuda, where, however, owing to cloud, the observations were only partially successful.

IN some agricultural districts the times at which labourers commence work have been advanced by one hour, thus cancelling the operation of the Summer Time Act. The reason given for this action is that at the earlier hour there is too much dew to enable farm work to be carried on. The advantage of the later lighting-up time in houses is also apparently to be discounted by an increase in the cost of artificial illumination, for the Brompton and Kensington Electricity Supply Co., Ltd., has just made the following announcement:—"In consequence of the operation of the 'Daylight Saving' Act, and in furtherance of the appeal of the Board of Trade to economise as far as possible in the use of electricity and gas (owing to the need for reducing the consumption of coal), the price of current will be increased by a further 10 per cent., to take effect from the date of reading the meters at the end of the current quarter." Other companies are also making this additional charge, which means that consumers will now have to pay a 20 per cent. increase on the cost of the units used, as there has been for some time an increase of 10 per cent. upon the pre-war rate. Whatever economy is effected in the consumption of current and gas by the introduction of the Daylight Saving measure will not, therefore, be to the advantage of the consumer, who will, under the increased rate, have to pay much the same for illumination as in corresponding periods before the Act came into force.

THE Standing Committee on Engineering appointed by the Advisory Council for Scientific and Industrial Research held its first meeting on Wednesday, June 7. The Committee has been so constituted as to represent both the scientific and the industrial sides of engineering, and includes the following members nominated by the professional associations:—Institution of Civil Engineers, Sir Maurice Fitzmaurice; Institution of Electrical Engineers, Mr. J. S. Highfield; Institution of Mechanical Engineers, Dr. Dugald Clerk; Institution of Naval Architects, Sir Archibald Denny, Bart.; N.E. Coast Institution of Engineers and Shipbuilders, Mr. Herbert Rowell; Manchester Association of Engineers, Mr. Alfred Saxon; Institution of Engineers and Shipbuilders in Scotland, Mr. James Brown; and the following members appointed directly by the Advisory Council:—Mr. F. R. Davenport, Mr. Alfred Herbert, Prof. Bertram Hopkinson, F.R.S., Mr.

C. H. Merz, Mr. V. L. Raven, Mr. A. A. Remington, Mr. G. Gerald Stoney, F.R.S., Mr. Douglas Vickers, Prof. Miles Walker. The Advisory Council has appointed Sir Maurice Fitzmaurice to be chairman of the Committee.

THE formation by the Advisory Council for Scientific and Industrial Research of a Standing Committee on Mining, constituted so as to represent both the scientific and industrial sides, has now been completed. The Standing Committee includes the following members nominated by professional associations:—Institution of Mining Engineers: Sir William Garforth, Dr. John Haldane, Dr. R. T. Moore, Mr. Wallace Thorneycroft; Institution of Mining and Metallurgy: Mr. Edward Hooper, Mr. Edgar Taylor; Iron and Steel Institute: Prof. H. Louis; the South Wales Institute of Engineers: Mr. W. Gascoyne Dalziel; and the following members appointed directly by the Advisory Council:—Sir Hugh Bell, Bart., Mr. Hugh Bramwell, Lieut.-Col. W. C. Blackett, Prof. Cadman, Prof. Frecheville, Mr. Bedford McNeill, Mr. Hugh F. Marriott, Sir Boverton Redwood, Bart., Mr. C. E. Rhodes. The Advisory Council has appointed Sir William Garforth to be chairman. The Committee is divided into two sections, as follows:—*Section on the Mining of Iron, Coal, and Hydrocarbons*: Sir William Garforth (chairman), Sir Hugh Bell, Bart., Mr. Hugh Bramwell, Lieut.-Col. W. C. Blackett, Prof. Cadman, Mr. W. Gascoyne Dalziel, Dr. John Haldane, Prof. Louis, Dr. R. T. Moore, Sir Boverton Redwood, Bart., Mr. C. E. Rhodes, Mr. Wallace Thorneycroft. *Section on the Mining of Minerals other than Iron, Coal, and Hydrocarbons*: Mr. Edgar Taylor (chairman), Sir Hugh Bell, Bart., Prof. Frecheville, Mr. Edward Hooper, Prof. Louis, Mr. Bedford McNeill, Mr. Hugh Marriott.

GENERAL JOSEPH SIMON GALLIENI, whose death was recently announced at the age of sixty-seven, had achieved fame, not only as a soldier, but as an explorer and colonial administrator. In 1880 he ascended the Senegal and explored the course of its two principal tributaries, the Ba-Khoy and the Ba-Fing, and the hitherto unknown regions between the Senegal and the Niger, and then descended the Niger to Segu Sikovo. Seven years later he was again exploring in the same region, and his work had much to do with the extension of French influence in the western Sudan and Timbuctu. In 1892 Colonel Gallieni was sent to Tongking, and combined much topographical work with his arduous military duties. But perhaps the most difficult task he ever undertook, and the one in which he was most successful, was his governorship of Madagascar. In nine years he rescued that island from a state of chaos and turned it into a possession worthy of France. Roads and a railway were built, agriculture put on a firm basis, mining was developed, and education taken in hand—to mention but a few of General Gallieni's works. Lastly, a detailed survey of Madagascar was commenced. General Gallieni distinguished himself in the Franco-German war of 1870, and in the present war was entrusted in September, 1914, with the defence of Paris at a time when the enemy's forces were advancing. This task General Gallieni was happily spared by the repulse of the enemy at the Marne.

A SUMMARY of the weather for the spring season for the several districts of the United Kingdom, collated by the Meteorological Office from the weekly returns for March, April, and May, shows that beyond an excessive amount of rain the conditions were fairly normal in spite of the fickle character of the weather. The mean temperature was below the normal in all districts except the north-east and east of England, but the deficiency was small, except in Ireland, where it amounted to nearly 2° F. Rainfall was in excess of the average, except in the north of Scotland, where the deficiency was only 0·04 in. The most abnormal rainfall was 153 per cent. of the average in the east of Scotland. Sunshine was deficient over the entire kingdom. Summer has commenced with exceptionally cold weather over the whole of the British Isles. The London reporting station of the Meteorological Office at South Kensington has no day temperature higher than 65° from June 1 to 16, the mean of the maximum readings for the period being 59·5°, which is the normal for the middle of April or October. It is 6° lower than the average of the day temperature in May last, and is only 1° warmer than the average maximum for last April. Several days have been colder than on some days in January last. The Greenwich records only show one colder June day in the last seventy-five years than June 12 this year, when the thermometer did not exceed 50°, the exception occurring on June 19, 1903. Only three Junes in the last seventy-five years have failed to record a London temperature of 70° in the first sixteen days; the exceptions are 1909, maximum 68°; 1860, maximum 67°; and 1843, maximum 69·9°.

THE Executive Council appointed for the purpose of carrying on the management of the Imperial Institute under the Secretary of State for the Colonies has been constituted as follows, the members being appointed by the Departments, Ministers, and Governments named:—*Board of Trade*: Sir W. H. Clark, K.C.S.I., Mr. H. Fountain. *Secretary of State for India*: Sir J. P. Hewett, Mr. L. J. Kershaw. *President of the Board of Agriculture and Fisheries*: Sir Sydney Olivier, K.C.M.G. *Government of India*: Sir R. W. Carlyle, K.C.S.I. *Government of the Dominion of Canada*: Sir G. H. Perley, K.C.M.G. *Government of the Commonwealth of Australia*: Mr. Andrew Fisher, High Commissioner for Australia. *Government of the Union of South Africa*: Mr. Philip Schreiner, High Commissioner for South Africa. *Government of the Dominion of New Zealand*: Sir T. Mackenzie, K.C.M.G., High Commissioner for New Zealand. *Secretary of State for the Colonies*: Lord Emmott, Director, War Trade Department; Lord Islington, Parliamentary Under-Secretary for India; Lord Scarbrough, chairman, the Niger Co., Ltd.; Lord Burnham; Sir Algernon Firth, president, Association of Chambers of Commerce of United Kingdom; Sir Owen Philipps, K.C.M.G.; Sir W. Taylor, K.C.M.G., formerly Resident-General, Malay States; Sir M. F. Reid, chairman, Bombay Chamber of Commerce (on the recommendation of Secretary of State for India); Prof. W. R. Dunstan, director, Imperial Institute; Mr. R. Threlfall, formerly professor of physics in the University of Sydney, N.S.W.; Mr. R. M. Kindersly, director, Bank of England; Mr. D. O. Malcolm, director, British South Africa Company; Mr. G. E. A. Grindle, Colonial Office; Mr. T. C. Macnaghten, Colonial Office. The Government of Newfoundland will shortly appoint a representative on the Executive Council.

