THURSDAY, JANUARY 18, 1917.

AN APPRECIATION OF WORK.

(1) *Pictures of the Wonder of Work.* By Joseph Pennell. Pp. lii. (London: W. Heinemann, 1916.) Price 7*s.* 6*d.* net.

(2) *Joseph Pennell's Pictures of War Work in England.* With an Introduction by H. G. Wells. Pp. xii+plates 51. (London: W. Heinemann, 1917.) Price 6*s.* net.

(1) THE author of this interesting volume of illustrations was recently requested by the Ministry of Munitions to record his impressions pictorially and in his own inimitable way of the wonder of the work now going on in the mills and factories of Britain and of France in order to enable us to understand better the efforts being made to win the war. These drawings are to be exhibited in all our great cities, and, judging from the quality of the illustrations in the book before us, such an exhibition will attract considerable public attention.

It is so seldom that a word of appreciation is heard of the conditions of life in our smoky centres of toil that to find an artist of high repute giving himself up enthusiastically to discover the wonder, the power, the romance, and the tragedy of it all is to arrest our attention whether we will or no.

In this handy volume is a collection of pictorial representations of the work of the world as done in mine, mill, and factory, and as seen under many different conditions and in many lands. To the author the vision of mill-wheel and crane, of tall chimney and of smoke unlimited, is as full of interest and of inspiration as the vacant landscape or the wooded hillside for the artist of another type of mind. The book is a pictorial record of the wonder of work, in the doing of it rather than of the product itself, and it brings home to the mind more vividly than by words the price that is paid by one-half of our people on behalf of the well-being of the whole. Though the conditions of manual work may improve as time goes on, it is certain that much of the indispensable work of the world will always be done under conditions of stress and strain almost beyond belief by those who dwell far from centres of toil. It is well that these conditions should be recorded, not only for our information, but to awaken in us sentiments of wonder at the skill, the strength, and the persistence of man in overcoming difficulties, and of gratitude to those by whom the work is done and by whose self-sacrificing service we all receive advantage. In this volume we have such a record conveying to us in a few strokes of the artist's pencil a vivid sense of life and reality.

The striking drawings are accompanied by some very shrewd and characteristic comments which add much to the interest of the book as a whole. "It is far easier," says the author, "to paint a heavenly host or a dream-city in one's studio than to make a decoration out of a group of miners or to draw a rolling-mill in full blast, yet one of these subjects can be as noble as the other." He has, as he says, "something to say in his own way about his own time." "I am simply an artist searching for the wonder of work—not for morals, political economy, stories of sweating, the crime of ugliness. I am trying to record the wonder as I see it, that is all." We congratulate Mr. Pennell on the success of his effort.

(2) This is a further volume by the same author, dedicated to the same purpose as the work already noticed. The production of munitions of war is delineated by a succession of marvellously clear and effective pencil drawings showing the various stages involved in the production of munitions from the iron-mine and the coal-mine onwards through the processes of steel melting in furnaces, of treatment in hammers and presses, and of manufacture in machine-shops, in which women as well as men are taking so great a part.

As Mr. Wells says in his Introduction: "Through all these lithographs runs one present *motif*, the *motif* of the supreme effort of Western civilisation to save itself and the world from the dominance of the reactionary German Imperialism that has seized the weapons and resources of modern science."

Mr. Pennell has had exceptional facilities afforded him for obtaining these pictures. No such opportunity is available to the ordinary citizen, and next to the privilege of actually visiting the works themselves, no more effective means are available for obtaining a clear and vivid idea of all that is meant by the manufacture of munitions of war than that provided in this most interesting collection of drawings. W. RIPPER.

ADJUSTMENT OF OBSERVATIONS.

Theory of Errors and Least Squares. By Prof. Le Roy D. Weld. Pp. xii+190. (New York: The Macmillan Co.; London: Macmillan and Co., Ltd., 1916.) Price 5*s.* 6*d.* net.

THIS work, which embodies the material used by the author as lecture notes at Coe College, Iowa, is intended not only as a text-book for undergraduates, but also as a book of reference which a research worker can read through in a few evenings and then put into immediate practice. An interesting feature of the work is the wide range involved in the illustrative examples, which include applications to numerous branches of science. The mathematical treatment in the text is very elementary, requiring little more than a knowledge of the meaning of differentiation. This is supplemented in the appendix by a few pages involving rather more advanced methods, but in the main the book is free from mathematical difficulties to a degree quite unusual in works on least squares.

The first chapter deals with the meaning of measurement, estimation, and errors of measurement, and is followed by some useful exercises, which junior science students will find very suggestive. In the next chapter the occurrence and

general properties of errors are treated, the distinction between errors and mistakes is carefully explained, and the reader will derive from these few pages a very clear idea of the kind of errors with which it is the mission of least squares to deal. This is followed by a chapter on the general theory of probability treated algebraically, and containing a brief explanation of the application of the theory to practical problems, such as life insurance, together with some examples from mortality tables.

We then reach the most important part of the book, chaps. iv. and v., comprising an exposition of the theory of errors and least squares on very elementary, but quite orthodox, lines. The great variety in the problems introduced to illustrate the text is very noteworthy: statistical tables, electrical resistance, balance constants, volumetric solutions, specific gravity bottles, surveying, transits of stars, the resolution of apparent parallax into actual parallax and proper motion, the solubility of salts, are all made to serve. The problems on chemical work are particularly suggestive, while the one on locating a distant station in surveying is of interest in employing rectangular co-ordinates instead of angles. There is an unfortunate mistake in the first numerical example of a normal equation (p. 75); the right-hand side of the equation should read 3·676, and the results of the problem as given in the text are appreciably inaccurate.

Chap. vi. is on empirical formulæ, and includes some useful hints as to the choice of mathematical expressions to represent the unknown relations between variables. A problem on the "reduction of pendulum to zero arc," on pp. 107 to 110, in which time is measured to the millionth of a second and arcs are recorded in whole degrees only, looks rather uncanny, but may be unexceptionable. The next chapter is on weighted observations, and follows the usual lines. In the final chapter, on the general theory of precision, an elementary knowledge of integration is assumed. The appendix, to which, as already mentioned, the more difficult analysis is relegated, contains also a very complete table of formulæ, all of which have been deduced in the text. On the whole, this is a good book, and being far less mathematical than most other works on the subject, it is likely to appeal to a wider class of readers.

NOXIOUS INSECTS.

Medical and Veterinary Entomology. By W. B. Herms. Pp. xii+393. (New York: The Macmillan Company; London: Macmillan and Co., Ltd., 1915.) Price 17*s.* net.

THIS excellent text-book is based on manuscript used in teaching in the University of California and in the San Francisco Veterinary College. It is not intended to be a very comprehensive treatise, but an attempt to systematise the subject. It, however, goes beyond this, as new matter is here and there incorporated, thus making the volume of greater value. It is mainly adapted to the American continent, but will be found of general usefulness elsewhere. For instance, there is only a key of the North American genera of Tabanidæ. The first chapter is an introduction. The second deals with parasites and parasitism in general; the third with insect anatomy and classification, with a useful working key to the orders of insects. The mouth-parts are shortly but very concisely treated in chap. iv.; this portion might well have been amplified.

Cockroaches, beetles, and thrips are dealt with, and the small yet important part played by cockchafers in the spread of *Echinorhynchus gigas* and the uses of Spanish fly, etc., are concisely detailed. There is an interesting chapter on lice (pp. 52–68); we notice here that the human clothes louse is still called *Pediculus vestimenti* instead of *P. humanus*; the figures given here are not good. Bed-bugs and cone-nose bugs form the theme of chap. viii. An excellent précis on mosquitoes or Culicidæ is found in chap. ix. (pp. 80–100), the classification used being that of Theobald and others, and not of the American dipterologists. Mosquito-carried diseases and control are also explained, and a full key of classification given under the Theobaldian system.

Other blood-sucking flies are dealt with, such as the buffalo-gnats, or Simulidæ, and horse-flies, or Tabanidæ, and notes on their control and relation to diseases are given. Naturally, the house-fly is fully described, twenty pages being devoted to its life-history, habits, and its relation to diseases, and another twenty-two pages to its control. The African tsetse-flies, or Glossinæ, and the horn- and stable-flies, are also fairly fully dealt with in chap. xv. (pp. 207–232).

An interesting account of Myiasis is given, including attacks of flesh-flies and bot-flies, or Œstridæ, and others, such as the Congo floor-maggot and the West Indian and American screw-worm. The portion dealing with the ox warble-flies, pp. 251–254, is not quite up to date; for instance, it is said that the larvæ are licked off by the tongue, and so pass into the œsophagus, Carpenter's researches in Ireland evidently being unknown to the author; these clearly prove that the larvæ enter by the skin, especially of the legs, and it is unlikely that any enter as described in this work. Nothing is said of their attack on human beings, the so-called "creeping disease," which is frequent in some countries. The remainder of the work is taken up with chapters on fleas and louse-flies, ticks, mites, including scab in sheep, scaly leg in fowls, and itch, and also an account of venomous insects and arachnoids. The section on louse-flies (Pupipara) might well have been extended; the account of the sheep "ked" is very brief, whilst all that is said of the Hippoboscidæ is contained in five lines, dealing with *H. equina*. Fuller information on *Pediculoides ventricosus* might also have been given, and the recent work of Willcocks in Egypt and others included.

The work ends with a four-page appendix dealing with general classification of bacteria and protozoa. F. V. T.

HISTORY OF MATHEMATICS.

Historical Introduction to Mathematical Literature. By Prof. G. A. Miller. Pp. xiii+302. (New York: The Macmillan Co.; London: Macmillan and Co., Ltd., 1916.) Price 7*s.* net.

DETAILS of the history of mathematics are better left to specialists, who still have plenty of occupation in clearing up doubtful points and amending errors. But there is a growing opinion among teachers that not only for themselves, but also for their pupils, some knowledge of the course of mathematical discovery is eminently desirable. Besides being a factor in a general education, it is stimulating to the learner, and supplies to the teacher a view of human activity and invention which ought to be suggestive from the psychological side. If there be a "natural" order of learning mathematics, it cannot be wholly different in the race and the individual; though, of course, this consideration ought not to be turned into a fad. A year should not be wasted on heuristic acquisition of the multiplication table.

To serve the purposes indicated, we want books which are not too long, put the main facts into proper perspective, avoid doubtful assertions, and show the trend of mathematics at the present time. In all these respects Prof. Miller seems to us to be successful. As to the perspective, a considerable proportion of the space is given to modern mathematics; this is quite justified by the remarkable progress, and in some ways revolution, of recent times. But the earlier history is by no means neglected; thus we have accounts of ancient and medieval arithmetic, geometry, and algebra, including the theory of irrationals—all in broad outline, but very well arranged. Among modern topics, we have a chapter on the development of mathematics since the close of the eighteenth century, and one on mathematical literature; the last ought to be very useful to those who are serious students of the subject.

The last chapter gives brief biographies of twenty-five deceased mathematicians, ranging from Euclid and Archimedes to Lie and Poincaré. The list could scarcely be improved upon, and the notices, on the whole, are excellent. For instance, justice is done to Cauchy's great achievements, at least those in pure mathematics, and the author scarcely professes to deal with applied mathematics. At the same time, notice is taken of Newton's theory of gravitation and of Poincaré's work on celestial mechanics, so that we cannot help being surprised when we find nothing said about Rowan Hamilton's contributions to dynamics or even his researches on systems of rays. It is curious how many seem to think of Hamilton as the inventor of quaternions and of nothing else.

The appendix gives a brief list of books, and is, we think, the most uneven part of the work; it almost seems as if the author had looked round his bookshelves and put down the titles of those volumes that caught his eye. For instance, under "Bibliographies and Encyclopædias" we have, among twenty entries, Mr. Somerville's bibliography of non-Euclidean geometry; the value of this is indisputable, but it is far too special a work for a list of this kind. Again, under "Teaching and Philosophy," we have the "Monographs" edited by Prof. J. W. A. Young; these are quite special things, like the Cambridge Tracts and other such publications, and to put them here among eighteen entries shows a lack of proportion.

Two things may strike the reader of the biographies: the full names are not always stated, and no indication is given of Jewish nationality. The last is a small matter; but the comparatively large number of Jews who have become eminent mathematicians and physicists is certainly remarkable.

Prof. Miller has the great merits of being lively and enthusiastic, and appreciating the beauties of his science. His anecdotes and *obiter dicta* are always interesting, and sometimes highly amusing; for instance, Abel writes of Cauchy: "Ses travaux sont excellents, mais il écrit d'une manière très confuse." Unless we are greatly mistaken, Abel deserves this criticism much more than Cauchy. Again, it will be news to most people that "Omar Alkhayami" (FitzGerald's Omar Khayyám) "made a statement in his algebra which seems to imply that he was able to determine the coefficients of the successive terms in the expansion of a binomial raised to any positive integral power."

We hope that copies of this book will find their way into many of our school libraries; quite a large part of it ought to be thoroughly enjoyed by a mathematical boy. It is well printed, too, and comparatively cheap. G. B. M.

OUR BOOKSHELF.

The Origin of the Earth. By Thomas Chrowder Chamberlin. Pp. xi+271. (Chicago: The University of Chicago Press; London: At the Cambridge University Press, 1916.) Price 6*s.* net.

THIS book forms the third of a series of publications intended to "present the complete results of series of investigations which have previously appeared only in scattered articles, if published at all." Needless to say, it is occupied mainly with a presentation of the planetesimal hypothesis, associated with the name of the author and his collaborator, Prof. F. R. Moulton. The original investigations on the planetesimal theory have perhaps been rather more scattered than most, so that an account of them in a compact and continuous form is especially welcome.

Prof. Chamberlin's theory is frankly tentative and speculative, and the reader is invited throughout to form his own judgment of the value of what is offered for his acceptance. The reader will proceed with caution, as indeed he is advised to do, for the progress of astronomy makes it evident

that much to which the author originally pinned his faith is no longer tenable. Spiral nebulæ are proving to be something bigger than the author at first imagined them to be, and both mathematicians and observers feel doubts as to whether their particular branches of astronomical science will altogether confirm the author's predictions as to the course of events. At the same time the author has always regarded his theory as one to be continually modified in the light of new facts, so that the question of present interest is whether the theory can be fitted to new knowledge without entirely losing its original character.

The book will be welcomed as providing a complete and authoritative account of a hypothesis which must be considered along with others in our efforts to unravel the history of our system.

J. H. J.

The Earliest Voyages Round the World, 1519–1617. Edited by P. F. Alexander. Pp. xxiii + 216. (Cambridge: At the University Press, 1916.) Price 3*s.* net.

IN the century, 1519–1617, covered by this travel-book there were six voyages round the world—one Spanish, led by a Portuguese, Magellan; two English, led by Drake and Cavendish; and three Dutch, led by Van Noort, Speilbergen, and Le Maire and Schouten. Mr. Alexander includes in this volume Pigafetta's account of the Magellan expedition; Francis Pretty's narratives of Drake's piratical voyage, and of Cavendish's first voyage; and an account of Le Maire and Schouten's discovery of the route round Cape Horn. There are numerous illustrations, including a sixteenth-century map of Drake's voyage corrected by the great navigator; a dozen pages of useful notes; a brief introduction to the narratives; and a table of important dates in the history of discovery. As a contemporary source book, which maintains the atmosphere of the great days of the early voyages, this compilation will prove extremely useful and stimulating.

Large-Scale Map of the French Battle-Front. (London: G. W. Bacon and Co., Ltd.) Paper, 1*s.* net; cloth, 1*s.* 6*d.* net.

THIS map, on a scale of four miles to an inch, shows the battle-front from Peronne to Verdun. There is a gap of about twenty miles to the south of Peronne, but the advance of the Allies will no doubt soon bring this part of the battle-line within the area of the sheet. The map shows woods in green, and the present front, approximately as it was on November 10, by a red line. There is, unfortunately, no attempt to show elevation either by contours or spot-heights. Rivers, railways, and canals are clearly and accurately shown, and there is an abundance of names. The map should make it easy to follow the course of any advance on this front, though the absence of indications of relief will not help the reader to grasp the significance of the line of front. There is a companion map at the same price of the British front to the north.

LETTERS TO THE EDITOR.

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

The Permanence of Finger-Print Patterns.

I RECEIVED a few days ago Sir Wm. J. Herschel's brochure, "The Origin of Finger-Printing." His object—in addition to examining other claims to this method—is stated to be the desire to place on record the discovery of this method of identification "in Bengal in 1858," and the author seems to be piously grateful for the "gift granted" to him of that great and most useful discovery. The evidence for this early date is contained in the imprint of a single hand of one Kōnāi, made at that time. This was issued on a single sheet some years ago, but when, as an eager student of the subject, I applied to the publishers for a copy, I was told it was issued only for private circulation, and could not be supplied to me. I now hasten at the first opportunity to give my own opinion of this impression, long guarded so carefully from the inspection of the expert critic.

The fateful lines so dear to palmistry are quite nicely shown up, and many of the skin furrows, or *rugae,* on the palm are printed with considerable clearness. That is, the part of the hand not at all used in the official system of identification is well done, but what of those parts on which the system entirely relies? The significant pads at the last joint of each finger, which are full of intricate patterns in every human, or monkey, finger, are not shown at all. They are mere uniform blotches of ink. There is absolutely no trace of a pattern of the simplest kind in any one of the five fingers shown. I wish to be understood as not exaggerating for any controversial effect, and appeal to any trained detective if this is not as I represent. No identification could be effected on such a basis, and the system was therefore clearly *not* discovered in 1858 by the baronet. I cannot perceive that even now the author has any adequate conception of what the system is, now in general and satisfactory operation throughout the civilised world. A most curious confusion has arisen from an original police blunder that no two single finger patterns are ever alike, for which, I think, Sir William himself is mainly responsible. I am quite sure that there is no scientific basis for such an assertion. My syllabic system of classification, applied to a large collection, would enable such an assertion to be severely tested, but I know of no other method in existence which could do so. To compare finger by finger in a large collection is utterly impossible. But by giving a short syllabic name to the pattern of each finger those names can be assorted apart from the hand collection, and those which are similar can be compared individually. I have no doubt in my own mind that such a search would reveal closely similar fingers in different individuals, so closely similar indeed that the slightest blur in printing would lead to the fallacious conclusion of identity. It was on getting a clear perception of this very dangerous fallacy, still manfully held and expounded by one or two police experts, that from 1879–80, when I first made public the method, I insisted on the use of the whole set of ten fingers, serially and consecutively printed, for criminal identification. It affords an example of mutations, but for trivial purposes fewer fingers might do very well. The English method, now practically used everywhere, cannot be greatly improved upon in this respect for identifying old convicts on reconviction.

The question of what degree of evidence a single bloody smudge may give of the identity of some supposed miscreant with a convict having a previous official record is a matter for dispute. Still more is that of a case where, say, the right forefinger of Richard Roe may be practically identical with the left ring-finger of John Doe. Such similarity would be no evidence whatever for personal identification. In labouring to be brief I trust I have not been quite obscure. Sir William, in his review of the history of this discovery, has not made any reference to my little contributions on the subject. He, however, did acknowledge my priority of publication in your columns of November 22, 1894, and for that "gift granted" I must feel grateful. HENRY FAULDS.

Stoke-on-Trent.

I HAVE to thank you for your courtesy in forwarding me a copy of Mr. Faulds's letter to you, and, in compliance with your request, I submit the following remarks.

The only point I feel bound to notice is his complaint that I have not mentioned his name in my story of "The Origin of Finger-Printing." Mr. Faulds's own account of his claim has been so fully placed before the public in his letters to you from Japan, of October, 1880, and later, that I think I was right in keeping to that period of history, twenty years further back than his, which lay within my own knowledge.

But his present letter breaks through all bounds of social courtesy, and it is only his position as a professed man of science that justifies me in correcting him. Mr. Faulds has the temerity to scout my statement that I was moved to study finger-printing by the fascination of Kōnāi's hand-mark (taken as it was for the same purpose as finger-prints now are). The finger-tips were badly smudged, but the small furrows on the palm were exquisite, and moved me to take better impressions than his from my own fingers, as I tell the reader on the same page, only Mr. Faulds ignores it. This is not the spirit of science.

I will now, with your permission, show reason why I could not honestly have introduced Mr. Faulds's name. His letter of 1880 announced that in the previous year his attention was directed to the peculiarities of finger impressions on pottery, and that he had come to the conclusion, by original and patient experiment, that finger-prints were sufficiently personal in pattern to supply a long-wanted method of scientific identification, which should enable us to fix his crime upon any offender who left finger-marks behind him, and equally well to disprove the suspected identity of an innocent person. (For all which I gave him, and I still do so, the credit due for a conception so different from mine.) But he went on to say:—"There can be no doubt of the advantage of having a copy of the for-ever-unchangeable finger-furrows of important criminals."

This expression made me protest at once, in my reply, that I could not understand how, in less than two years, he could have come to the knowledge that the furrows were unchangeable. It had taken me nearly twenty years of sustained experiment to demonstrate this persistence of the patterns for at least fifteen years of a man's life, and it is plainly impossible for any man with a scientific turn of mind to put this doctrine forward after only twenty months or so of experiment. My reply, therefore, of 1880 expressly challenged his authority for the statement, and he has never justified it. My challenge did oblige him to meet it as best he could, but the nearest approach I have seen to an answer is the following extract from an article of his in *Knowledge*, April, 1911:—

"The mode I took to test whether the ridges ever shifted their situation or changed their form was by shaving away their elevations . . . having first taken careful imprints of the patterns. After the skin grew up again, fresh imprints were taken and compared with the old ones, . . . but in many hundreds of cases, tested thus three or four times, not one solitary example of a variation in pattern was detected." His return to England broke the further investigation. He goes on to say:—"The firm conviction, however, was established in my mind, which nothing has occurred to change, that skin furrows for the purposes of identification are invariable throughout life."

This quotation is his latest statement of his authority, but it needs to be read with an extract from a previous letter of his, dated June 5, 1909, in which he says:—

"One of my earliest experiments was to shave off the ridges of the finger-tips with razors; the pattern on the skin was reproduced with quite unvarying fidelity, unless part of the true (deep) skin was removed."

I take it that this is the only foundation he has for his claim to have known the law of persistency in 1880. I leave it to men of science to judge whether his experiments sufficed to prove persistency of a finger pattern for life. W. J. HERSCHEL.

Warfield.

The Date of the Introduction of the Term "Metabolic."

THE concept and the term "metabolism" have played such a prominent part in the development of physiological science that it should be interesting to know by whom, and when, the term was first used. Prof. Bayliss, in his "Principles of General Physiology" (1915, p. 263), says that, so far as he can discover, "metabolism" was first used by Sir Michael Foster in his "Text-book of Physiology," the first edition of which was published in 1883. It seems, however, that there is a still earlier use of the term in the writings of no less well known an investigator than Theodore Schwann, enunciator of the cell-theory. The passage I allude to occurs in the chapter called "Theory of Cells," the last in Section III. of Schwann's classic, "Microscopical Researches into the Accordance in the Structure and Growth of Animals and Plants, by Dr. Th. Schwann, Professor in the University of Louvain," published in Berlin in 1839. My translation of it is that made in 1847 by Dr. Henry Smith, of London, for the Sydenham Society; it runs thus (p. 193):—"The question, then, as to the fundamental power of organised bodies resolves itself into that of the fundamental powers of the individual cells. . . . These phenomena may be arranged in two natural groups: first, those which relate to the combination of molecules to form a cell; secondly, those which result from chemical changes either in the component particles of the cell itself or in the surrounding cytoblastema, and may be called *metabolic* phenomena (*τὸ μεταβολικὸν*, implying that which is liable to occasion or suffer change)." The italics are in the original. Here, then, so far as I know, is the first use of the term "metabolic," though undoubtedly not the first occurrence of the conception of chemical changes in living matter. Schwann uses the term "metabolic" exactly in its present-day sense, the phenomena of change, interchanges, of material in and by living matter.

The year 1839 may be taken as the date of the introduction into biological terminology of the expression "metabolic," and the person Theodore Schwann, at one time professor in the ancient University of Louvain.

As soon as I came across Prof. Bayliss's statement I wrote to him pointing out what seemed a use of "metabolic" earlier than 1883. Not possessing the work in the original, I asked Prof. Bayliss what was the exact word translated "metabolic," as I wished to know whether it was any derivative of "Stoffwechsel," the present-day German word for "metabolism." Prof. Bayliss replied at once to say that he had found the original passage, which he kindly transcribed for me as follows:—"Zweitens, Erscheinungen, die sich auf chemische Veränderungen, sowohl der Bestandtheile der Zelle selbst, als des umgebenden Cytoblastems, beziehen, diese kann man *metabolische* Erscheinungen nennen (τὸ μεταβολικὸν) was Umwandlung hervorzubringen oder zu erleiden geneigt ist."

"Metabolische," and not any derivative of "Stoffwechsel," is, therefore, the word employed. This is not the only passage in which Schwann uses the word; on p. 197 he speaks of "metabolic power," and again later, in contrasting a crystal and an organism, he remarks that the metabolic properties are "quite peculiar to cells." The word occurs twice more at the close of this remarkable chapter.

As the origin of anything cannot fail to be interesting, and as the word "metabolism" is so very much used in biological exposition, I have thought it well to ask you to publish these remarks.

D. FRASER HARRIS.

Cultural Amœbæ from the Intestine of Man.

I SHOULD like to thank your reviewer for his commendatory remarks in NATURE of December 21, 1916, on the account of the parasitic Protozoa which I contributed to the "Animal Parasites of Man." Without in any way wishing to raise a discussion, I think it should be pointed out, in respect to his statement about *Amoeba limax*, that much information concerning these cultural organisms that may occur in the human intestine will be found under the designation "cultural amœbæ" on pp. 42, 618, 742 and 743 of my work. As your reviewer rightly infers, *A. limax* is not now strictly the name of a single species, but rather of a group or type of free-living forms which show differences among themselves, but can be cultivated on artificial media. It is not easy to point out marked differential characters between them and Entamœbæ, especially after consideration of the work of Drs. Williams and Calkins, to which reference is made by me on p. 42 and pp. 742 and 743 of the book.

H. B. FANTHAM.

Cambridge.

DR. FANTHAM has given information concerning the culture of "cultural amœbæ," and mentions (p. 618) that they are non-pathogenic, but beyond the statement (previously overlooked), on pp. 42, 743, that they exhibit morphological variations there is no note of their characters. The account does not therefore afford adequate help to those who, during microscopic examination of a stool, find for the first time amœbæ with a very large karyosome, and desire to know what they are. Although amœbæ of the *limax* type exhibit variations under different methods of culture, as described by Williams and Calkins, reference might have been made to the striking karyosome by which amœbæ of this type, as found in the human intestine, are often distinguishable. In view of the frequent references in recent literature to "amœbæ of the *limax* type," some account under this designation might have been given, *e.g.* on p. 42, following the account of the morphology of species of Entamœba from the intestine.

THE REVIEWER.