IN the *Psychological Review* (vol. xxiii., No. 3) Mr. S. Bent Russell, in an article on "The Effect of High Resistance in Common Nerve Paths," discusses the means by which he thinks complex forms of behaviour may be interpreted in terms of nervous mechanisms, such as are generally admitted for the simpler forms of behaviour. His theory depends upon the assumption of the synapses, *i.e.* junctions or points of contact between neurons, as centres of resistance to the

nervous impulse, and is an attempt to make more concrete the way in which competing paths may operate. He shows how a synapse mechanism, *i.e.* a system of interrelated neurons connected with other systems similarly constructed, by the varying degrees of resistance at their junction may serve for the selective distribution of impulses, and for the linking of one impression with another in the formation of habits.

THE new volume of the *Anales* of the National Museum of Natural History of Buenos Aires (vol. xxvii., for 1915) contains a very varied series of contributions to our knowledge of the natural history of the Argentine Republic. Beginning with some observations on ants, by the director of the museum, Dr. A. Gallardo, it comprises several technical papers on entomology and botany, and deals with many other subjects, ranging from old maps of the River Plate and drawings of the fabulous beast known as the "succarath," to a detailed petrographical account of some granitic rocks. The exploration of a sepulchral cave on the coast of Chubut leads Dr. F. F. Outes to conclude that during the sixteenth and seventeenth centuries the Patagonians possessed only the bow and arrow as a weapon; that in the first third of the eighteenth century they began to use the imported horse, and then first employed the bolas. Photographs of well-preserved portions of three arrows, or javelins, provided with a stone tip, are given.

IN the Journal of the South African Ornithologists' Union for December, which has just reached us, Mr. C. F. M. Swynnerton gives a long account of his experiments with captive birds in regard to their choice of insect food. For the most part his experiments were made with butterflies and moths and their caterpillars, though wasps, beetles, and other insects were also used. The Lepidoptera included both the protectively coloured, edible species and the warningly coloured, nauseous species. He finds that birds will readily eat even the most nauseous forms if they are hungry, but their readiness to accept these, and their ability to retain them when swallowed, decrease rapidly as hunger is satisfied. Thus the warningly coloured species derive benefit from their coloration only when their avian enemies can afford to pass them by. Even those birds with the smallest capacity for eating nauseous insects are able to eat one or two with apparent impunity, and even eagerness, when their stomachs are empty and the appetite is good. A bird with a rapid digestion is able to go on eating the most nauseous insects indefinitely, with frequent short intervals for assimilation, provided that no more tempting insects are within reach to carry the filling of the stomach well beyond the point at which such nauseous morsels are usually refused. Discrimination between edible and nauseating forms, the author contends, comes by experience only, and not instinctively.

IN the *Kew Bulletin*, No. 3, ten new exotic fungi are described by Miss E. M. Wakefield. *Polyporus shoreae*, a serious disease of Sal (*Shorea robusta*), is illustrated by a photograph showing the large sporophore at the base of a tree-trunk in Bengal. *Cordyceps peltata*, a species parasitic on the larvæ of a Cryptorhynchus, which infests cultivated Codiæums in St. Vincent, differs from all other species in the very large spores, which, instead of breaking apart at every septum at maturity, only separate at the middle into two narrowly wedge-shaped halves. The description of the fungus is illustrated by text figures.

IN the *Journal of Botany* for April Dr. W. Botting Hemsley contributes a paper on the flora of the Seychelles and Aldabra, giving descriptions of new flowering plants collected mainly during Prof. J. Stanley Gardiner's Percy Sladen Trust Expedition in 1905. Fifteen new species are described in the present contribution, which includes the Rubiaceæ and the description of a new Impatiens drawn up in 1910 by the late Sir J. D. Hooker. Some emendations in synonymy are also made. In a short introduction Dr. Hemsley gives an account of the botanical collections made in the Seychelles since 1901, when the flora of the islands was being critically studied by the author.

A SUBJECT of considerable importance to officers is most clearly and simply treated by Mr. E. A. Reeves in a paper on "Night Marching by Stars" in the *Geographical Journal* for June (vol. xlvii., No 6.). A good deal has recently been published on the subject, but no one perhaps has to such an extent the happy way of Mr. Reeves of putting technicalities in simple language. This paper, based on a lecture delivered at the Royal Geographical Society, deals both with the methods of finding the bearings of stars at any time and the more practical issue of using these bearings in marching.

AN important paper in Swedish by V. Tanner, occupying more than 800 pages, describes the development and retreat of the continental ice in Finnish and Scandinavian Lapland (*Bull. de la Comm. géol. de Finlande*, No. 38, 1915). A good *résumé* in French is given. Numerous eskers have been examined, and the author points out that several of these have suffered since their formation from fluvioglacial erosion and deposition. He takes the view, now common, that the eskers arose in tunnels in or under the ice-sheet, the eskers with "centra," described by De Geer, from the Stockholm district being special cases of formation where the ice-front abutted upon a lake or sea. The author wishes to reserve judgment as to whether centra in the eskers of Lapland have been produced in the same manner. Good illustrations are given of the gorges cut by glacial waters during the epoch of ice-recession. The work represents field-observations, extending over several years, in a country sparsely inhabited, difficult to traverse, and of singular monotony from the scenic point of view. The glacial map forming plate i., which unfortunately has no place-names, sufficiently attests the author's industry, covering an area of 350,000 sq. kilometres, or some 135,000 sq. miles, between latitude 66° 30′ N. and the desolate tundras that bound the Arctic seas.

WE have received *Revista de la Academia de Ciencias*, etc. (vol. i., No. 1, May, 1916; Zaragoza), and "La Ciencia, La Universidad, y La Academia," the latter being an inaugural address by Dr. Zoel G. de Galdeano. Their principal interest is that they show that Spain is beginning to appreciate the value of the exact sciences.

As supplementing the information given in the note on the "Mineral Resources of Great Britain," vol. v., which appeared in NATURE of June 15 (p. 327), reference may be made to the account of the occurrences of molybdenum ores throughout the world which appeared in the Bulletin of the Imperial Institute, No. 2 of 1908. The information then published was brought up to date by a special circular, issued by the Imperial Institute in 1915, dealing with occurrences of molybdenite in the British Empire, which are either commercially productive or afford promise of becoming so. The collection and publication of information respecting the occurrence of economic minerals in the Colonies and India has for some years been a prominent part of the operations of the Imperial Institute.

IN an address to the American Institute of Electrical Engineers, which is reproduced in the April number of the Journal of the Franklin Institute, Mr. J. D. Ball, of the General Electric Company, Schenectady, gave a *résumé* of the results obtained by him in his recent examination of the magnetic properties of steels and other materials. He finds that for pure materials the reluctivity when plotted against magnetising force H gives a straight line from H = 10 to 400, and that the hysteresis loss per cycle for such materials varies as the 1·6th power of the maximum induction. The deviations from these laws which have been found by other observers are due, he finds, to the use of impure or mixed materials. A mixture of two materials which follow both laws follows neither at high fields. In the case of steels the presence of scale on the surface is sufficient to account for the observed deviations from the two laws. The paper contains a number of tables and curves showing the magnetic properties of steel, cast-iron, and scale.

SMOKERS have hitherto been implored—or compelled through heavier taxation—to practise war economy by avoiding, or at least restricting their use of, tobacco. Now it seems that were one of the products of their indulgence to be collected they would become national benefactors in disguise. In an article in the *Chemical News* for June 2 Mr. B. A. Burrell points out that tobacco ash contains 20 per cent. of potash. A cigar, cigarette, and pipe of tobacco of ordinary sizes, weighing severally 106·5, 27, and 25·5 grains, will give ash containing respectively 6·5, 1·75, and 1·60 grains of potash. (We think that there must be some mistake in Mr. Burrell's figures, since in our experience ordinary cigarettes weigh eighteen to twenty to the ounce, whilst it is difficult to obtain more than fourteen "pipes" from an ounce of tobacco.) As regards the possibility of recovering this waste potash, Mr. Burrell found that from the smoke-room of a club 9¾ oz. of ash and unburnt tobacco could be collected in eight days; from the lounge of a large hotel 13 oz. in four days; from a large restaurant 2½ lb. in ten days, and from a music-hall (one-tenth part of the auditorium) 4 oz. after one performance. The tobacco consumed in the United Kingdom for the year ending March 31, 1914, would give approximately 13,359 tons of ash, containing 2672 tons of potash, which, at the pre-war price of kainit, would be worth nearly 51,000*l*.