FLOUR STANDARDS.

REFERENCE was made in NATURE of November 23 and 30, 1916, to the Order directing that millers shall increase the yield of flour from wheat by about 5 per cent. The result was that the corresponding proportion of "offal" was mixed in with the flour. An Order has now been made to the effect that a further 5 per cent. *must* be added to the flour. This may be done either by taking another five parts of offal for that purpose, or (and this is a most important new departure), at the miller's option, by adding five parts of flour derived from barley, maize, rice, or oats. In addition, he *may* add voluntarily another five parts, making ten parts in all over and above the previous increase in flour yield of seventy-one to about seventy-six parts of flour from 100 parts of wheat. The result is a compulsory 10 per cent. or a voluntary 15 per cent. more bread with the use of the same quantity of wheat.

In his article in NATURE of November 30, the present writer deprecated any further addition beyond the first 5 per cent., except in case of dire necessity, because of the deterioration in quality of the resultant flour. The necessity has apparently arisen, but the use of flour from other cereals is a valuable alternative in the present difficulty. Except for the absence of gluten, barley and the other flours indicated will not differ greatly from wheaten flour. They will not of themselves have rising power, and consequently the gluten of the wheaten flour present will have to buoy up the whole loaf during fermentation. But, on the other hand, there will be an absence of the proteolytic and starch-converting enzymes which are so active in the whiter portion of the offal of wheat, and act so adversely on the gluten and starch of the flour.

So early as January, 1915, the *Lancet*, in a leading article, suggested the use of cornflour in order to eke out the wheat supply. In consequence some experiments were made by Lieut. W. Claude Jago, the results of which were published in the *Lancet* of February 13 of the same year. Loaves of bread were baked from (1) London household flour only, (2) a mixture of ninety parts of the same flour and ten parts of cornflour, and (3) a mixture of eighty parts of the flour and twenty parts of cornflour. The bread from the mixtures was slightly less in volume, but fairly equal to that from the flour only in texture and appearance. This judgment was confirmed by the editor of the *Lancet*, who stated that the loaves "appeared to be quite acceptable." Cornflour is, of course, maize starch, and is manufactured very largely in the United States. If this variant of maize flour be permitted, its employment will result in a considerably larger yield of bread and of a type which will accord with the reasonable tastes and requirements of the British public.

WILLIAM JAGO.

MORTALITY TABLES AND EXPECTATION OF LIFE.

IN NATURE of July 6 (xcvii., pp. 383–384) reference was made to a statement by Dr. W. W. Campbell, president of the American Association for the Advancement of Science, that recent discoveries in preventive and curative medicine had increased the average length of life by many years, and that the increase so caused had been great for those healthy men whose lives had been accepted as risks to be insured by life assurance companies. While it was admitted that there was a high probability in favour of that conclusion, it was also pointed out that the tables in existing use had been available for fifteen years only, and that the time had not come for them to be superseded by fresh observations. Upon this Dr. Campbell stated in NATURE of September 21 (p. 48) that the data upon which those tables are founded go back to the thirty years from 1863 to 1893, and do not therefore give full effect to the improvement in the duration of life which he believes has arisen during the last fifty years.

Observations recently made in America and in Australia have raised questions as to this alleged improvement which call for careful consideration. They affect principally the middle-aged man—that is, the man of forty years or more. They do not, therefore, directly negative Dr. Campbell's conclusion, which relates to persons under that age as well as to some above it. Dr. C. F. Bolduan, who is director of the Bureau of Public Health Education in New York, is quoted in the *Lancet* and the *Times* as having stated in an official report that the death-rate in the United States registration area at the age period forty-five to fifty-four has increased by nearly 2 per cent. during the last ten years, and that between fifty-five and sixty-four by nearly 7 per cent. When these figures are compared with those representing the variation in death-rates between 1850 and 1900, as given in Mr. Gore's report to the New York International Congress of Actuaries, they acquire some significance. That report records for ages forty to forty-nine a diminution in the rate of mortality of $7\frac{1}{2}$ per cent., for fifty to fifty-nine of $7\frac{3}{5}$ per cent., and for sixty to sixty-nine of $6\frac{1}{5}$ per cent. If it is the fact that this favourable tendency has been checked at a time when not only the discoveries referred to by Dr. Campbell, but other contributory causes, such as better sanitation, have been in full operation and should have produced a further diminution in the rate of mortality, it is evident that some adverse influences are at work which ought to be investigated. Dr. Bolduan finds them in over-strain and over-eating, and a committee appointed by the Department of Trade of the Commonwealth of Australia to inquire into the causes of death and invalidity has made a report on the risks of middle age which arrives at similar conclusions.

Whether a like reaction is observable in this country may be doubted. The report of Mr. Warner to the actuarial congress mentioned above showed that, as between the investigation of the Institute of Actuaries ending in 1863 (termed H^M) and that of the Assurance Companies ending in 1893 (termed O^M), the expectation of life for males uniformly increased—at age forty from 27·4 years to 27·9; at age fifty from 20·3 to 20·6; at age sixty from 13·9 to 14·1; at age seventy from 8·5 to 8·7. It is unfortunate that the body of experience available relating to female mortality is insufficient for a similar comparison to be made, for there is reason to think that female life is now passed in better hygienic conditions than formerly.

The remedy suggested in America and Australia consists in a campaign against avoidable adult mortality; but there is some force in the caution of the *Lancet* that risk lies in the direction of faddiness.

PROF. THOMAS PURDIE, F.R.S.

THE value of a close, sympathetic relationship between professor and student is perhaps not fully recognised, and certainly can be properly appreciated only when it has formed part of a personal experience. The power of winning the affection and confidence of young men was a marked feature of the personality of Prof. Purdie, whose death was announced in NATURE of December 21 last; and no record of his life, however slight, would be complete without special reference to the wonderful insight and understanding that bound him to his students. During the twenty-five years he occupied the chair of chemistry in St. Andrews he devoted himself to the development of character in the undergraduate quite as much as to the simpler duty of converting him into a chemist.

Purdie's early experience in life enabled him to escape the limitations frequently imposed on the specialist. Born at Biggar in 1843, he spent seven years of his youth in South America, where, under conditions which were always primitive and often dangerous, he lived an active, open-air life. All his time, however, was not spent in the saddle. The flora of the pampas and the minerals of the hills claimed his attention and interest, and aroused the spirit of inquiry which was never thereafter quenched. On his return to this country at the age of twenty-seven, definite direction was given to these scientific instincts by a conversation with Huxley while walking under the cliffs at St. Andrews, and probably to this impetus can be traced his subsequent career as a chemist.

After studying at the Royal School of Mines under Frankland, he went to Würzburg, where he came under the inspiring influence of Wislicenus, and a close and lasting friendship sprang up between the two men, who had much in common. His teaching experience was gained at South Kensington and Newcastle-under-Lyme, and in 1884 he was appointed to the vacant chair at St. Andrews. The University must for all time be grateful to the electors for their choice. Cramped accommodation, imperfect equipment, and the fact that chemistry had then no official

place in the curriculum were not regarded by him as insuperable difficulties. Original papers, many of which bore the names of students to whom he had communicated the spirit of research, flowed in steady succession from St. Andrews. Fifteen years ago he put into operation a scheme which had long been in his mind. He presented to the University a fully equipped research laboratory. This building, although erected in memory of his uncle, will always be regarded in St. Andrews as the outward symbol of Purdie's life-work. With rare foresight the laboratories were made self-supporting by means of a generous endowment. This not only enables students to work free of charge, but can be used to assist them to remain at the University after graduation. In the best sense of the expression, Purdie founded a "research school." His publications on optical activity, on the process of alkylation, and on the chemistry of sugars, apart from their intrinsic importance, must be regarded as models of accurate scientific work.

Not only the successful student, or those who made chemistry a special study, drew inspiration from Purdie. His arresting personality, his eloquence in the lecture-room, and his philosophic treatment of the subject attracted men from every faculty, who now remember gratefully all they owe to him.

The severe handicap of periodic attacks of asthma he bore uncomplainingly and with characteristic cheerfulness. His sympathies were immense; his door was never closed, his help never denied, to one in trouble. His tastes were simple and his interests varied. During vacations he travelled extensively or plied his rod on Highland lochs, and, as was once said of him, "on the links he played a good game—for a professor." Although he retired about eight years ago, he may be said to have died in harness, for the department he created and the work of the University he loved remained absorbing interests to the end.

Recognition and honours came to him, and he must have had the satisfaction of looking on his work and finding it good; but what he probably prized most in his official life was the warm feeling he aroused in his students—a feeling which no St. Andrews man would wish to remain unexpressed. J. C. I.

DR. N. H. J. MILLER.

IT is with deep regret that we record the sudden death of Dr. N. H. J. Miller, at Harpenden, on Friday, January 12, from heart failure. Dr. Miller had worked for many years at Rothamsted; he began under Lawes and Gilbert, having gone there in 1887 direct from college, and continued up to the day of his death. His chief work was the measurement of the amount of the combined nitrogen brought down in the rain, and of the amounts of nitric nitrogen washed out from the soil. Both measurements were indispensable for the settlement of important controversies in agricultural chemistry.

Liebig had argued that plants derived their nitrogen supply from the ammonia brought down in the rain, and supported his view by analyses which seemed to bear it out. He therefore urged that nitrogen need not be artificially supplied. "If the soil be suitable," he wrote, "if it contains a sufficient quantity of alkalis, phosphates, and sulphates, nothing will be wanting. The plants will derive their ammonia from the atmosphere as they do carbonic acid." Had this view not been promptly controverted, it might have done untold harm to the new science and industry of artificial manuring by giving it a wrong turn at the outset, for Liebig's position was very exalted.

Lawes and Gilbert were unable to accept this statement, because they knew that in practice plants did require nitrogenous fertilisers, but they were equally unable to refute it because they had only isolated analyses of rain-water to go upon. The pioneering work of Warington had shown its improbability, but only a long-continued series of analyses could finally dispose of it. This Miller undertook, and he continued the work without intermission for thirty years. A large gauge was erected at Rothamsted, 1/1000 of an acre in extent, and he himself analysed a sample of every collection of rain. The results completely and finally disposed of Liebig's erroneous view, and they have provided a remarkably continuous set of observations on the composition of rain which is never likely to be excelled. Nowhere else is there an unbroken series of analyses extending over so long a period made by one and the same man.

The analysis of the drainage water settled equally conclusively a difficult and fundamental problem in soil chemistry. It was known that uncropped soils suffered a loss of nitrogen through the effect of weather, but the extent and nature of the loss were not known. In any single year it is too small to be investigated, and the only hope of success is to follow the change for a long period on the same plot of land. This Miller did on the drain gauges. All the drainage water was collected and analysed and the nitrate determined; the results showed that the land lost in the form of nitrates from 35 to 40 lb. of nitrogen per acre per annum. After the work had continued for many years all these annual losses were added together, and a sample of soil was taken for the determination of the total nitrogen; this was compared with the initial amount so as to give the loss. To the great satisfaction of Dr. Miller and those who had followed the experiment, the loss of nitrogen thus directly determined agreed within 10 per cent. with the amount of nitrate washed out. The result not only demonstrated the accuracy of the working, but it showed that in these conditions the loss is mainly due to the leaching out of nitrate. Miller's detailed analyses show how the loss is distributed and provide a wealth of material for discussing the many important problems connected with it.

The work was tedious and would have been impossible for anyone with less patience and in-

spired with less conscientious ideals. But Miller knew the importance of getting the figures right, and spared no pains to keep his records unbroken.

Dr. Miller was deeply interested in the literature of agricultural chemistry, and unreservedly placed his knowledge of it at the disposal of his colleagues. For many years he did nearly the whole of the abstracting in agricultural chemistry for the Chemical Society, and of late years he wrote the society's annual report on the progress of this subject. He will long be remembered as a painstaking, accurate worker—unhasting, unresting—who, having undertaken a long investigation, would not relinquish it until he had finished it.

E. J. RUSSELL.

NOTES.

AT the meeting of the Royal Astronomical Society on Friday, January 12, the president announced that the council had awarded the gold medal of the society to Mr. W. S. Adams, of the Mount Wilson Solar Observatory, for his investigations in stellar spectroscopy, and especially for his determination of absolute magnitudes.

WE learn from *Science* that the Bruce gold medal of the Astronomical Society of the Pacific for the year 1917 has been awarded to Prof. E. E. Barnard, of the Yerkes Observatory, for his distinguished services to astronomy. The formal presentation will take place at the annual meeting of the society at San Francisco, on the evening of January 27.

THE disease known as "epidemic jaundice" has occurred of late on the Western front. It is caused by a delicate spiral microbe, or spirochæte, which is present in the blood and tissues in small numbers at certain stages; it was discovered by Inada and other Japanese observers in 1914. The organism probably has its natural habitat in the rat, from which man becomes infected either by direct contact or possibly by insect-carriers.

THE death is announced, in his seventy-first year, of Dr. T. H. Bean, a former president of the American Fisheries Society. He was for many years connected with the U.S. Fish Commission, and was curator of fishes at the U.S. National Museum from 1880 to 1887. He was director of the New York Aquarium from 1895 to 1898. Since 1906 he had been fish culturist of the State of New York. Dr. Bean was the author of several volumes on ichthyology.

MR. UDNY YULE, one of the honorary secretaries of the Royal Statistical Society, has been appointed head of the Information and Statistical Bureau of the Ministry of Food. With Mr. Yule will be associated Prof. T. B. Wood, Drapers professor of agriculture in the University of Cambridge, and Prof. W. H. Thompson, professor of physiology, Trinity College, Dublin.

THE Food Controller announces that he has appointed a committee to make such arrangements as may be necessary and expedient for the increase of supplies of fertilisers in the United Kingdom and for controlling, so far as may be necessary, their output and distribution. The following are the members of the committee:—Capt. C. Bathurst, M.P. (chairman), Mr. H. R. Campbell, Sir James J. Dobbie, Mr. R. R. Enfield, Capt. R. B. Greig, Mr. T. H. Middleton, Mr. W. Anker Simmons, Prof. W. Somerville, Mr. G. J. Stanley, Mr. R. J. Thompson, and Prof. T. B. Wood. Mr. H. Chambers will be the secretary to the committee.

THE council of the Geological Society has this year made the following awards:—Wollaston medal, Prof. A. F. A. Lacroix (Paris); Murchison medal, Dr. G. F. Matthew (Canada); Lyell medal, Dr. Wheelton Hind (Stoke-on-Trent); Bigsby medal, Mr. R. G. Carruthers (H.M. Geological Survey); Wollaston Fund, Dr. P. G. H. Boswell (Imperial College of Science); Murchison Fund, Dr. W. Mackie (Elgin); Lyell Fund, Dr. A. H. Cox (King's College, London) and Mr. T. C. Nicholas (Trinity College, Cambridge); Barlow-Jameson Fund, Mr. H. Dewey (H.M. Geological Survey).

PROF. AND MRS. HERDMAN have recently established and endowed an institute at Port Erin, Isle of Man, as a memorial to their son, Lieut. George A. Herdman, who was killed in action near Montaubon, in the battle of the Somme, on July 1, 1916. Lieut. Herdman spent a great part of his boyhood at Port Erin, associating with the local fishermen and working at the Marine Laboratory, and was well known there. The institute has been handed over permanently to the Commissioners of Port Erin. It is intended for the rest and social intercourse of the men, boatmen, and fishermen of the port, and to extend hospitality to fishermen, yachtsmen, and sailors visiting the harbour. Arrangements are made for the provision of refreshments and recreation, and opportunities for mutual self-education are being given by the collection of a library of works on navigation, fisheries, and general science. The institute was formally opened by Prof. and Mrs. Herdman, and is now available for the men.

PNEUMONIA is a disease of great importance to South African mining communities, contributing from 30 to 60 per cent. of the total mortality among native mine labourers. An exhaustive investigation upon the disease was conducted in 1911 and 1912 by Sir Almroth Wright and co-workers, and he recommended inoculation with pneumococcus vaccine as a preventive. Dr. F. S. Lister has now completed a further experimental study of the subject. He finds that several races of pneumococci are associated with pneumonia in the Rand, and that rabbits inoculated three times with killed pneumococcal vaccine in suitable doses are resistant to at least eight times the lethal dose of living pneumococcus for an untreated rabbit. For the prevention of the disease in man he recommends that three inoculations, at seven-day intervals, should be employed, each dose consisting of 6000 million pneumococci of each strain against which immunity is desired (the South African Institute for Medical Research, No. VIII., 1916).

THE death is announced in the *Morning Post* of Vicomte Charles de Foucauld, the French traveller and scholar. Thirty-five years ago Foucauld resigned from the French Army to travel in Morocco. In the disguise of a Jew merchant he explored parts of the Atlas region which were, and still are, closed to Christians. An account of these travels, entitled "Reconnaissance en Maroc," was published in 1888, and is still regarded as a standard work. It contains invaluable sketches and views and geographical information collected at great risks. After a brief period of travel in the Caucasus, Foucauld became a Trappist monk and returned to Africa. He visited the Targui country, explored it for several years, and collected a vast amount of information on the language, customs, and literature of its people. Later he elected to settle in the desert, and for several years had lived at Tamanraset, half-way between Algeria and French Guinea, where he devoted himself to a study of the country and its people. He never attempted proselytising. Foucauld is reported to have met his death at the hands of brigands, but it is

hoped that the valuable manuscripts on the Touareg people which he was preparing may have escaped destruction.

PROF. G. ELLIOT SMITH contributes to the Journal of the Manchester Egyptian and Oriental Society for 1915–16 an important paper on "Ships as Evidence of the Migrations of Early Culture." In this commentary upon certain aspects of the history of shipbuilding, he lays special stress upon the factors which influenced the early development of the shipbuilder's craft in Egypt. "I have indicated how the dug-out became transformed when more efficient tools enabled the Egyptians to shape the vessel, and add beams, at first tied to its sides, to increase its capacity. The shape of the papyrus-boat determined the earliest form of the ship; and the Egyptian conception of the vessel as a living thing led to subsequent modifications in its build. All of these features, with distinctive methods of rigging and steering, represent so many tokens of characteristic Egyptian inventions which can be recognised whereon ships have been built."

THE current number of the *Quarterly Journal of Microscopical Science* (vol. lxii., part 1) contains a very complete and interesting account of the development of *Alcyonium digitatum* by Miss Annie Matthews. As this common British species forms the usual laboratory type of the Alcyonaria, an up-to-date description of its development will be of great value to zoological students, and Miss Matthews's work is not only up to date, but also readable. One of the most interesting features of the development is the occurrence of additional, imperfect mesenteries in the primary polyp, a very remarkable fact in view of the constancy with which the normal eight mesenteries occur throughout the entire group, possibly indicating an ancestral condition in which many mesenteries were present. Much light is also thrown upon the order of appearance of the polyps in the young colony, and upon many details of development.

AN important paper on the early larval stages of the fresh-water eel (Anguilla) and some other Atlantic Murænoids, by Dr. J. Schmidt, appears in *Meddelelser fra Kommissionen for Havundersogelser, Serie Fiskeri*, Bind v. The author has had the good fortune to obtain a number of specimens of between eight and nine millimetres in length, which are carefully described and figured. He also describes and figures numerous specimens of the American eel, *A. rostrata*, and a number of Leptocephalid forms which he regards as new species. He gives some valuable figures illustrating the development of the hypural bones, and a number of others, greatly enlarged, showing the teeth during these early stages. As to the nature of the food seized by these teeth, and the precise use of the anterior grasping teeth, which are long, median in position, and forwardly directed, nothing appears to be known.

THE *National Geographic Magazine* for November, 1916, is devoted to the description of the larger American mammals, and is illustrated by no fewer than thirty-two coloured plates of remarkable beauty by Louis Agassiz Fuertes, and in addition to these are a number of uncoloured plates of no less merit. The text is by Mr. E. W. Nelson, the assistant-chief of the U.S. Biological Survey, and is thus in every way worthy of the illustrations. The descriptions are of necessity brief, but they are sufficient to furnish a survey of the salient features of each of the species described, its haunts, range, and numbers. We regret to note that the prong-horn antelope is almost as much in danger of extermination as the sea-otter. Having regard to the jealous guardianship which is now displayed over the native fauna, it is surprising to be told that complaint has to be made of "the despicable work of poachers, who are shooting elk [wapiti] for their two canine teeth, and leaving the body to the coyotes." Information has been received that more than 500 were ruthlessly slaughtered for this purpose about the border of Yellowstone National Park during the winter of 1915–16 In referring to the size of the bull sperm-whale no mention was made of the very great disparity in size between the male and the female, nor is any mention made of the teeth of the upper jaw of the male.

WE regret to learn that that old-established and very useful journal, the *Zoologist*, ceased to exist with the issue of the December number. In name, at any rate, it still survives, since it has been incorporated with *British Birds*, published by Messrs. Witherby and Co. All other branches of natural history which found a place in the *Zoologist* will, however, now be excluded. This we gather from the January number of *British Birds*, which, at the same time, makes the welcome announcement that in future its pages will be open to articles and notes on the avifauna of other parts of the western portion of the Palæarctic region, or, in other words, of Europe and North-West Africa. This number includes some valuable observations "On the Breeding Habits of the Red-backed Shrike," by Mr. J. H. Owen. The author believes that the cock is responsible for the "larder" peculiar to the shrikes, and that it is usually made during the incubating period, presumably for the use of the female. The indigestible parts of the food are thrown up by the young birds, he remarks, in the form of pellets. These are often so large that the very young birds are unable to expel them, so that they have to be drawn out of the mouth by one of the parents. Both birds take part in cleaning the nest, and the excrement for the first few days is swallowed by them, but later it is generally carried away and dropped at a distance from the nest.

ACCORDING to the *Chemical Trade Journal* of December 30 the Trade and Industry Committee of the Royal Colonial Institute has investigated the properties of the grass lalang, which is found in large quantities close to the coasts of Malaya, as a possible paper-making material. The grass, which can be obtained for the mere cost of collection, is shown by chemical analysis to be capable of yielding a good quantity of cellulose, quite suitable for the manufacture of paper. It is very susceptible to the action of dilute alkalis, but the final product is unusually pure and readily resolved. After washing, the pulp obtained is uniform in quality and of good colour, and, subject to judicious treatment for the improvement of the latter, it would furnish a paper very suitable for printing purposes. A high-class wrapping paper, strong, and having a comparatively high resistance to folding, would be obtained by using a mixture of half lalang grass pulp and half cotton beaten together.

THE November issue of the *Journal of the Board of Agriculture* contains a useful summary of experimental work with palm-kernel cake carried out during the past year by Prof. C. Crowther and his colleagues in the Agricultural Department and Institute for Research in Animal Nutrition of the University of Leeds. The work includes studies of the palatability, digestibility, and keeping properties of the cake, together with an examination of its effects upon the yield and composition of milk and butter. Apart from an initial reluctance of the animals to eat the cake, which was traced to difficulties of mastication, the

results were generally favourable, and demonstrated that the cake possesses qualities which should secure its permanent inclusion in the list of feeding-stuffs widely used on British farms. Further work with palm-kernel products is reported by Prof. C. Crowther in the December issue of the same journal, in an account of a practical feeding experiment with pigs, carried out on behalf of the Co-operative Wholesale Society at their farm near Clitheroe. In this experiment with three groups of eighteen pigs each, palm-kernel cake and extracted palm-kernel meal were compared with the grade of milling offals known as "thirds." The cake proved an efficient and economical substitute for "thirds," and appreciably superior to the meal. These results should usefully supplement the great efforts now being made to secure for this country the palm-kernel crushing industry, the great importance of which from Imperial and national points of view was strikingly revealed in the recently issued report of the Edible Nuts Committee of the Colonial Office.

AN article on river frontiers in Europe, by Prof. L. W. Lyde (*Scottish Geographical Magazine*, xxxii., pp. 545–555), is an able rejoinder to Sir T. H. Holdich's well-known views on the subject. Prof. Lyde holds that as war is not a normal condition, it is surprising that the accepted theory of frontiers is essentially a military one, the object of which is not to effect an international equilibrium across it, but to make international intercourse, peaceful or otherwise, impossible. Prof. Lyde maintains that the principle of democracy is sufficiently mature to demand that boundaries should make for peace as well as for security. A navigable river encourages peaceful intercourse, and so has a civilising influence which cannot be said of any barrier which keeps peoples apart. Sir T. H. Holdich admits that a river makes a good boundary except on its plain course. But this contention, Prof. Lyde says, must be modified in the light of events in the present war. The Danube proved to be an absolute defence to Belgrade during four months in 1914, and in the great Russian retreat rivers backed by railways were defensive positions of enormous strength. Prof. Lyde cites the Plate, the St. Lawrence, and the lower Danube to show that a navigable river does not of necessity form an unstable boundary and become the property of the most pushing nation on its banks. Again, economic equilibrium, a necessary factor in international equilibrium, is more likely to result from a river frontier, as that will hold a fair balance of the mineral and other wealth on either side. The author holds that if the new map of Europe is based on purely military lines, Europe will have to expiate it once more on purely military lines.

MR. E. L. TROXELL traces back the one-toed horse to a new species, *Pliohippus lullianus*, discovered by him in the Lower Pliocene of S. Dakota (*Am. Journ. Sci.*, vol. xlii., p. 335, 1916). This horse presents the unique feature of an ulna unfused at any point with the radius.

AN interesting case of the replacement of calcite by iron pyrites as the cementing material of a sandstone is given by Mr. T. A. Jones in a note on Permo-Triassic sandstones of South-west Lancashire (Proc. Liverpool Geol. Soc., vol. xii., p. 257, 1916). It may be remembered that even quartz has been thus replaced during the formation of concretions in certain Karroo sandstones (see NATURE, vol. xcv., p. 216).

GEOLOGISTS interested in the much-discussed stratigraphy of New Zealand will find new material concerning the junction of Cretaceous and Cainozoic horizons in a paper by Mr. P. G. Morgan ("Notes of a Visit to Marlborough and North Canterbury, with especial reference to Unconformities post-dating the Amuri Limestones," Geological Survey, N.Z., tenth annual report (1916), p. 17). The unconformities traced by the author do not, as the title might imply, assign a date to the Amuri Limestones, but are above this horizon, and the lowest one divides the upper limestone from the Weka Pass Stone. This break is shown to be widespread, but, like the others, may not be continuous throughout New Zealand.

A "CATALOGUE of the Collection of Meteorites" belonging to the Geological Survey of India, and preserved in the Indian Museum in Calcutta, is given by Mr. J. Coggin Brown in the Memoirs of the Geological Survey of India (1916, vol. xliii., part 2, pp. 149–287). The private collection of the late R. P. Greg, purchased in 1865, formed the nucleus of this collection, which now represents 379 meteoritic falls, and is the largest in Asia. Previous catalogues were prepared in 1867 by Thomas Oldham, and in 1879–80, with a supplement in 1901. The main part of the present catalogue is occupied by an alphabetical list of the specimens arranged under the geographical names of the falls. There are brief descriptions of the individual specimens and their weights are recorded. A second short list gives an outline of the Brezina classification of meteorites, with the names of falls represented in the collection under each of the seventy-four groups.