IN a paper read before the Federated Malay States Chamber of Mines in March last, Mr. J. B. Scrivener, geologist, discusses the situation in the peninsula created by the increased demand for tungsten. The peninsula is one of the chief world sources of this metal, which nearly always occurs in the form of wolfram—a mixed iron and manganese tungstate—contaminated with tin-stone. To get new supplies Mr. Scrivener concludes that two courses are open. The first is to encourage prospecting in new land and to do everything to encourage the Chinese miners going into the less known parts of the granite ranges. It is anticipated that it is unlikely that large quantities of pure tungsten ores will be found, but that mixed wolfram and tin-stone areas will be discovered. The second course is to improve the facilities for the magnetic treatment of this mixture with the separation of the wolfram. For this at present only two plants exist, and much wolfram contaminated with tin ore is lying idle because of the expense of sending it for treatment. Scheelite (calcium tungstate), which cannot be magnetically purified, is in a different category. It is certainly to be hoped that the Government will do all in its power to encourage the output of a metal the usefulness of which, both for war and peace purposes, is increasing every year.

THE *Revue générale des Sciences* for May 15 contains an article by M. Zach in which he gives formulæ for the strength of flat rectangular plates encastré at the edges, and subjected to uniform pressure p. These formulæ are based on experiments made by Bach, and by the Naval Departments in Germany and the United States of America. The maximum bending moment occurs at the middle of the long edge of the plate, and is $\frac{pa^2}{12}$ if the ratio of breadth a to length b is greater than 1 : 3. The bending moment at the centre of the plate has a value less than half of this. For other ratios of $a : b$, the bending moments at the middle of the long edge and short edge respectively are $K_A\frac{pa^2}{12}$ and $K_B\frac{pb^2}{12}$, where K_A and K_B are factors having the following values :—

$a : b$	1 : 2·5	1 : 2	1 : 1·8	1 : 1·6	1 : 1·4	1 : 1·2	1 : 1
K_A	0·99	0·96	0·94	0·91	0·86	0·79	0·64
K_B	0·03	0·06	0·09	0·14	0·22	0·38	0·64

At the corners of the plate the bending moment reverses in sign. The subject is of considerable importance in connection with the design of bulkheads, and we believe that the results of other experiments which have been made in this country will be available shortly.

UNDER the title, "A Scheme for the Promotion of Scientific Research," a suggestive little volume by Mr. W. B. Priest was published by Messrs. Stevens and Sons, Ltd., Chancery Lane, London, E.C., in 1908 (see NATURE, January 21, 1909, vol. lxxix., p. 345). The scheme is based on the Patent Acts, and, according to it, any person who had made a scientific discovery of a prescribed description could apply for a grant of money, the application being accompanied by a specification of the discovery. The formation of the Committee of the Privy Council for Scientific and Industrial Research has led Mr. Priest to adapt his scheme to the work of this Committee; and he has sent us a copy of a communication made by him to the Advisory Council upon the matter. One of the chief difficulties which the Council has to meet is that industrial firms are unwilling to make known valuable results of researches in their works without adequate safeguards for the protection of their interests. Mr. Priest shows in detail how his scheme may be used for this purpose, and we have no doubt it will receive careful consideration from the Advisory Council.

OUR ASTRONOMICAL COLUMN.

THE SOLAR ACTIVITY.—The large spot group (NATURE, June 8) is again visible, and can be easily seen with binoculars screened with smoked glass.

COMET 1916*a* (NEUJMIN).—A possible connection between this comet and Encke's comet has been traced by H. Svoboda. A comparison of their orbit elements indicates that Neujmin's comet originated in the path of Encke's comet, possibly by a partition of the latter.

THE SHOWER OF PERSEID METEORS.—There is evidence that the Perseids begin to appear during the last week in June, and that the whole duration of the shower extends over ten weeks.

This year there will be a favourable opportunity for making observations, the moon being only slightly in evidence between June 25 and July 7. If any streaking meteors are seen during this interval directed from the region of Andromeda, near the stars 37 and

theta, they should be carefully recorded. Duplicate observations of the same meteors will be very valuable, and will probably supply the data from which the question of duration may be finally answered. The computed place of the radiant is as follows:—

June 25	...	358°+33°	July 1	...	2°+39°
26	...	358°+34°	2	...	3°+40°
27	...	359°+35°	3	...	3°+41°
28	...	0°+36°	4	...	4°+42°
29	...	0°+37°	5	...	5°+43°
30	...	1°+38°	6	...	6°+44°

SELENIUM PHOTOMETRY.—Prof. J. Stebbins describes his important work in connection with the employment of selenium bridges in astronomical photometry in the current number of the *Observatory*. This doubtless forms a completed chapter in the story of the electrical measurement of radiation, since Prof. Stebbins has for some time directed his attention to the later photo-electrical methods (NATURE, May 4). It may be remarked that there is a somewhat misleading reference to Prof. Minchin's work in the brief historical statement, as the "*cell*," properly so called, devised by him was based on a quite different principle from that of the bridges used by Prof. Stebbins. Moreover, the first essays in the application of Prof. Minchin's selenium cell to stellar photometry were made by Mr. Monck and Prof. Fitzgerald in 1892, at Dublin. Afterwards Prof. Minchin greatly increased the efficiency of his apparatus, and himself made measures of stellar radiation in 1895 at Daramona.

THE CHEMICAL ORIGIN OF SOLAR RADIATION.—This question is discussed by Dr. Briner in the *Revue générale des Sciences*, No. 9. The adequacy of purely mechanical processes to account for the vast out-turn of solar energy became seriously questioned after the discovery of radium. Later, spectroscopic evidence pointed to the existence of chemical compounds in the sun's atmosphere, and additional hypotheses were advanced. Dr. Briner agrees with Arrhenius regarding the inefficiency of radio-active changes, but shows that both endothermic and exothermic reactions involving either elementary or compound substances are likewise insufficient. Dr. Briner then proceeds to consider the thermo-chemical aspects of Sir Norman Lockyer's dissociation hypothesis, and concludes that if the interior of the sun is largely made up of matter in a proto-atomic state, it would constitute a respectable reservoir of energy capable of supplying a considerable portion of the solar radiation by the successive associations, resulting ultimately in the formation of the chemical elements.

THE SOUTH-EASTERN UNION OF SCIENTIFIC SOCIETIES.

THE South-Eastern Union of Scientific Societies held its twenty-first annual congress at Tunbridge Wells on May 24–27, with the Rev. T. R. R. Stebbing in the presidential chair. Mr. Stebbing was president of the first congress held in the same town in 1896. Dr. Geo. Abbott, who was the chief founder of the union, was also present, and read a paper on "Some Remarkable Resemblances of Inorganic Formations to Organic." The president's address, which was, as he said, full of "thoughts that burn," took the unusual form of a comparison of Biblical records with scientific truth. Considerable feeling was elicited in discussion, and a proposal that the address should not be printed was defeated overwhelmingly. Mr. H. R. Knipe, in giving a paper on some extinct animals, showed a series of new slides made from remarkably lifelike drawings by Miss Alice M. Woodward. Dr. Keeble's paper on "Prehistoric Man" was illustrated by models of a lake-village, beehive Neolithic huts, etc., thus introducing an excellent method of educating an audience into the mysteries of human ancestry. Dr. P. Chalmers Mitchell lectured on the "Youth of Animals," and Mr. A. Archibald gave a valuable paper on the "Coinages and Mints of the South-Eastern District," illustrated by the asphingoscope.