AMONG the Memoirs of the National Academy of Sciences of Washington (1916, xiv., pp. 1–29) Dr. G. P. Merrill, the head curator of geology in the United States National Museum, has recently published a report on researches on the chemical and mineralogical composition of meteorites, with especial reference to their minor constituents. When preparing an earlier paper on a similar subject he had been struck with the comparatively small number of trustworthy analyses available, and the apparent similarity in, and simplicity of, the composition of meteorites. At his instigation careful analyses were made of twenty typical meteorites, ranging from irons to stones, by Dr. J. E. Whitfield, of Messrs. Booth, Garrett, and Blair, in Philadelphia, and the results obtained are tabulated, and in some instances compared with those published by earlier workers. Occasionally considerable discrepancies were revealed, the most remarkable being in the case of the Collescipoli stone, in which none of the rare elements noted by Trottarelli could be found; on the other hand, whereas the latter gives nearly 8 per cent. of sulphur, Dr. Whitfield found none, and yet in the description of the stone the presence of metallic sulphide is noted. The analysis of meteorites is a task calling for care, skill, and unlimited patience owing to the paucity of material usually available and the necessity for testing for so many elements which can only be present in extremely small amounts, and it should, moreover, be combined with a careful microscopic examination of thin sections; obviously such work can only be undertaken as a labour of love.

SOME excellent specimens of the important tungsten ores, wolframite and scheelite, have just been received at the Imperial Institute from the Federated Malay States, and can be seen in the Malay Court of the Exhibition Galleries. As is now well known, the most important use of tungsten ores is in the manufacture of tungsten steel, of which large quantities are now being employed in munition factories in Sheffield and elsewhere in the manufacture of high-speed tools and for other special purposes. Tungsten is also used in the form of wire in the manufacture of metallic filaments for electric lamps. Wolframite, commonly called wolfram, which forms the

bulk of the tungsten ore produced, occurs in various parts of the main mountain range in British Malaya, and in Pahang and Trengganu. Scheelite is mined in Perak and Selangor.

THE current issue (vol. xlvii., part 3) of the Records of the Geological Survey of India contains a review of the mineral production of India during 1915, compiled by the Director of the Survey. The results may fairly be described as satisfactory, having regard to the conditions set up by the European War. The total value of the mineral products shows an increase of more than 700,000*l.* above that for 1914, some of this increase being undoubtedly due to the higher prices obtained for many of the products. The most important of these, however—coal—actually shows a decrease in value of 126,000*l.*, although the output has risen from 16,464,000 tons to 17,104,000 tons, due to the lack of sufficient shipping to transport it, in consequence of which the price at the pits necessarily declined. The gold output is practically the same as in 1914, but important increases in production are shown in tinstone, wolfram, and lead ore; these minerals come almost exclusively from Burma, where considerable attention has recently been paid to the improvement of the means of transport and other facilities for the development of the mineral resources of the country. Petroleum is another mineral the production of which shows a very considerable increase. There has been a fall, on the other hand, in the output of manganese ore and iron ore; the reason for the former is to be found in the difficulty of obtaining tonnage and in the high rates of freight. In this connection it is interesting to be able to chronicle the first attempt to utilise the ore within the peninsula, the Tata Company having put a furnace on to ferromanganese, of which 2658 tons were produced. Attention may also be directed to two pamphlets issued by the Department of Mines and Geology of the State of Mysore, one giving a brief account of the mineral resources of the State, which include, in addition to gold, ores of chromium, iron, and manganese, and the other a synopsis of the laws and regulations governing the issue of mineral licences; both these publications should prove of great interest to all who are, or are likely to be, interested in mining in this part of India.

IT is well known that the factors which determine the rate of evaporation of water from the earth's surface are the depth of the surface of the water underground, the nature of the soil above this surface, the temperature and humidity of the air, and the speed with which it is moving. To a great extent the nature of the influence of each of these factors on the evaporation is known, but it has not been possible to determine the quantitative laws connecting them. The results of a research carried out by Messrs. F. S. Harris and J. S. Robinson at the Utah Agricultural Experimental Station during the past four years, and published in the United States Department of Agriculture Journal of Research for December 4, 1916, appear to justify the belief that before long these laws will have been discovered. By keeping the water level only a centimetre below the level of the surface of the sand or soil used, the authors have greatly reduced the effect of capillarity, and are able to give curves showing the effects of percentage of water in the soil, of the amount of dissolved salts in the water, of the size of grains and compactness of the soil, and of the speed, temperature, and humidity of the air on the rate of evaporation. Copies of the paper may be obtained from the Government Printing Office, Washington, at 10 cents a copy.

WHILE the name of Pappus of Alexandria is associated in the minds of modern mathematicians with Guldin in the theorem relating to the volume and area of the surface traced out by a moving closed curve, practically nothing is known of the life of the geometer himself. An introductory paper on Pappus is now given by Dr. J. H. Weaver in the December Bulletin of the American Mathematical Society. Of the eight works attributed to him, the only one extant even in part is the "Collectio," which is a summary in eight books of the works of preceding Greek mathematicians, of which Dr. Weaver gives a general account. Of this an edition was published by Hultsch, of Berlin, in 1876–78. Reference is also made to Sir T. J. Heath's article on Pappus in the "Encyclopædia Britannica," eleventh edition.

AN outline of the mathematical course of an Italian technical school is given by Prof. Virgil Snyder in the Bulletin of the American Mathematical Society (xxiii., 3). The account refers to the Reale Istituto Tecnico Superiore of Milan, where, as elsewhere in Italy, the course extends over five years, and includes a two-year course in mathematics, physics, and chemistry, as also in Italian and two other languages. Candidates for admission are required to be familiar with plane and solid geometry, plane trigonometry, algebra including determinants, theory of equations, graphical processes, and elementary projective geometry. Differential calculus is only commenced as a portion of a heavy course in the first term, and integration in the second term is taken by the students, together with an extensive discussion of analytical solid geometry.

WHEN all the roots of an algebraic equation are complex with modulus unity, it is fairly evident that the equation must be reciprocal. Writing in the *Tohoku Mathematical Journal* (x., 3), Mr. A. Kempner, of Urbana, U.S.A., gives certain extensions of previous work relating to equations having roots of this special form, and in particular proposes a simple proof of the theorem that if *one* such pair of roots exists the equation must be reciprocal provided that it is irreducible in the domain of rationality formed by the coefficients. The journal contains the usual summary of new books and contents of mathematical periodicals, of which the latter form a very useful reference catalogue of current mathematical literature. We could wish, however, that this portion, appealing as it does to readers of all nations, did not contain so much matter in Japanese characters, or that a translation were given in English or French.

WE have received an official publication of the Government of South Australia entitled "An Investigation into the Prospects of Establishing a Paper-making Industry in South Australia," by Mr. W. A. Hargreaves, being Bulletin No. 1 of the Department of Chemistry, of which the author is director, and "issued under the authority of the Hon. R. P. Blundell, Minister of Industry." Of indigenous raw materials for paper-making Australia presents a conspicuous dearth, and Mr. Hargreaves's conclusion from his exhaustive investigations is that the only immediate industrial proposition is the utilisation of cereal straws: lime-boiled for "strawboards" and caustic-boiled for "cellulose" papers—*i.e.* for printings and writings; in the latter case the paper-furnish requiring from 30–40 per cent. of bleached wood cellulose, which means an imported raw material. The cost of production of the bleached straw pulp from the hypothetical works' cost-sheets is 7*l.*–8*l.* per ton; the process described and "costed" is based on the caustic-soda boil, with 80 per cent. recovery, and the assumption that "the losses of caustic soda are made up

with sodium sulphate, because it is cheaper." There is no reference to the consequent modification of the entire scheme in terms of the main product (cellulose) and of the offensively malodorous volatile by-products. To the main report is appended one by Mr. D. C. Winterbottom on "Supplies and Cost of Raising 'Marine Fibre,'" the remarkable product of *Posidonia australis*. For the industrial utilisation of this product more than one "promotion" has been attempted; according to the author, two of these survive, of which the Posidonia Fibres Syndicate is producing six to seven tons per week at Port Broughton. On his estimate of the costs of dredging, etc. (4*l*. 10*s*. 6*d*.), and subsequent handling, the clean, air-dry fibre cannot be produced to sell at less than 17*l*. per ton. A second appendix, by Mr. J. C. Earl, on the paper-making value of various South Australian raw materials, deals with six indigenous products of little promise.

WAR problems and after-the-war problems are discussed by writers of every varying shade of opinion in *Scientia*, the Italian equivalent of our own *Science Progress*, but which exhibits a more international tendency by publishing French translations of English and Italian articles. Thus Prof. Sayce (xix., 5) considers that the history of the Assyrian empire under Tiglath Pileser and his successors affords a lesson as to what may be expected from a military nation imbued with the spirit of world-conquest. In the same number Prof. Roberto Michels, of Turin and Bâle, deals with the demolition of the international labour movement. Prof. Knut Wicksell (Lund, Sweden) discusses the influence of over-population in stimulating wars, and expresses the somewhat sanguine prophecy that with the present decline of the birth-rate in European countries peace conditions may become more possible (xix., 6). Prof. A. Pillet, of Paris (xx., 12), considers that the problem of the war from the Allies' point of view involves the entire crushing of the German Empire. Peace conditions and what is to happen after the war form the subject of speculations at the hands of Prof. E. Catellani, Padua (xx., 8), and E. Cecotti, Messina (xx., 6). Sir Alfred Hopkinson (xx., 12), while emphasising the strict adherence to the principles of international law in the operations of the Allies, blames the neutral countries for not taking action in enforcing the observance of similar principles on the enemy. But an attempt is made to apply the methods of exact science to the problem of when and what offers of peace should be made by a victorious belligerent, in a paper on "The Economic Dynamics of War," by Prof. John Bates Clark, of Columbia University. In his opinion the time for making the offer is when the gain to be derived from continuing the war is more than outbalanced by the sacrifice required for its continuance. And the terms to be exacted from the vanquished side should consist of all that the prospective victor could gain by pushing his conquest to the bitter end *minus* the cost of so pushing it. If these terms are offered and can be secured there is no advantage for either side to continue the struggle.

THE Open Court Company will publish very shortly a translation, from the first edition, of "The Geometrical Lectures of Isaac Barrow." The work will contain a portrait of Barrow, and an introduction and notes by J. M. Child.

OUR ASTRONOMICAL COLUMN.

AURORA BOREALIS.—Mr. Denning writes that though the moon was nearly full on the evening of January 4 there was a brilliant occurrence of aurora observed from widely distant stations. The Rev. W. F. A. Ellison observed it from Fethard-on-Sea, near Waterford, and describes it as a particularly magnificent display. From Edinburgh, at about 10 p.m., there was also a fine exhibition, extending along a considerable range of the northern horizon. Rapid variations were apparent in the details, the light alternately appearing and disappearing. Clouds were very prevalent at low altitudes in the northern region, and the glow spread upwards from behind these with striking effect. At Bristol there was an auroral glow between about 8 and 9 p.m., and at 8.30 a bright streamer shot upwards to about 15° W. of the Pole star. But the appearance was rendered somewhat inconspicuous by the unusual brilliancy of the moon, due to the very clear atmosphere.

Dr. A. A. Rambaut, Radcliffe Observatory, Oxford, sends us the following notes of observations of this aurora made by Mr. W. H. Robinson at that observatory, and also of the bright meteor of the same date, referred to in last week's NATURE (p. 379):—A bright haze in the northern sky attracted considerable attention at Oxford soon after 8 p.m. on January 4. A long segment of an auroral arch lay along the horizon, with its apex at a small altitude in the N.N.W. Isolated streamers appeared, but generally for a few seconds only. The finest display occurred at 10.15 p.m. (or perhaps a minute or so later), when streamers suddenly developed all along the arch, lasting for a very brief interval, a white haze taking its place. At about 10.15 p.m. a brilliant fireball attracted notice, which ran rapidly downwards from the direction of the moon, passed 2° or 3° east of Jupiter, and burst, with a blue colour, 10° or 15° below the planet, its trail swiftly disappearing. The light of the meteor was distinctly more intense than that of the moon. An approximate estimate places the track from 3h. 0m., +18° (first seen), to 0h. 45m., +5°.

CLOUDS ON MARS.—In the course of a report on the planet Mars, in which observations made by members of an international organisation are summarised and compared, Prof. W. H. Pickering makes several interesting references to clouds which appeared on the planet during the opposition of last year (*Popular Astronomy*, vol. xxiv., p. 639). Clouds were seen frequently by all the observers, and Prof. Pickering points out that the clouds always lie over the so-called desert regions of the planet, apparently being precipitated so soon as the fertile regions are reached. Dissolution is sometimes very rapid. Only a few years ago it was claimed by some observers that clouds were rarely or never to be seen on Mars, but during the last opposition the planet was scarcely ever seen without them. The existence of clouds in the atmosphere of Mars appears to have been first established by Sir Norman Lockyer in his observations during the opposition of 1862.

THE CEPHEID VARIABLES.—The results of some further investigations of the relations between the orbital elements of Cepheid stars have been given by Dr. Ludendorff (*Astronomische Nachrichten*, No. 4869). He finds that for several stars resembling δ Cephei, the elements are closely related, as shown in the formula

$$100e \cos \omega = -21{\cdot}8 + 0{\cdot}963(1-e^2)^{\frac{1}{2}}K^3P.10^{-3},$$

where e, ω, P are respectively the eccentricity, angle from periastron to node, and the period in days, while K is half the total amplitude of the radial velocity.