In speaking on "Some Rarer British Birds," Miss E. L. Turner spoke of the reeve having been known to nest in England in 1907, and previously in 1897 and 1830, although now it is merely a migrant. Wholesale "egging," and the reclamation of land, were the causes of the extinction of the bittern in our country. The "boom" of the bittern was heard by a watcher in July, 1911, and by careful tracking the bird was found to be actually breeding. Miss Turner referred to the great crested grebe as a species which has largely benefited by the Bird Protection Acts. The curiously furtive habits of the water-rail were illustrated by a fine series of photographs, its shy habits making it a difficult bird to approach. Miss Turner undoubtedly scored a triumph when she found a pair of cormorants breeding in a disused heron's nest in Norfolk in July, 1914. This was the more remarkable in that there has been no record of nesting since 1825, and that in Suffolk. For upwards of 200 years Norfolk had lost the cormorant as a nesting bird. Sir T. Browne states that it built at Needham "upon trees, from where King Charles I. was wont to bee supplyed" ("MS. Notes and Letters, 1605–82," printed by T. Southwell, 1902). The nest which Miss Turner observed could only be reached by a 40-ft. ladder, and at this distance above the ground she exposed more than one hundred negatives. Some of these showed the playfulness of the young cormorants, and the insight gained into the habits of the nestlings is invaluable.

In a lecture by Prof. H. H. Turner, on "The Discovery of Oxygen in the Stars," the various steps by which the knowledge of this occurrence has been obtained were described. A paper which may prove of great educational importance was given in "Kosmos" Cinema Theatre by Dr. W. Martin on "The Educational Importance of the Cinema." It was pointed out how valuable a means of education is being lost in the neglect of this invention, and it was especially emphasised that by leaving picture-palaces severely alone the better classes were tending to allow the degradation of the type of film-pictures which are shown in them.

The congress met in very fine weather, and the excursions that were arranged met with success. Mention should be made of the visit to Lawson Wood's half-timbered house at Groombridge, which was removed from Udimore, near Winchelsea, where it was threatened with demolition. The remains of this fine old fourteenth-century court-house were thus saved from being treated as firewood.

BRITISH GEOLOGICAL SOCIETIES.

THE deep attraction which the study of the earth possesses for dwellers in our islands is shown by the existence of local geological societies, in addition to the numerous bodies devoted to natural history. While to many workers "the Geological Society" means that founded in London in 1807, and worthily commemorated in the "History" written by the late H. B. Woodward, we must remember that associations with similar objects exist in Edinburgh, Glasgow, Manchester, and Liverpool. The Geological Society of Dublin issued its first publication in 1838,

and its last in 1889, after it had become the Royal Geological Society of Ireland. There is no doubt that a knowledge of the aims of geology was more generally diffused in Ireland during the fifty years of its existence than is the case at the present day. Though the publication of researches outside London is naturally regretted by dwellers in the capital, a proper system of exchange and distribution after all renders reference easy. The index of geological literature, published annually by the Geological Society of London, now makes the place of publication unimportant. The recognition of other cities as centres of research requires a certain magnanimity, but is in itself a stimulus to cultured minds throughout the country. The claims, moreover, on the resources of metropolitan societies enable the publications of smaller bodies to compete successfully as regards style of issue and illustration.

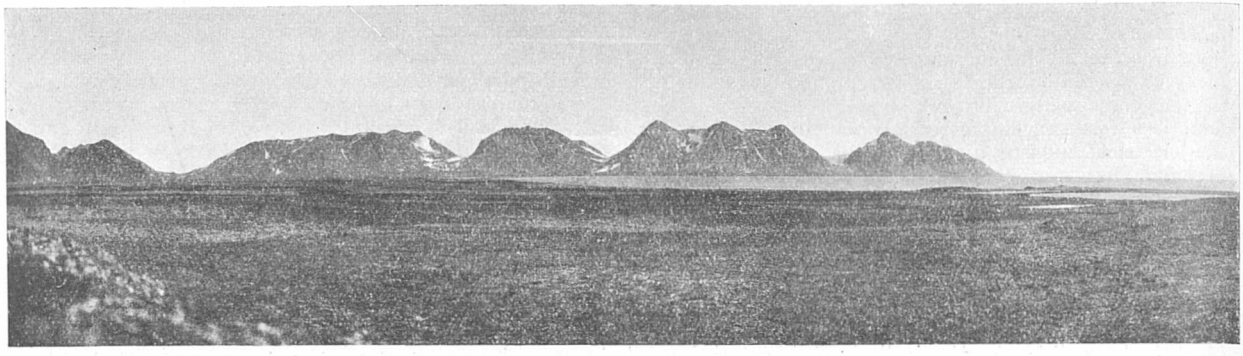

FIG. 1.—West coast of Prince Charles Foreland, showing the dissected "Backbone Ridge" and the coastal platform with raised beaches and lagoons. From the Transactions of the Edinburgh Geological Society.

The Edinburgh Geological Society has just published part 3 of volume x. of its Transactions. It contains a noteworthy and beautifully illustrated paper on the incorporation of dolomite in an intrusive basaltic sill at Gullane, near North Berwick, by T. Cuthbert Day, who also traces similarly intimate associations of igneous rock and sediments at Weak Law, where the composite mass resembles a fault-breccia or a conglomerate. Mrs. Wallace describes volcanic rocks from the necks along the coast of Fife, and points out the frequent occurrence of analcite. An international character is given to the Transactions by a paper by R. M. Craig on Prince Charles Foreland, Spitsbergen, the peaks of which are so conspicuous from the entrance to the Ice Fjord. A. McEwen Peach follows with an account of the pre-Glacial platform and raised beaches of the island (Fig. 1). The platform has the same relation to the submerged valleys as that discovered by Maufe and Wright in southern Ireland.

The Geological Society of Glasgow, in part 3 of vol. xv. of its Transactions (1916), devotes itself to the basin of the Clyde. Prof. J. W. Gregory (p. 310) regards the hanging valleys on the walls of Loch Long as pre-Glacial in origin. W. R. Smellie describes in detail the igneous rocks of Bute, after a field-survey of the island (Fig. 2). P. Macnair correlates the Lower Carboniferous limestones of North Lanarkshire with those farther to the south, in a paper that reveals characteristically patient research in river-banks and quarries.

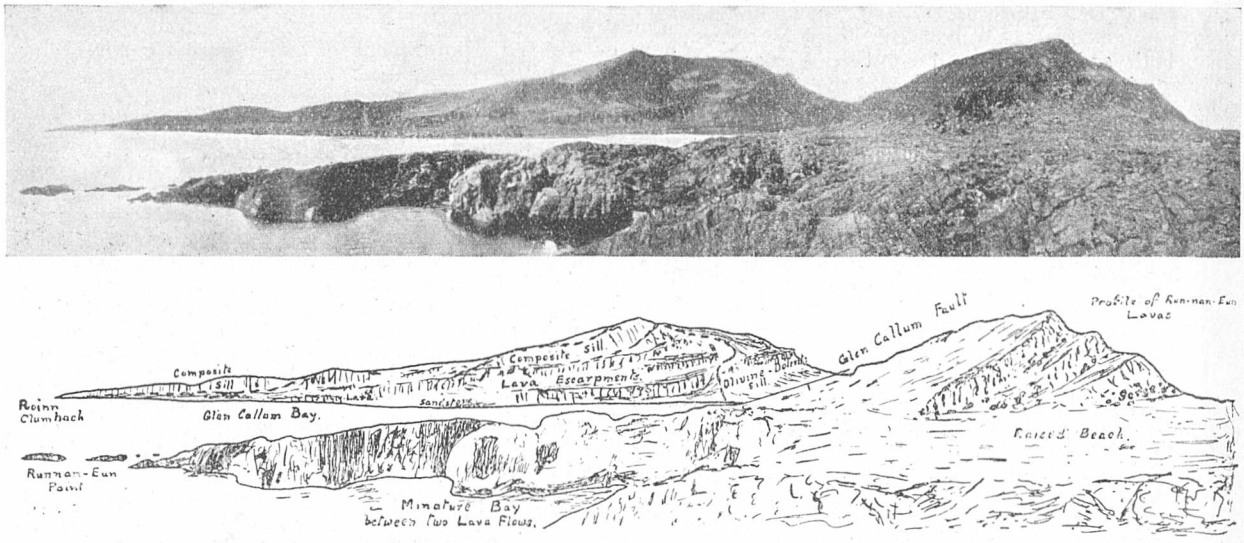

FIG. 2.—Panorama of South Bute, showing escarpments of lava uptilted towards the right, and a raised beach in the foreground. From the Transactions of the Geological Society of Glasgow.

The Liverpool Geological Society continues to investigate the Triassic strata of the district. In part 2 of vol. xii. of the Proceedings (1915), this work is represented by F. T. Maidwell, H. W. Greenwood, and C. B. Travis. There is an interesting reference in a paper by the two latter authors to "boulders of strontium" in the Keuper Marls of Bristol. These are pre-

sumably celestine, like the well-known examples from Aust, which were mentioned by Wm. Phillips as far back as 1816. H. Bolton and C. J. Waterfall have described the occurrence at Abbots Leigh as "strontia." Messrs. Greenwood and Travis indicate the presence of secondary, as well as primary, rutile in the Triassic rocks of Wirral. The former author, in a paper on the paragenesis of marcasite, wurtzite, and calcite at Halkyn Mountain, North Wales, concludes that, while the two former minerals arise from acid solutions (see NATURE, vol. xciv., p. 430), a higher temperature or a greater concentration of acid is required for the production of wurtzite than is required for marcasite. In the Halkyn case the acid present was the carbonic acid that simultaneously gave rise to calcite. Zinc-blende here predominates largely over wurtzite, while more than 90 per cent. of the iron disulphide is present in the form of marcasite.

The same society also issues a part entitled the Cope Memorial Volume, presented to geologists in this form by the generosity of Mrs. T. H. Cope, and embodying the researches of her late husband on the igneous rocks of the Berwyn Hills. G. A. J. C.

THE "RUSSIAN ZOOLOGICAL REVIEW."

WE have received the first number of a new Russian journal, of which the French title is given as *Revue Zoologique Russe*. It is published at Moscow, under the editorship of Prof. A. N. Sewertzoff and W. S. Elpatiewsky, of the Moscow University. The intention of the editors is to publish preliminary notes and short articles on zoology, comparative anatomy, histology, and embryology, together with abstracts, personalia, and a zoological bibliography. The text is to be either in Russian with a French or English *résumé*, or in French or English with a Russian *résumé*.

The contents of this first number show that the editors aim at a high standard of work. One of the most interesting contributions is an account of some important experiments by D. Filatoff on the removal and transplantation of the auditory vesicle of the embryo toad. It has been known for some years that the optic vesicle of certain embryos can be transplanted, and that the presence of such transplanted vesicles determines the development of a lens from the epiblast in abnormal situations. M. Filatoff claims to have established analogous facts with regard to the auditory vesicles. He maintains that the presence of the auditory vesicle, even in an abnormal situation, determines the formation of a cartilaginous auditory capsule from the surrounding mesenchyme cells, which would not normally give rise to such a structure. Unfortunately for English readers, the original article is published in Russian, and the English abstract is scarcely detailed enough to afford convincing proof that the author has established his point with regard to the development of the auditory capsule. That an auditory capsule does actually develop around the transplanted vesicle there seems to be no doubt, but, as the author himself suggests, it seems to be possible that it may develop from mesenchyme cells transplanted with the auditory vesicle, and this is the point which we should like to see more satisfactorily cleared up, though we agree that the probabilities are in favour of the contention that it arises from the surrounding mesenchyme of the new locus.

We regret to note in this article the oft-repeated use of the German word "Anlage," which seems to have established itself permanently as an essential part of embryological terminology. Why it should have done so we have never been able to understand, for the term "rudiment" seems to meet all requirements in a perfectly satisfactory manner. It is true that this term used to be very loosely employed by English writers, and was at one time very generally applied to disappearing structures. The much more appropriate term "vestige" has, however, now been very generally accepted for structures belonging to the latter category, and all possible objection to the use of the term "rudiment" for the first recognisable indication of a developing organ seems to have disappeared. Not long ago it was customary on the part of certain English zoologists to use the German term "Haus" for the enveloping test of certain Ascidians. The inappropriateness of the English word "house" was perhaps recognised by these writers, but did it really improve matters very much to adopt the German form of the same word? Even since the commencement of the war we have seen, in a newspaper, the term "under-sea boat"—an obvious adoption from the German—used in place of our own "submarine." It is little wonder, when we show ourselves so slavishly dependent upon German phraseology, that the impression should have been created that in scientific matters our German antagonists are a long way ahead of us.

This digression, however, has taken us a long way from the *Revue Zoologique Russe*, to which we wish to extend a hearty welcome, and our best wishes for a long and useful career. It says much for the confidence and sanity of our great Allies that they are able at such a time as this to devote their attention to researches in pure science and even to find funds for the publication of new journals. They have set an example which those of us who are unable to take any active share in the prosecution of the war need not be ashamed to follow. A. D.

THE WATER SUPPLY OF MELBOURNE.

RECENT issues of the *Engineer* (April 7 and May 5) contain an extremely interesting *résumé* of the inception and gradual development of the water supply system of the city of Melbourne. As is customary in the case of primitive settlements, the earliest supplies were derived from the local river, the Yarra, and until about the middle of last century this simple, although scarcely altogether satisfactory, expedient sufficed for the needs of the inhabitants. In 1853, the first steps were taken to secure a more trustworthy and less contaminated supply from the watershed at Mount Disappointment. This was achieved by the formation of an embankment at Yan Yean. The undertaking, which was completed in 1857, at a cost of 754,206*l*., was considered to be capable of providing a population of 200,000 with water at the rate of 30 gallons per head per day; as a matter of fact, it considerably exceeded this expectation. The dam, which was of earth, was 30 ft. in height, and formed a lake of 1360 acres, with a water capacity of 6400 million gallons, of which 5400 million gallons were available for consumption.

By the year 1879 it became evident that additional gathering ground was necessary to meet the demands of a population now grown to 256,000, with a consumption of 80 to 90 gallons per head per day. After some search, a suitable extension of the existing system was devised to Wallaby Creek, on the north side of Mount Disappointment. The Wallaby Aqueduct was constructed in 1883, 5½ miles long, with a carrying capacity of 33 million gallons, together with the Toorourrong Reservoir, holding up 60 million gallons of water, and forming a lake of 36 acres surface.

The city continued to expand, and, in process of time, the Yan Yean system was fully exploited and

incapable of further development. In anticipation of this exhaustion, in 1880, a scheme had been prepared for tapping the Watts River, the average daily flow of which was estimated at 42 million gallons. The execution of the project was, however, delayed, and it was not until 1891 that water from this source was actually turned on, when the name of the system, as well as of the river itself, was changed into Maroondah. The aqueduct is 41 miles long, with 25½ miles of open channel and twelve tunnels (three over a mile in length). The total cost of the Maroondah system amounted to 778,944*l*.

By 1907 the population had increased to 536,540, and still further sources of supply were found necessary. In 1910, powers were granted to incorporate the O'Shannassy and Upper Yarra watersheds, and by 1914 a supply of 20 million gallons per day was being obtained from the former river by means of an aqueduct 48¾ miles in length. The Upper Yarra supplies remain to be exploited at some future date. The amount spent so far on the O'Shannassy scheme has been 426,890*l*.

THE MECHANISM OF CHEMICAL CHANGE IN LIVING ORGANISMS.[1]

IF we take a general view over the large field of chemical reactions known, we notice that there is a great variety in the *rate* at which these reactions take place. Some, and especially those in which electrical forces play a part, reactions between inorganic ions, are practically instantaneous. They are familiar to all in the precipitations of the analytical chemist. Others, such as the hydrolysis of cane-sugar by water, are so slow as to be incapable of detection at ordinary temperatures, unless a very long time is allowed. There are, moreover, all possible stages intermediate between these extremes. Reactions between carbon compounds are, generally speaking, comparatively slow; but, as the name "organic" indicates, they are the characteristic chemical changes of the living cell.

Early workers in the domain of physiological chemistry—Schönbein, for example—were struck by the fact that reactions which require, in the laboratory, powerful reagents, such as strong acids and high temperatures, to make them take place at a reasonable rate, occur rapidly in the living organism at moderate temperatures and in the presence of extremely weak acids or alkalis. I may refer to the decomposition of proteins into their constituent amino-acids, which is a part of the normal process of digestion, but, when ordinary laboratory methods are used, requires boiling for several hours with concentrated hydrochloric or sulphuric acid.

The problem before us, then, is to discover how a slow reaction can be made to go faster. The most obvious and well-known method of doing this is by raising the temperature; but this is clearly out of the question in living cells. Another possibility is to make use of mass action, increasing by some means the effective concentration of the reacting substances; in this way the number of contacts per unit time would be raised. This is possible in the cell. There remains a third, the formation of an intermediate compound with another substance. This compound may be supposed to be both formed and again decomposed at a rapid rate, so that the total time taken is much less than that of the original reaction.

Now it is evident that something of the kind contemplated by these two latter possibilities is at the bottom of the process called "catalysis" by Berzelius. This chemist directed attention to the numerous cases known, even at his time, where the presence of a third substance brings about an enormous acceleration of a reaction, without itself taking part in it, so far as appears at first sight; at all events, this third substance reappears at the end unchanged. An example is the effect of finely divided platinum on hydrogen peroxide. Similar phenomena were known to Faraday, and described by him about the same time, but without giving them a special name.