A similar formula is applicable to stars resembling ζ Geminorum, the two numbers on the right-hand side of the equation then becoming +2·4 and +0·73. Further confirmation has been obtained of the relation previously given by Dr. Ludendorff, 2K=47·3 A, where A is the range of variation in brightness expressed in magnitudes; this, however, appears to be valid only for stars of types F to G.

GEOLOGICAL WORK IN CANADA AND AUSTRALASIA.

THE Geological Survey of Canada publishes in Memoir 72 an account of "The Artesian Wells of Montreal," which is suggestive to investigators in other limestone districts. Out of 179 deep wells, only about twenty yield less than 5000 gallons a day. The water usually comes in greatest abundance from depths of 300 to 1000 ft., and rises to within 30 ft. of the surface. The chance of finding a good supply below 1000 ft. is small, and it seems that the source of the water (p. 26) is the rain that falls on the St. Lawrence highlands and lowlands and creeps into the Palæozoic sediments. This water moves in the limestone along fissures and cracks, and is held up at no particular horizon; the closing of the fissures as the depth increases is held to explain its practical absence below 1000 ft. The author, C. L. Cumming, discusses the origin and possible interactions of the dissolved salts; the proportion of sodium carbonate is high for water in sedimentary deposits (p. 48), and this salt may be derived from flow over the crystalline rocks of the Laurentian highlands.

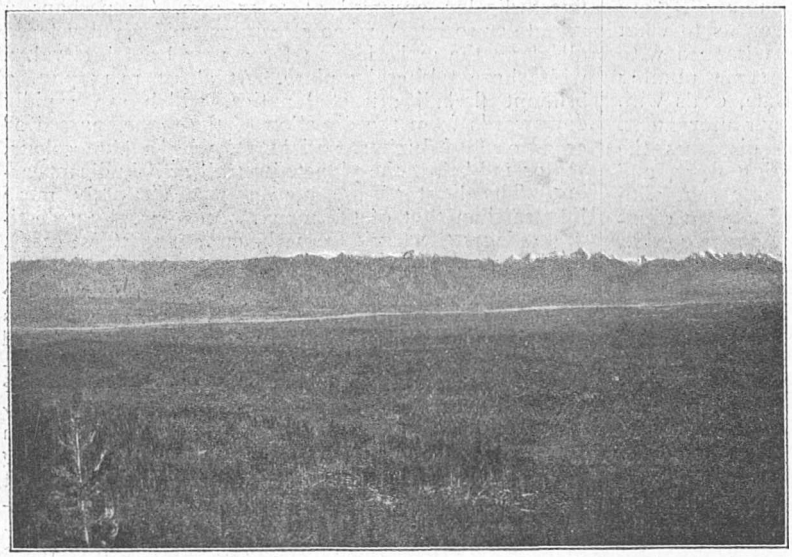

FIG. 1.—The Rocky Mountain Trench, looking east across the Kootenay River near Cranbrook, B.C. From "Geology of Cranbrook Map-Area, British Columbia."

Four considerable memoirs deal with districts in British Columbia, and are accompanied by geological maps conveniently folded in pockets at the end. Memoir 55, by J. A. Allan, on the "Geology of Field Map-area, B.C. and Alberta," covers the mountainous district on the west slope of the Rocky Mountains, where Mt. Goodsir rises to 11,676 ft., with residual glaciers on its steep north-east descent. One of the most famous stretches of the Canadian Pacific Railway lies within the area, and the continuous Cambrian section studied by Dr. C. D. Walcott in recent years occurs on Mt. Bosworth, in the north-east corner of the map. A mass of igneous rocks rich in alkalies was intruded through the older Palæozoic strata in post-Cretaceous times, and has been cut into by the valley of the Ice River. The richness of the prevalent nepheline-syenite in lime is attributed (p. 186) to its absorption of limestone at the contact-zone. The author points out (p. 42) the necessity for distinguishing cirques formed by local excavation at high levels, by the action of Russell's "mountain-side" type of glacier, from those left behind as hanging valleys. This distinction is even now worthy of emphasis, although Matthes's work on "nivation" in the Bighorn Mountains has justly attracted attention.

Toxada Island, the elongated and steeply flanked ridge that rises from the Strait of Georgia, northwest of Vancouver, is described by R. G. McConnell (Memoir 58). The main rock is a great body of porphyrite of Lower Jurassic age, which shows pillow-structure (plates iv. and v.), here called nodular structure, though it seems to be an intrusive mass. Magnetite lenses, which sometimes form low hills, have encouraged mining. They are held to be contact-products (p. 77), connected with the younger intrusive rocks, which are in part of Lower Cretaceous age.

The Cranbrook map-area has been studied by S. J. Schofield (Memoir 76), on account of the development of gold-mining in lodes in the eastern part of the Kootenay electoral division. The district is well served by railways, which connect it southward with Montana, and northward with the main Canadian highway west of Field. It includes the south end of the "Rocky Mountain Trench" (p. 10), which extends to the borders of Alaska. In this tectonic feature the Kootenay River runs southward, amid parklike and largely alluvial country, while deeply dissected mountains of pre-Cambrian sediments rise beyond Cranbrook on the west. The Rocky Mountains on the east present the appearance of a distinct range, their crests of remarkably even altitude being touched here and there with snow (Fig. 1). The composite Purcell sills (p. 75), with upper zones of micropegmatitic granite and lower gravitational zones of gabbro, have much interest for petrographers.

The singular course of the Kootenay River brings it round the Purcell Range again into British Columbia, along the flooded valley known as Kootenay Lake, and westward out of this hollow to join, and largely to form, the rapid Columbia River descending on Washington and Oregon. Rossland (Memoir 77) lies on the upper part of the Columbia, close to the International Boundary, which cares for none of the things of physical geography. The alpine landscapes here lie away upon the east, and the town has grown up in the last twenty-five years among glacially moulded and often wooded hills. From its sulphide ores the output of copper rose to a maximum in 1902. Gold is extracted from massive pyrrhotine and copper pyrites, in which it is occasionally visible in a free form. C. W. Drysdale, in this memoir of 317 pages, deals with mining matters first. The ores made their appearance (p. 92) in fissures in connection with the intrusive rocks of the Jurassic mountain-building stage, and secondary enrichment, including the rise of gold, occurred during the Miocene disturbances. The author inclines (p. 186) towards a "three-cycle hypothesis" of the development of the surface-features around Rossland, beginning with the dissection of the Cretaceous peneplane, of which very few traces now remain. The Laramide upheavals were the cause of this dissection, which continued through Eocene times. Movements in the Oligocene period led to the destruction of much of the Eocene deposits by renewed erosion; and then Miocene diastrophism, accompanied by the introduction of mineral ores, provided a surface in which broad fairly mature features were established by the close of the Pliocene period. Renewed upwarp-

ing started the present cycle, which includes the modifying erosion of the Glacial epoch. The author's treatment involves some repetition from the sketch on pp. 41–43 to the final chapter on geological history (p. 244). His views are opposed to R. A. Daly's broad conception of the Purcell and Rocky Mountain ranges as derived from the continuous dissection of the folded Laramide mass. The scenery, whether of mines or mountains, the rocks and minerals, and even the useful cores obtained from prospecting bore-holes, are well and fully illustrated.

In a paper on the "Nephelite Syenites of Haliburton County, Ontario" (Amer. Journ. Sci., vol. xl., p. 413), W. G. Foye gives reasons for believing that the syenites rich in alkalies arose in the invading granite magma in consequence of the interactions which converted the local limestone into amphibolite. The production of calcium silicates set free solutions richer in sodium than the invading granite, and these in places modified the granite mass. The field evidence adduced thus supports R. A. Daly's theory of the origin of nepheline-bearing rocks.

From Australasia we receive E. C. Saint-Smith's report on the Stanthorpe district of S. Queensland (Queensland Geol. Surv., Publication No. 243). The granites of the region show the characteristic "bouldery" weathering associated with tropical sunlight and clear starry nights. These granites and the finely grained more acid types that cut them have brought up cassiterite, wolfram, and molybdenite. The intrusion is possibly of Mesozoic age. In Publication No. 249 L. C. Ball gives a cautious description of the "Oil Shales in the Port Curtis District," where fireclays may prove to be an important asset.

E. C. Andrews (New South Wales Geol. Surv., Mineral Resources, No. 18) regards the copper lodes of the Canbelego district (p. 63) as connected with Silurian or even older earth-movements. He reports in detail on the mines, which are associated with those of the Cobar copper- and gold-field, and lie up-country more than 300 miles north-west of Sydney. On p. 62 cerussite has by an accident become included in the oxides.

R. L. Jack, with the aid of a team of camels, has explored a region between the Musgrave Ranges and the 28th parallel of latitude in South Australia (Geol. Surv. South Australia, Bulletin No. 5), and reports that the country could rear stock if a trustworthy water-supply could be obtained. He advocates (p. 35) the sinking of further wells; but the forethought required in undertaking such work is shown in the necessity for choosing "a good season, when water is obtainable to enable the first wells to be sunk." The memoir, in addition to geological data, contains papers on the flora and on magnetic observations. The Government astronomer, G. F. Dodwell, contributes maps showing the magnetic declination, inclination, and horizontal intensity in South Australia.

Bulletin No. 61 of the Geological Survey of Western Australia, by J. T. Jutson (price 2*s.* 6*d.*), is a volume for geographical libraries and for any general reader interested in colonial progress. Its title, "An Outline of the Physiographical Geology (Physiography) of Western Australia," is well borne out in its systematically written chapters. Numerous maps and landscapes illustrate the surface-features and the flora. The tropical weathering and the arid condition of the interior will impress scholars in our islands, and the memoir may well be used by those who wish to illustrate geographical principles by a new and unhackneyed field. H. P. Woodward's "Geological Reconnaissance of a Portion of the Murchison Goldfield" (Bull. 57) is of equal interest through its excellent illustrations of the country, several of which reappear in Jutson's memoir. We are thus able to realise sheet-denudation caused by sudden rains falling on dry surfaces, laterite caps on crumbling desert hills, and water-holes of dubious character. The holes mentioned on p. 35 have a palæontological interest, since they were found, on being "cleaned out," to be full of dead kangaroos, thus serving as an example of the localisation of such remains in arid lands. Students of prehistoric man will note the valuable and fully illustrated account (pp. 74-89) of the native red-ochre mine at Wilgie Mia, where initiated medicine-men worked the pigment and developed a valuable trade (Fig. 2). The association

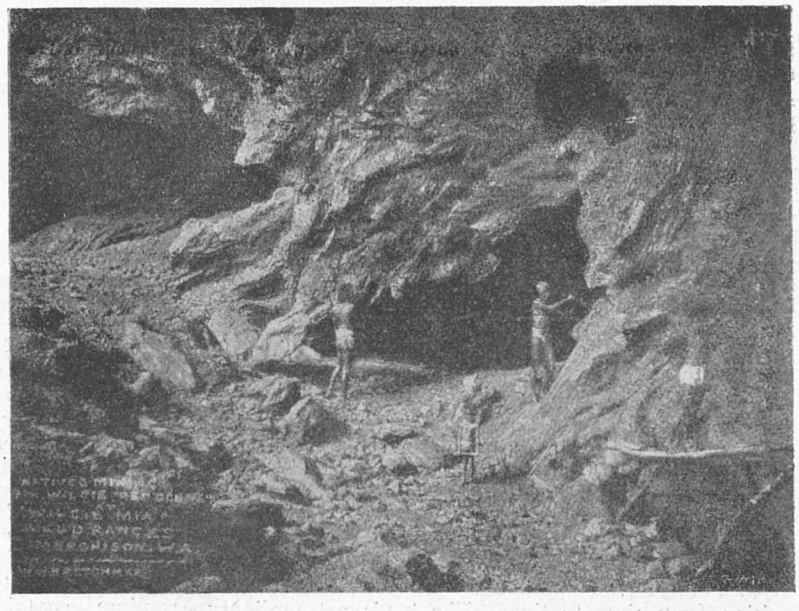

FIG. 2.—Natives working red ochre at the cave of Wilgie Mia, Western Australia, with the aid of timber staging. From "Geological Reconnaissance of the Murchison Goldfield."

of the ochre with legendary blood-stains (p. 88) may be compared with the story of the origin of the hæmatite veins on the face of Slieve Gallion in Co. Londonderry.

The New Zealand Geological Survey, now under the direction of P. G. Morgan, has issued Bulletin No. 17, on the Buller-Mokihinui sub-division, a district on the coast of Westport. Despite preliminary difficulties of access, and in a district of deep gorges and high rainfall, a large industry has been established in bituminous coals that were formed in Eocene lakes. One seam on Magatini Creek is 54 ft. thick, and the authors, P. G. Morgan and J. A. Bartrum, write (p. 155): "The numerous magnificent outcrops of clean, almost ashless, hard coal in this locality cannot fail to arouse enthusiasm in the spectator." This shows the right spirit; and the volume also reveals the impression made by beautiful river-scenery. The word *Gräben* for *Graben* occurs in several places; we cannot be too careful when importing such words into our geographical nomenclature, and we have recently noted the strange form *ösar* nearer home.

G. A. J. C.

SCIENCE IN PUBLIC SCHOOLS.