Agents of this kind were soon discovered to be present in living cells. Such catalysts are called, for convenience, "enzymes," as suggested by Kühne, although there is no real scientific necessity for the name. That of "ferments" is still sometimes used, and is not now liable, as it was in Kühne's time, to cause confusion by application to living microbes.

Since catalysts are, as a rule, found unchanged at the end of their work, it is clear that they do not themselves afford energy for the purpose. Indeed, the energy change of a catalysed homogeneous system is the same as that of the reaction when proceeding at its ordinary slow rate. How, then, do they act?

The first thing to note with respect to enzymes is that they are capable of activity in media in which they are insoluble. Whatever may be the nature of this activity, therefore, it is exerted by the surface of the catalyst. We may then reasonably ask, as the most obvious hypothesis, is there ground for holding that the increased rate of reactions brought about by enzymes is effected by increase of concentration of the reagents at the surface and consequent acceleration of the reaction by mass action? We know that substances which lower surface energy of any form are concentrated at such boundary surfaces. The process is well known as "adsorption," and is a consequence of the operation of the principle of Carnot and Clausius, which states that decrease of free energy always occurs, if it is possible for it to do so. In fact, such an explanation was given by Faraday of the effect of metallic platinum in causing combination of oxygen and hydrogen gases. Although the name "adsorption" was not used in this description, Faraday had very clear ideas of the process, and gives several interesting cases. He showed that the necessary condition for the activity of platinum in the case referred to is a chemically clean surface, in order that the gases may condense on it. It matters not whether the removal of deposit is effected by mechanical polishing; by the action of acid or of alkali; by oxidation or reduction—making it either anode or kathode in an electrolytic cell will serve. It should be mentioned that this view did not receive universal acceptance, but the fact that it recommended itself to the keen insight of Faraday is powerful evidence in its favour.

I would not venture to state that this hypothesis is yet in a position to explain all the facts met with in the action of enzymes themselves, but it is remarkable how many receive a satisfactory account. We are at once confronted by the difficulty of the considerable number of different enzymes. But we must not forget that adsorption is controlled by a great number of factors in addition to mechanical surface tension. All those properties which suffer modification at phase boundaries play their part—electrical charge, solubility, compressibility, even chemical reaction itself, may be mentioned. Moreover, as Hardy has pointed out, the act of condensation in itself may well be accompanied by the manifestation of molecular forces which result in increased chemical potential of the reacting substances. It is clear that experimental decision of the questions involved is almost impossible until we have in our hands pure preparations of enzymes. We cannot as yet exclude the possibility of the formation of intermediate *chemical* compounds

[1] Abridged from a discourse delivered at the Royal Institution on March 24, by Prof. W. M. Bayliss, F.R.S.

between enzyme and substrate, but their existence has not been demonstrated, and what I may venture to call Faraday's view has the advantage of simplicity, and thus the support of William of Occam's "razor."

The important question of the synthetic action of enzymes demands a little attention at this point. All reactions may be regarded as being, in principle, reversible or balanced, and the greater part of those of the living organism are found experimentally to be so. If we take for consideration those enzymes the action of which consists in the addition or removal of the elements of water, we find that, as would be expected from the law of mass action, the position of equilibrium in the presence of a large excess of water is very near to that of complete hydrolysis, and this is the state of affairs in the usual laboratory experiments. On the other hand, the less water is present, the greater is the preponderance of the opposite—synthetic—aspect. Take the classical case of ethyl acetate. If the ester and water are mixed in molecular proportions, hydrolysis to acid and alcohol occurs until two-thirds of the ester are decomposed. Moreover, the same final composition is obtained if we commence with acid and alcohol, and so work in the other direction. But these reactions proceed by themselves with extreme slowness, taking months before coming to an end. But the presence of a catalyst, such as mineral acid, brings about equilibrium in an hour or so, and we notice that it is the same as the spontaneous one. An enzyme, known as lipase, also brings about equilibrium rapidly. The important point in respect of the mechanism of living cells is that by changing the available amount of water, the reaction may be made to proceed in either direction at will. The series of curves given by Armstrong and Gosney (Proc. Roy Soc., 88 B, p. 176) show this fact very clearly. Further, if the equilibrium is brought about rapidly, even if to any position except that of complete change in one or the other direction, the enzyme must accelerate *both* reactions, and any hypothesis of special "synthesising" enzymes is superfluous. This is essentially the position taken by van't Hoff in the work with which he was engaged at the time of his death. What is required, then, is a means by which the cell is enabled to change the available water at the disposal of reactions occurring therein. We do not as yet know the precise nature of such mechanisms, but there is reason to believe that they are provided by changes in the surface area of colloidal constituents or in the power of imbibition possessed by certain contents of the cell.

We here come across an interesting problem which cannot be said to be solved satisfactorily at present. We have seen that the equilibrium position of an ester system when reached rapidly under the action of a soluble catalyst is the same as the spontaneous one. But there is a certain difference when a heterogeneous catalyst, or enzyme, is used. Nevertheless, the equilibrium is a true one, being in the same position when approached from either end. The amount of butyric acid combined as amyl ester in a particular system under acid catalysis was found by Dietz to be 88 per cent. of the total; under the action of the enzyme lipase it was only 75 per cent. This fact has given rise to various suggestions, and has troubled people's minds because it appears to give a possibility of evading the second law of energetics. Now, it was pointed out to me by Prof. Hopkins that, on the hypothesis of a rapid attainment of equilibrium by condensation on the surface of the enzyme, it is necessary, if the natural equilibrium is to be unaltered, that adsorption of all the components of the system should be the same proportion of each, because the position of equilibrium must be the same on the surface of the enzyme as that which results in the body of the solution. In the presence of a large excess of water, it does not seem likely that a difference of equilibrium owing to this cause could be detected. But this should be possible when the equilibrium position is nearer the middle, so to speak, and I am at present engaged in experiments on the question. At any rate, difference in adsorption may be the cause of the phenomenon of Dietz. It would simply imply that water is adsorbed by the enzyme in relatively larger proportion than the other constituents of the system. It should be remembered that the solvent in these experiments was amyl alcohol containing about 8 per cent. of water, and, as Arrhenius has shown, all substances present are adsorbed, although the laws governing the relative proportion of these various substances are not yet completely worked out.

We see, by consideration of the facts relating to the action of enzymes, how important a part is played by changes in the rate of reactions, and there are two further points to which attention has been directed by Prof. Hopkins. Take, first, a series of reversible reactions in which the products of one form the starting point of the next following :—

$$A \rightleftharpoons B \rightleftharpoons C \rightleftharpoons D \rightleftharpoons \text{etc.}$$

If the rate at which B is converted into C is greater than that at which A changes into B, it is obvious that the amount of B present at any moment may be extremely small, although the whole of the final products have passed through the stage. The fact warns us from estimating the importance of any particular constituent of the cell by the quantity to be obtained.

The second point is this. Suppose that there are two independent reversible reactions, both leading to the same product, C.

and that A⟶C is more rapid or easier than B⟶C. This latter reaction will be practically absent, being balanced by the excess of C. But, if the former reaction is abolished by removal of A, then B⟶C will take place in proportion as C is used up in other reactions. Thus, under special conditions, a reaction may take place which is not detectable under normal conditions, although capable of taking place.

One of the most difficult questions is the manner in which the various components of the cell are prevented from entering into chemical reaction except when required. Enzymes, for example, are not always in activity. The conception which states that the cell consists of numerous minute "reaction chambers," separated from one another by membranes, seems to present most possibilities. These membranes must be regarded as capable of removal and of reconstruction, or reversible as regards their permeability. The food vacuoles of an Amœba may serve as an illustration of such chambers on a comparatively large scale. In these vacuoles digestion processes are going on independently of other reactions in various parts of the same cell protoplasm, although this latter behaves as a liquid.