THE seventeenth annual meeting of the Association of Public-School Science Masters was held at Eton College on January 3 and 4. In his presidential address, Prof. H. H. Turner dealt with two main points, namely, that few boys have in them the making of scientific investigators, and that more openings are required for those who possess these attributes. Just as some boys have no sense of appreciation for music, so others are dead to scientific things, and may have a habitual dislike to them. It must, of course, be acknowledged that such types exist, but like indifference or antipathy can be found to all school subjects. Prof. Turner dealt with instruction in science as if its intention was to produce experts, whereas up to the age at which specialisation is permitted in a school course, the scientific teaching should be that which can claim a place in general education as justly as the teaching of letters, history, and mathematics. Boys who specialise in science afterwards may become investigators, but at present the careers open to them are few, and the prospects in them are unpromising. Prof. Turner suggested the formation of a Research Civil Service, parallel to the existing Administrative Civil Service. There is plenty of work to be done, such as the survey of our Empire, geodetically, magnetically, gravitationally, bathymetrically, and in other ways. There are forestry and fisheries, and industrial research of many kinds. Work is less likely to fail than workers. Modern researches are often of embarrassing length and involve much labour, but schools may help with some of them, and Prof. Turner gave a number of instances, of which "upper-air research" was one. He quoted Capt. Cave's opinion that such work is suitable for boys, and would be scientifically valuable. Mr. O. H. Latter, of Charterhouse, in seconding a vote of thanks to the president, proposed by Mr. C. E. Ashford, of the Royal Naval College, Dartmouth, thought that the views of parents would have to be taken into consideration when contemplating purely scientific investigation in schools. In this connection he read the following letter received by him as typical of the attitude of many parents towards certain studies of natural history :—

"I wonder if I may ask your co-operation in regard to my son? I believe you are the principal natural science master, and that he has been under your tuition from time to time. The boy's extraordinary liking for what I regard as the most repulsive branch of natural history—newts, beetles, and insects—is a source of much disappointment both to his mother and to me. Can you either directly or indirectly turn his mind to a higher and more refined branch of the subject—birds, trees, or flowers? I cannot help feeling that the tendency of his present study is degrading, and I shall be glad to know if you think you can influence him in the way I suggest. If you can, I shall be extremely grateful to you."

Prof. R. A. Gregory, in opening a discussion on "Science for the Rank and File," said it is necessary to distinguish clearly between courses of work suitable for the rank and file and those intended as preliminary training for scientific or industrial careers. One has to do with science as an essential element of a liberal education; the other with vocational instruction. The former is at least as important as the latter, and little justification can be found for the concentrated attention given to a few subjects, with the view of imparting knowledge of experimental methods, when such a course means that the wonders of the fields beyond are kept outside the range of vision. For the imparting of the rudiments of a liberal education to all pupils the descriptive and qualitative school science of a generation ago is better adapted than the quantitative work in the narrow fields mapped out for instruction to-day. A plea was made for the introduction of descriptive lessons and reading intended to stimulate interest in scientific work and achievement and their relation to modern life, instead of limiting the teaching to dehumanised material of physics and chemistry.

Different aspects of this general subject of science for all were put forward in papers on :—A scheme of instruction in science for all boys throughout their school career, *i.e.* some science indispensable for all boys, by Mr. F. S. Young (Bishop's Stortford); the teaching of science on the classical side, by the Rev. S. A. McDowall (Winchester); the age for beginning serious science, by Mr. W. D. Eggar (Eton); classics the basis of a scientific education, by the Rev. A. L. Cortie, S.J. (Stonyhurst); how far can the advantages derived from teaching classics be derived from science? by the Rev. F. G. Forder (Charterhouse).

On the second day of the meeting, the first subject of discussion was technical bias in schools, and the papers read were :—School science in its relation to modern industrial problems, by Mr. E. R. Thomas (Rugby); school chemistry with a technical bias, by Mr. W. J. Gale (King's College School, Wimbledon); value and danger of giving a technical or topical trend to scientific education, by Mr. D. Berridge (Malvern). There was also a discussion on the place of text-books in science teaching, opened by Mr. G. N. Pingriff (University College School).

In the course of the discussion on technical bias in schools, Prof. A. Smithells said that in teaching science it should never be forgotten that however perfect might be the inculcation of scientific method, however sound the mental discipline, however powerful the intellectual weapon they supplied, unless they showed how science bore upon the environment and avocations of human life—unless, in fact, they humanised it—science could not flow effectually into the general culture of the nation.

Mr. C. L. Bryant, secretary of the association, in reading the report of the committee, said that towards the end of 1915 it was decided to arouse public opinion on the lack of appreciation of science in this country, and as the result of the work of a sub-committee, Mr. M. D. Hill was able to form what became known as the "Neglect of Science Committee." The committee of the association has also drawn up a memorandum containing a statement of facts, principles, and policy, which served as a text for discussion between a deputation and the Government Committee on Science in Education. In view of the growing opinion that training in science forms an essential part of a liberal education, the committee of the association has drafted a scheme of work which it considers to be suitable for all boys at the public schools up to the age of about sixteen and a half years. The meeting passed, *nem. con.*, a motion expressing general approval of this scheme.

FERTILISERS AND AGRICULTURAL PRODUCTION.

THE January issue of *Blackwood's Magazine* contains an important article by Prof. W. Somerville entitled "Increased Agricultural Production." As indicative of the present position of British agriculture, the author points out that of the food consumed we produce only one-fifth of the wheat, rather more than half the meat, one-quarter of the butter and margarine, one-fifth of the cheese, and nearly all the milk. The chief factor causing the reduction of the area of land tilled was the great increase in the

amount of wheat imported from North America in the 'seventies and 'eighties. In the past forty-three years Great Britain has lost 3½ million acres of tillage crops, including 1½ million acres of wheat, and has produced no more meat, although the milk production has doubtless increased. This fact supports the contention that the area of land under crops may be largely increased without any decrease of stock-keeping.

After contrasting the English and German increase in food-production in the past forty years as shown by the recent Memorandum of the Board of Agriculture, and summarising the recommendations of the English, Scottish, and Irish Committees for increased food production during the war, Prof. Somerville urges that the post-war problem of a large permanent increase in food production is the more difficult to solve. The solution of the problem is complicated by the consideration that if a durable peace is obtained there will be a long period available for the reconstruction of our agriculture, whilst if only an "armed" peace results from the present conflict, rearrangement will be necessary in the shortest possible time. Given that it is desirable to secure an increase of a million acres of wheat, many consider that this could be effected by guaranteeing a minimum price, which presumably would have to be extended to oats as well as to wheat, since the latter is of quite subordinate importance in Scotland and Ireland.

A rather more attractive suggestion is that farmers should be granted a bonus on the area of grass land converted to arable: this has recently been adopted in France. But there is one way in which an immediate and large increase in production can be effected, namely, by using on British land the whole of the ammonium sulphate produced in this country. Of the 400,000 tons of this fertiliser annually produced, 294,000 tons were exported in 1915, and for 1916 the amount was probably about 250,000 tons. If the latter were used on one-fourth of the area under wheat, oats, roots, potatoes, and hay, it would only give 60 lb. to the acre. Representing sulphate of ammonia in terms of wheat, the amount exported in 1916 is equivalent to 2½ million quarters of wheat—*i.e.* an addition of more than 30 per cent. to our present home-grown supply. Further, the exportation of fertiliser and importation of wheat require shipping to the extent of 800,000 tons, and result in an adverse trade balance of 4,575,000*l*.

The case for prohibiting the export of ammonium sulphate is enormously strengthened by the reduction in the import of sodium nitrate in 1916. Since the latter decrease has not been compensated for by increased use of sulphate of ammonia, the land must have suffered a reduction in fertility. The 40,000 tons of basic slag exported in 1916 could be used on British land even more easily than the ammonium sulphate. It would suffice to produce 3,200,000 lb. of meat annually for five years, and here again considerations of freight and exchange are in favour of prohibited export. The use of basic slag on second-rate and inferior pastures is the most certain way of increasing production of food, and it is important now, because it involves only a fraction of the man and horse labour necessary for tillage.

Prof. Somerville is of the opinion that some measure of compulsion will be necessary, and advocates the establishment of local committees to decide which farms can make best use of the sulphate of ammonia and basic slag available, and which grass lands are to be tilled. Although recognising their obvious advantages, he considers that the creation of small holdings would prove more a hindrance than a help in regard to the production of the major part of the people's food.

ITALIAN METEOROLOGY.[1]

A NUMBER of useful meteorological memoirs by Prof. Eredia, of the Central Meteorological and Geophysical Institute of Rome, deal with various aspects of the meteorology of Italy. No. 1 is the Italian meteorological observers' handbook, copiously illustrated, in which full instructions are given regarding the installation of instruments for a normal station, along with practical hints regarding its maintenance. Instructions are also given for the taking of phenological observations. "The Variation of the Climate in Italy" (No. 2) is a reprint of a paper read at the tenth International Geographical Congress held in Rome during 1913, in which the mean annual temperature from 1866 to 1910 at sixteen stations is discussed. The warmest year was 1879, except in the insular areas, while 1900 was the coldest. The temperature variations, it may be said, are in general the reverse of those in the British Isles. Fog frequency over the region embraced by Lombardy, Venetia, and Emilia, based on data for twenty-three stations over the period 1892–1914, forms the subject-matter of No. 3. From May to August there are few fogs, the maximum taking place in winter Maps of fog frequency are given for the autumn, winter, and for the year, while several isobaric charts indicate the conditions associated with some winter fogs.

The storm of October 7, 1915, along with a synopsis of storm frequency at the Tripoli Observatory from 1892 to 1914, is dealt with in No. 4. Isobaric charts referring to 8 a.m. and 9 p.m. illustrate the progress of the October storm. At Tripoli during the twenty-three years under consideration 164 storms were observed, the greatest number recorded being twenty in 1906, and the least number two in 1913 and 1914. The frequency by seasons shows that autumn is the stormiest time of the year with sixty-nine instances, followed by spring with forty-five, winter with thirty-three, while in summer only seventeen were noted. The diurnal period shows a maximum in the three hours ending 9 p.m., when storms are six times more numerous than in the three hours ending with 3 p.m. The rainfall associated with the storms discussed is small. In forty-five cases none was measured, and in forty-one other cases less than 5 mm. fell. In nineteen instances the fall exceeded 20 mm. A general review of the various drosometers hitherto employed for the registration of the amount of dew is given in No. 5, along with a description of a new form employed by the institute, which has many features to recommend it. R. C. M.

ETHNOBOTANY OF AMERICAN INDIANS.

IN the thirtieth annual report of the Bureau of American Ethnology, Mr. M. C. Stevenson publishes an elaborate article on the ethnobotany of the Zuni Indians. This tribe had discovered the medicinal value of a large number of plants, one of the most important of which is the Jamestown weed (*Datura meteloides*), and the writer observes that from the symptoms caused by this drug, its homœopathic adaptability to hydrophobia will be at once evident. "There is no drug so far proven that deserves as thorough and careful a trial in this dread disease as stramonium." "They learned the value of *Datura meteloides* as a narcotic perhaps centuries before the birth of Baron Stoerck, of Vienna, who first brought it to the atten-

[1] (1) "Norme per l'impianto e per il funzionamento della stazioni termo-udometriche." Pp. 41. (Rome, 1916.) (2) "Le variazioni del clima in Italia." Pp. 23. (Rome, 1915.) (3) "Le nebbie in Val Padana." Pp. 12+ charts. (Rome, 1916.) (4) "Sul temporale verificatori a Tripoli nell' ottobre 1915 e sulla distribuzione dei temporali en Tripolitania." Pp. 17. (Rome, 1916.) (5) "Sulla misurazione della rugiada." Pp. 11. (Firenze, 1915.)

tion of the medical profession, and the use of antiseptics while Lister was still unknown. How long ergot has been employed by the Zuni for the chief purpose to which it is devoted by civilised men, no one can say."

The subject of the ethnobotany of the American Indians is discussed in an elaborate report on "Iroquois Foods and Food Preparation," by Mr. F. W. Waugh, published as Memoir No. 86 by the Department of Mines, Canada. We have a full account of their agricultural methods and customs, their cooking and eating customs, and the utensils employed in gathering, preparing, and cooking food. The method of rain-making is of interest. The performer, stripped to the waist, or clad only in a breech-cloth, burns tobacco, and calls upon the Thunder Man, in return for his offering of tobacco, to provide abundant rainfall. Another curious custom is that of subjecting girls at puberty to the task of grinding a quantity of the hardest grain which can be found: if she fails to accomplish the task she is believed to be unfit for married life. Spoons used in eating are decorated with designs which are disclosed in dreams, and interpreted by the local seer. Such dream-objects presented to the sick secure recovery.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

LONDON.—Ten public lectures on "Science and the Empire: the Exploitation of Plants," arranged in co-operation with the Imperial Studies Committee, will be delivered at University College during the term which opened on Monday. The introductory lecture on January 22 will be by Prof. F. W. Oliver, and the remaining lectures are to be as follows:—Plant food and soil problems, Prof. W. B. Bottomley; Timber production in Britain, Dr. E. J. Salisbury; Cotton, Dr. W. Lawrence Balls; Tea-making, Dr. S. E. Chandler; The plant as healer, Dr. E. N. Thomas; Tropical exploitation, with especial reference to rubber, Dr. J. C. Willis; Vegetable dyes, Dr. S. M. Baker; Diseases of plants, Dr. H. C. I. Gwynne-Vaughan; Coal, Dr. Marie C. Stopes. All these lectures are open to the public without fee.

MR. JOSEPH YATES, of the Blackburn Technical School, has been appointed head of the chemistry department of the Derby Technical College.

THE sum of 20,000*l.* has been given anonymously to the Higher Institute of Medicine for Women at Petrograd for the foundation of scholarships in the name of Count Vorontzoff, who died in 1916.