The general conclusion to which we arrive is that velocity of reaction plays an exceedingly important part in the regulation of cell mechanics. I venture to think that the conception is destined to replace static points of view, such as that of "lock and key" or the fitting together of molecular groupings. That there is still very much to be discovered is obvious. We have to find out how the living cell is able to modify and adjust together the large number of reactions known to the chemist. The study of the methods by which the rate of these reactions is affected is one of the most valuable of those accessible to us.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

IN "A Forgotten Chapter in the History of Education," referring especially to the important report of the Consultative Committee on Examinations in Secondary Schools, issued in 1911, Mr. J. S. Thornton pleads earnestly the case of the College of Preceptors, a union essentially of the private schools, as the originator and sustainer of a system of leaving examinations which has not only been the inspirer of the Local Examinations instituted by the Universities of Oxford and Cambridge, but has also helped materially in making them efficient. To quote his own words, the College "was the poor inventor; the Universities, by their capital and prestige, have worked the invention for all it is worth. College and University have done together what neither of them could have done separately." So he urges that, rather than set up some other system, the State should more fully utilise the services of both bodies. But Mr. Thornton's pamphlet is much more than an apologia of the College of Preceptors; it is really a fervent plea for the full recognition by the State of the private schoolmaster and the private school, even to the extent of adequate financial aid. In support of such a policy he adduces the example of Scandinavian countries, and claims that the extraordinary success it has achieved from the point of view of efficiency, fruitfulness of suggestion, freedom of experiment, excellence of results, and economy in working fully warrants the closest investigation with a view to the recognition by the State under conditions of educational freedom of every kind of efficient and needed school.

SEVERAL important points relating to university education in the United States, Germany, and the United Kingdom are referred to in the *Observer* of June 18, in an interview which a representative of our contemporary had with Mr. Alfred Noyes, who has just returned to this country, after occupying the chair of English literature at Princeton. Mr. Noyes points out that a large proportion of the staffs of the colleges and universities in the United States received all its educational training, or at any rate its post-graduate training, in Germany. Americans have been encouraged to go to Germany and to pass from one university to another to take whatever courses they desire, but no facilities of this kind have been offered them here. It must, however, be remembered that, in addition to providing opportunities for intensive or extensive study, English-speaking students—whether American or British—have, by going to Germany, had the advantage of acquiring the use of the German language. This fact has no doubt often induced American students to take post-graduate courses in German, instead of British, universities. Mr. Noyes says:—"I am told by Americans that in many cases when they want to come to English universities to do post-graduate work they must begin all over again, and that the work they have done for their American degrees will not be allowed to count." We believe, however, that this is not now the case, and that post-graduate students are welcomed at most of our universities. Mr. Noyes refers to the large number of students in American universities, and we are able to supplement his remarks with figures showing—to the nearest hundred—the enrolment for 1915 in thirty institutions, excluding summer-session students:—Columbia, 7000; Pennsylvania, 6600; California, 6000; New York University, 5900; Michigan, 5900; Illinois, 5500; Harvard, 5400; Cornell, 5400; Ohio State, 4900; Wisconsin, 4900; Minnesota, 4700; Chicago, 4300; North-western, 4100; Syracuse, 3800; Pittsburgh, 3600; Yale, 3300; Nebraska, 3100; Missouri, 3000; Iowa State, 2700; Texas, 2600; Cincinnati, 2500; Kansas, 2500; Stanford, 2000; Indiana, 1800; Princeton, 1600; Western Reserve, 1500; Tulane, 1300; Washington University, 1300; Johns Hopkins, 1200; Virginia, 1000.

THE confidence of the German nation in the value of education and in its uplifting and recuperative power, even in face of a disastrous termination to the present struggle, is strikingly illustrated by the following extract, which appeared in the *Schoolmaster* for June 17, taken from *Der Tag*, a paper established some years ago with the view of promoting German naval supremacy. "We Germans," it said, "can proudly point to the fact that our expenditure on the education of our children has been fully maintained during the war at its former level. In Prussia and elsewhere it has even, for certain objects, been increased. But the money-making, so-called democratic England finds it necessary to cut down her education bill to the lowest limit. We rejoice at the fact that our enemies are discouraging the education and instruction of the masses. By the mere fact that British children are being deprived of education we have a great victory over England, for after the war, more than ever before, will knowledge and education, organisation and adaptability on the part of all classes of the population bring victory in the economic struggle." The leaders of the nation look forward with triumphant anticipation to the resumption of the economic struggle after the close of the war, and are intent upon preserving and enhancing the educational means and methods which have given them victory in the past. We, on the other hand, both Imperially and locally, have entered upon a policy of educational starvation: urgent building operations are suspended, equipment is curtailed, school buildings are commandeered and school hours reduced, secondary-school fees are raised, scholarships are reduced in value or are suspended, evening classes are in large measure closed, and school children allowed to leave school at a much earlier age. It is not for want of means—witness the enormous profits made as a result of the war as appears from a statement in the *Manchester Guardian* of June 19, wherein appeared a list of 154 firms engaged in shipping, coal, iron, engineering, tea, rubber, and other industries which showed a gross and net profit for 1916 exceeding by thirteen millions sterling those for 1914; and our direct expenditure upon drink exceeds 180 millions annually—but lack of vision and indifference to the value and potency of education. We need to raise the status of the Board of Education and give it the rank of a department of the State, so that it will attract to its direction men of the highest intelligence and zeal. Education is at least as vital to the well-being of the nation as any other of the great services under the Crown. Whilst leaving a desirable liberty of interpretation according to local conditions, it should at least make mandatory upon all local authorities the duty of providing completely and adequately for all forms of education.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, June 8.—Sir J. J. Thomson, president, in the chair.—The Earl of **Berkeley** and E. G. J. **Hartley**: Further determinations of direct osmotic pressures. In this communication the osmotic pressures of the following substances are measured directly:—Cane-sugar and methyl glucoside, a number of ferro- and ferri-cyanides, and one or two other salts. The cane-sugar determinations were made on a

somewhat purer sugar than was the case in the previous work; the results extend over the range already covered by Prof. Morse and his co-workers, and the two sets of numbers are found to differ slightly at the lower concentrations. For the ionised substances examined it may be stated that, with the exception of one salt, all those having a molecule made up of a dyad base combined with a dyad acid radicle are associated in aqueous solution. The "dynamic" method of measuring osmotic pressures is developed so as to afford a means of rapidly estimating molecular weights to a considerable degree of accuracy even in very dilute solution.—Prof. E. **Wilson** and Prof. J. W. **Nicholson**: The magnetic shielding of large spaces and its experimental measurement. (1) The magnetic shielding of a large space is a problem wholly different in practice from that of a small space, and in view of important applications the efficiency to which much shielding can be raised is a matter of importance. Considerations of mobility of the apparatus and weight of iron required necessitate the solution of the problem of maximum shielding for a given weight of iron and more than two shells, together with an examination of the limitations of utility of lamination. These problems are discussed in the paper. (2) A field of order as low as 3×10^{-3} has been obtained in a space of radius 30 cm. by the use of 1273 kilos (2806 lb.) of high-permeability dynamo magnetic steel, and an accurate method designed for the measurement of fields of lower order. (3) The leakage through air spaces in a magnetic shield has been studied. (4) It is now possible to examine the behaviour of iron under practically no magnetic force.—G. I. **Taylor**: Motion of solids and fluids when the flow is not irrotational. The paper deals with the motion of solids in rotationally moving fluids, a problem which has not apparently engaged the attention of mathematicians before. The motion of cylindrical solids in rotating fluids is discussed, and it is shown that a solid cylinder of the same density as the fluid will move through a rotating fluid exactly as if the fluid were not rotating. On the other hand, a solid sphere of the same density as the fluid will be deflected to the right if the fluid is rotating anti-clockwise, and to the left if it is rotating clockwise. This property of rotating fluids is demonstrated experimentally by means of experiments performed with a rotating tank full of water. It is shown experimentally that vortex rings move in circles through a rotating fluid.

Mathematical Society, June 8.—Sir J. Larmor, president, in the chair.—Prof. M. J. M. **Hill**: The classification of the integrals of a linear partial differential equation of the first order.—Prof. W. H. **Young**: (1) Non-absolutely convergent, not necessarily continuous, integrals. (2) The convergence of Fourier series and of their derived series.—Dr. S. **Brodetsky**: The general linear differential equation.—A. E. **Jolliffe**: A note on the series $\Sigma a_n \sin n\theta$ and $\Sigma a_n \cos n\theta$, where (a_n) is a sequence of positive numbers tending steadily to zero.—T. C. **Lewis**: Circles connected with "four Tucker circles."—F. J. W. **Whipple**: A symmetrical relation between Legendre's functions with parameters cosh α and coth α.—H. T. J. **Norton**: A problem in Diophantine approximation.

CAMBRIDGE.

Philosophical Society, May 22.—Prof. Newall, president, in the chair.—Dr. **Willis**: Some considerations on the geographical distribution of species. In some recent papers it has been sought to show that the dispersal of species (so long as no barriers intervene) depends simply upon their age within the country concerned, and is independent of natural selection. A general account was given of the results so far obtained by a study of the floras of Ceylon and New Zealand.—C. P. **Dutt**: A preliminary note on the internal structure of *Pityostrobus* (*Pinites*) *macrocephalus* from the Lower Eocene. A brief description is given of the general anatomy of two forms of cone from the Lower Eocene of the London basin, attention being drawn to certain unrecorded or characteristic features. The structure of the seeds is described for the first time, and the presence of fossil embryos is recorded. Pollen grains are found occurring at the apex of a peculiar nucellar column. Evidence is given that the two forms are specifically identical, and are related to an existing species, *Pinus excelsa*.

EDINBURGH.

Royal Society, May 15.—Dr. J. Horne, president, in the chair.—Dr. D. **Ellis**: The Jurassic fossil fungus, *Phycomycites Frodinghamii*, Ellis. The paper brings forward fresh evidence of the true biological nature of this fossil fungus, found by the author in the Frodingham Ironstone of Lincolnshire. It is the first recorded instance of fossil fungi from Jurassic rocks. The probable reason for its preservation was the absorption within the organism of iron from the surrounding water. The members thus became impregnated with ferric oxide, as in the case of modern iron-bacteria. The most significant feature is that the fossil threads show the same variations in nature of membrane as in these bacteria. Although no traces were found of the cellular tissues of the animal host in the Frodingham Ironstone, such traces were found in combination with fungal threads in the Dunliath ferruginous limestone. It is interesting to note that this fossil fungus was found in a marine deposit.—Dr. R. A. **Houstoun**: A possible explanation of the satellites of spectral lines. Many bright lines in the spectra of gases are accompanied by fainter lines known as satellites. The usual way of regarding these is to consider them as due to independent electrons or degrees of freedom in the molecule. The view presented in this paper and worked out mathematically was that they might be regarded as due to the same degree of freedom as the main line, being caused merely by the manner in which the vibrations are started or stopped.

PARIS.

Academy of Sciences, June 5.—M. Camille Jordan in the chair.—H. **Le Chatelier**: The devitrification of glass (*cristal*). Devitrification has hitherto been noticed only in glasses containing lime and calcium monosilicate, $CaSiO_3$ separating out. Details are given of a case of devitrification in a lead glass. The separated crystals in this case were found to be tridymite, and this is the first example of a crystallisation of silica in the devitrification of a glass.—A. **Chauveau**: Dr. Lucien Jacquet and tuberculosis in the employés in Parisian wine-bars. Important hygienic consequences of the new facts obtained in this study.—A. **Blondel** and J. **Rey**: The comparison, from the point of view of range, of short light signals produced by a rotating apparatus, by sources of light giving different periods of impression. The conditions of maximum efficacity of the light flux utilised. The experiments described prove that in the utilisation of a source of light for the production of light flashes succeeding each other at fixed intervals, and produced by the rotation of an optical apparatus, it is better that the flashes should be as short as possible.—A. **Denjoy**: Certain classes of functions of real variables.—M. **Fréchet**: The equivalence of two fundamental properties of linear ensembles.—G. **Hall-Hamilton**: Study of the planet Mars at the Flagstaff Observatory, Arizona. A map of the markings on the planet is given. The atmosphere proved to be exceptionally favourable for

these observations.—C. V. L. **Charlier**: The construction of the galaxy. Charts are given showing the projections of the group of stars of spectral class B (helium stars) in three directions.—A. **Pictet** and P. **Stehelin**: The formation of pyridine bases by condensation of ketones and amides. Following the analogy of the formation of mesitylene, an attempt was made to prepare pyridine by the condensation of acetone and acetamide. The experiment failed with the usual dehydrating reagents, but pyridine (2 to 3 per cent. yield) was obtained by heating in sealed tubes to 250° C.—B. **Galitzine**: The localisation of the epicentre of an earthquake from observations at a single seismic station.—L. **Eblé**: The deviations from the vertical at Paris.—J. **Cardot**: The bryological flora of Kerguelen. This flora presents close analogies with that of South Georgia.—MM. **Neveu-Lemaire, Debeyre,** and **Rouvière**: A prolonged form of cerebro-spinal meningitis and cerebral trepanning. A description of a case in which the injection of antimeningococcic serum into the right lateral ventricle was resorted to, resulting in a complete cure.—F. **Bordas**: Ozonised oxygen in the treatment of war wounds. The wounds are kept in an atmosphere of ozonised oxygen, without dressings, and exposed to solar radiation. The results have been particularly satisfactory in large wounds where the tissues had been invaded more or less deeply by septic products and anaerobic fermentations. The treatment can be prolonged without inconvenience to the patient, and the general appearance of the wounds rapidly improves, the fetid smells disappearing at the very commencement.—J. **Amar**: The sense education and utilisation of mutilated limbs.

BOOKS RECEIVED.

Milk and its Hygienic Relations. By Dr. J. E. Lane-Claypon. Pp. viii+348. (London: Longmans and Co.) 7*s.* 6*d.* net.

The Cruise of the *Tomas Barrera*. By J. B. Henderson. Pp. ix+320. (New York and London: G. P. Putnam's Sons.) 12*s.* 6*d.* net.

Proceedings of the South London Entomological and Natural History Society, 1915–16. Pp. xv+156. (London: Hibernia Chambers.) 5*s.*

Exercices Numériques et Graphiques de Mathématiques sur les leçons de Mathématiques générales du même auteur. By Prof. L. Zoretti. Pp. xv+124. (Paris: Gauthier-Villars et Cie.) 7 francs.

Leçons sur le Fonctionnement des Groupes Electrogènes en Régime Troublé. By Prof. L. Barbillion. Pp. ii+306. (Paris: Gauthier-Villars et Cie.) 11 francs.

Sex-Linked Inheritance in Drosophila. By T. H. Morgan and C. B. Bridges. Pp. 87+plates ii. (Washington: Carnegie Institution.)

Guide to the Materials for American History in Swiss and Austrian Archives. By Prof. A. B. Faust. Pp. x+299. (Washington: Carnegie Institution.)

On the Manufacture and Testing of Prismatic Compasses, especially Mark VII., Military Pattern. By F. E. Smith. Pp. 48. (London: Optical Society.)

My Yoruba Alphabet. By R. E. Dennett. Pp. xi+45. (London: Macmillan and Co., Ltd.) 1*s.* 6*d.* net.

Man—an Adaptive Mechanism. By Prof. G. W. Crile. Pp. xvi+387. (New York: The Macmillan Company; London: Macmillan and Co., Ltd.) 10*s.* 6*d.* net.

The Military Map. Elements of Modern Topography (French School of War). Pp. vii+130. (London: Macmillan and Co., Ltd.) 2*s.* 6*d.* net.

Some Recent Researches in Plant Physiology. By Dr. W. R. G. Atkins. Pp. xi+328. (London: Whittaker and Co.) 7*s.* 6*d.* net.

Discovery: or, The Spirit and Service of Science. By R. A. Gregory. Pp. x+340. (London: Macmillan and Co., Ltd.) 5*s.* net.

DIARY OF SOCIETIES.

THURSDAY, JUNE 22.

ROYAL SOCIETY, at 4.30.—Croonian Lecture: Evolution and Symmetry in the Order of the Sea-pens: Prof. S. J. Hickson.

WEDNESDAY, JUNE 28.

GEOLOGICAL SOCIETY, at 5.30.—A New Species of Edestus from the Lower Carboniferous of Yorkshire: Dr. A. Smith Woodward.—The Tertiary Volcanic Rocks of Mozambique: A. Holmes.

THURSDAY, JUNE 29.

ROYAL SOCIETY, at 4.30.—*Probable Papers:* The Genesis of Pleochroic Haloes: Prof. J. Joly.—Some Determinations of the Sign and Magnitude of Electric Discharges in Lightning Flashes: C. T. R. Wilson.—Further Observations on Protozoa in relation to Soil Bacteria: Dr. T. Goodey.—New Bennettitean Cones from the British Cretaceous: Dr. M. C. Stopes.—And other Papers.

ROYAL SOCIETY OF ARTS, at 4.30.—The Sikhs: Sirdar Daljit Singh.

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