A SERIES of popular lectures by Miss Edith A. Browne on "The Tropical Products and Industries of the Empire," illustrated by the collections of the Imperial Institute, began yesterday, and will be continued on Wednesdays in January, February, March, and April, at the Imperial Institute, at 3 o'clock. Admission to the lectures is free by ticket, for which application should be made to the director of the Imperial Institute, South Kensington.

AT the Guildhall Art Gallery on January 12 the Lord Mayor took the chair at the annual general meeting of the Royal Drawing Society, when the annual report was presented and speeches were made on the need for convincing educationists of the value of drawing for school work in general, but especially with reference to science teaching. A letter was read from Sir Robert Baden-Powell approving the work of the society, and stating that in the training of the junior Boy Scouts badges had been introduced for proficiency in drawing of a kind that displayed observation, memory, sense of proportion, reason, and so on. Dr. F. A. Bather showed how the society's method of making pupils draw objects from written descriptions encouraged the precise use of language and the precise interpretation of it. Few people knew how to read or write, but this method taught them how to do both, as well as to draw. Sir John Cockburn agreed that reading and writing were most difficult arts, and maintained that children should first be given such a knowledge of concrete objects as could best be gained through drawing and modelling. The same applied to arithmetic. It was absurd to teach children their weights and measures until they knew what was really meant by a quart, a bushel, or a pound. The endeavour of this society to make drawing a natural mode of expression in all branches of school work certainly deserves warm encouragement.

WE have received particulars of the dedication of the Ceramic Engineering Building at the University of Illinois, Urbana, Ill., on December 6–7, 1916. The American idea of the meaning of the term "ceramic" is interesting in view of a recent assumption in England that "ceramic" refers only to pottery, and that the English Ceramic Society ought, therefore, to deal with nothing but pottery. This assumption is not in accord with general usage. The ceramic industries to be treated in this building cover the technology of all mineral products except ores and minerals of organic origin, and it is stated to include all kinds of clay products; plasters, mortars, cements, and concrete; all varieties of glass; enamelled metals; and refractory, insulating, and abrasive materials. The new Ceramic Engineering Building covers a ground area of 67 ft. by 189 ft.; it is a three-story structure with a basement, and, from a description in the dedicatory pamphlet, it appears to be handsomely equipped. It is said that the department of ceramic engineering is intended (1) to train engineers for the direction and control of various operations connected with ceramic industries; (2) to cultivate intimate relations with the clay-workers of the State; (3) to co-operate with the State Geological Survey in the systematic study of all the ceramic resources of the State; and (4) to prosecute research in special ceramic problems, and the more fundamental scientific problems connected with the behaviour of ceramic materials in the various processes to which they are subjected during manufacture. The staff includes Prof. E. W. Washburn as head of the department, Prof. C. W. Parmelee, Assistant Prof. R. K. Hursh, and Instructor H. C. Arnold. Addresses on the development of the various ceramic industries were given at the dedication by Messrs. S. W. Stratton, J. P. Beck, W. D. Yeates, W. W. Marr, H. J. Burt, C. Bragdon, and C. F. Binns. The ideals described in the dedicatory pamphlet are splendid, and it would be equally splendid if they were realised in the near future.

SOCIETIES AND ACADEMIES.

WASHINGTON, D.C.

National Academy of Sciences, November, 1916 (Proceedings No. 11, vol. ii.).—C. **Barus**: Path differences within which spectrum interferences are observable. The method of observing interferences in the zeroth, first, second, third, and even fourth order, successively, without essential change of the parts of the apparatus, is noteworthy. The present experiments furnish a striking example of the uniform breadth of the strip of spectrum carrying the fringes, quite apart from the dispersion of the spectrum.—C. **Barus**: Non-reversed spectra of restricted coincidence. The method, apart from any practical outcome, is worth pursuing because of the data it will furnish of the width of the strip of spectrum carrying interference fringes under any given conditions.—L. J. **Henderson** and E. J.

Cohn: The equilibrium between acids and bases in sea-water. The ocean, which, because of the presence of free carbonic acid, was originally acid, and has been becoming more alkaline from the accumulation of basic material, is at present in an epoch where the growing alkalinity is checked by the *buffer* action of acids of approximately the strength of boric acid. These buffers regulate the reaction of sea-water in a manner similar to the way in which bicarbonates and phosphates regulate the reaction of blood.—H. S. **Washington**: An apparent correspondence between the chemistry of igneous magmas and of organic metabolism. The object is to direct attention to what appears to be a congruous relation of two pairs of elements in the organic world; it would appear that iron and sodium are necessary for animal metabolism, while magnesium and potassium are essential to vegetable metabolism.—W. **Trelease**: The oaks of America. A summary of a manuscript now prepared for submission to the academy for publication as one of its scientific memoirs. Three hundred and fifty-four species of oaks, of which about one-half are new, are recognised. The relations to fossil oaks are pointed out.—E. V. **Huntington**: A set of independent postulates for cyclic order. Five postulates are given for cyclic order.—R. M. **Yerkes**: A new method of studying ideational and allied forms of behaviour in man and other animals. A description of the author's method of multiple choices for the deduction of reactive tendencies and the study of their *rôle* in the attempted solution of certain types of problem. The method involves the presentation to the subject of a problem, or series of problems, the rapid and complete solution of which depends upon ideational processes — G. N. **Lewis** and T. B. **Hine**: Electrical conduction in dilute amalgams. The resistance of amalgams of lithium, sodium, and potassium is studied at constant pressure and shows extraordinary differences; the resistances at constant average atomic volume are also calculated and found to differ materially from those at constant pressure.—R. M. **Yerkes**: Ideational behaviour of monkeys and apes. The general conclusions which may be deduced are that the ape exhibits various forms of ideational behaviour, whereas the reactive tendencies of monkeys are inferior in type.—W. D. **Harkins**, R. E. **Hall**, and W. A. **Roberts**: The osmotic pressure and lowering of the freezing point of mixtures of salts with one another and with non-electrolytes in aqueous solutions. The general result obtained with mixtures already investigated is that the lowering of the freezing point of the mixture is very nearly that which would be calculated on the basis that each salt produces a lowering of the freezing point proportional to its own concentration and to the mol-number which it has when present alone in a solution of salt concentration.—H. **Blumberg**: Certain general properties of functions.—S. W. **Williston**: Sphenacodon, Marsh: a Permo-Carboniferous theromorph reptile from New Mexico. Reconstruction of a fossil reptile found in a bone bed from which some collections were made so early as thirty-eight years ago, but which seems to have been almost forgotten until recently.—L. J. **Henderson**: On volume in biology. When equilibrium has been established in a heterogeneous system (capillary and gravitational phenomena being absent) the volume of the phases is not relevant to the state of the system, but in nearly all physiological changes the regulation of volume is of great importance.

CALCUTTA.

Asiatic Society of Bengal, December 6, 1916.—Sarat Chandra **Mitra**: Secrecy and silence in North Indian agricultural ceremonies. The author discusses the taboos against speaking and the presence of outsiders which are observed throughout northern India at the times of (*a*) sowing the seeds; (*b*) threshing the harvested crops; (*c*) winnowing the threshed-out grain; (*d*) heaping up the cleaned grains; and (*e*) measuring the same. The popular explanation of the observance of this taboo against speaking is that, if any kind of talking is done while the aforesaid operations are going on, the evil spirits would come and deprive the corn of its substance and nutritive properties. The author thinks that this explanation is not plausible enough. He has, therefore, broached the theory that all supernatural beings dislike not only being recognised and spoken to, but also being seen; that the Earth-mother or the Earth-deity is one of these supernatural beings; and that, as all the aforementioned agricultural ceremonies are performed in honour of the Earth-mother, she does not wish that anybody should speak to her or profane the scene of these operations—the scene of her hallowed presence—by breaking the silence that reigns.—N. **Annandale**: Zoological results of a tour in the Far East. Batrachia and reptiles. No attempt was made to collect batrachia or reptiles indiscriminately. In the former group specimens were collected mainly with two objects: to obtain material (1) for a systematic study of the frogs, *Rana tigrina*, *R. limnocharis*, and allied forms, and (2) for the comparison and description of larval forms, more particularly of those that exhibit peculiar characters correlated with life in rapid running water. In the collection of reptiles only aquatic and amphibious species are represented. In reference to the batrachia it is shown that three species (one practically confined to India and Ceylon, one widely distributed in continental Asia east of the Bay of Bengal, and a third characteristic of the Malay subregion) have been confounded under the name *R. tigrina*. The first of these is the true *R. tigrina* of Daudin, the second must be known as *R. rugulosa*, Wiegmann, and the third as *R. cancrivora*, Gravenhorst. Most of the reptiles are well-known forms, the most interesting being the lizard, *Tropidophorus sinicus*, which lives at the edge of hill-streams in Hong-Kong. —C. A. **Paiva**: Zoological results of a tour in the Far East. Aquatic Hemiptera from Tale Sap, Peninsular Siam. The paper deals with ten species (of which one is new to science) belonging to nine genera and six families. The majority of the species are very widely distributed Oriental forms, but one has hitherto been known only from Burma, one from Laos, and one from the Siamese Peninsular province of Patani. All are true fresh-water forms, except the last, which is probably estuarine. The most interesting feature of the collection is the fact that it includes specimens of a new species of the subgenus Kirkaldya (genus Microvelia), which has hitherto been known only from North America.

CAPE TOWN.

Royal Society of South Africa, October 18, 1916.—Dr. L. Péringuey, president, in the chair.—Miss A. V. **Duthie**: African Myxomycetes. In this preliminary paper an attempt has been made to compile a list of the species of Myxomycetes previously recorded from Africa in various journals and monographs, and also to record forms which have been accessible to or collected by the author.—Miss A. V. **Duthie**: Hybrid forms in the genus Satyrium, with descriptions of two new forms. The paper contains a description of two hybrids from Tulbagh, one *Satyrium erectum Xcoriifolium*, the other *S. erectum Xbicorne*. A detailed description, with illustrations, is given of the vegetative and floral structures in each form.—L. **Simons**: Ionisation of gases and the absorption of Röntgen rays. The independence of X-ray effects of molecular aggregations and the dependence only on the atoms present, together with the fact that it has

been shown that the absorption of a given wave-length in a solid varies as the fourth power of the atomic number of the solid, whilst for a gas the primary β ionisation also varies as the fourth power of the atomic number of the atom ionised, leads to the conclusion that absorption in solids (apart from scattering) is due throughout to the production of β particles. Expressions are found for the fall in the constant of proportion between the absorption per atom and N^4 when a K line ceases to be excited, and when an L line ceases to be excited.—M. **Rindl**: Note on the occurrence of daphnin in the arthrosolen. The author has determined the presence of daphnetin and glucose in *Lasiosiphon polycephalus*, a perennial shrub which flowers in August and September, known to the South African farmers as Januariebosje, and assumes that the glucoside daphnin has been present and hydrolysed in the process of extraction.

BOOKS RECEIVED.

Manual of Psychiatry. By Dr. J. Rogues de Fursac and Dr. A. J. Rosanoff. Fourth edition. Pp. xi+522. (New York: J. Wiley and Sons, Inc.; London: Chapman and Hall, Ltd.) 10*s.* 6*d.* net.

Food and Health. By Prof. H. Kinne and A. M. Cooley. Pp. vi+312. (New York: The Macmillan Co.; London: Macmillan and Co., Ltd.) 3*s.* net.

Theoretical Chemistry from the Standpoint of Avogadro's Rule and Thermodynamics. By Prof. W. Nernst. Revised by H. T. Tizard. Pp. xix+853. (London: Macmillan and Co., Ltd.) 15*s.* net.

Bacon's Large-Scale Map of the Salonika Battle Front. (London: G. W. Bacon and Co., Ltd.) 1*s.* net.

Tropical Agriculture. By Dr. E. V. Wilcox. Pp. xviii+373. (New York and London: D. Appleton and Co.) 10*s.* 6*d.* net.

Scheme for Maternity and Child Welfare Work. By Misses I. Macdonald and K. C. Atherton. (London: Royal Sanitary Institute.) 1*s.* net.

Functions of a Complex Variable. By T. M. MacRobert. Pp. xiv+295. (London: Macmillan and Co., Ltd.) 12*s.* net.

A Laboratory Course of Practical Electricity for Vocational Schools and Shop Classes. By M. J. Archbold. Pp. ix+211+Exp. 98. (New York: The Macmillan Co.; London: Macmillan and Co., Ltd.) 5*s.* net.

A Critique of the Theory of Evolution. By Prof. T. H. Morgan. Pp. x+197. (Princeton: University Press; London: Oxford University Press.) 6*s.* net.

Human Physiology. By P. G. Stiles. Pp. 405. (Philadelphia and London: W. B. Saunders Co.) 6*s.* 6*d.* net.

Farm Spies: How the Boys Investigated Field Crop Insects. By Prof. A. F. Conradi and W. A. Thomas. Pp. xi+165. (New York: The Macmillan Co.; London: Macmillan and Co., Ltd.) 2*s.* net.

DIARY OF SOCIETIES.

THURSDAY, JANUARY 18.

LINNEAN SOCIETY, at 5.—The Comparative Morphology of the Sorus of Ferns: Prof. F. O. Bower.

MATHEMATICAL SOCIETY, at 5.30.—Some Asymptotic Formulæ in Combinatory Analysis: G. H. Hardy and S. Ramanujan.—Singular Solutions of Ordinary Differential Equations of the First Order: M. J. M. Hill.—The Nature of a Moving Electric Charge and its Lines of Electric Force: H. Bateman.

ROYAL SOCIETY OF ARTS, at 4.30.—Between the Tigris and the Indus. The Ben-i-Israel: Sir T. H. Holdich.

CHEMICAL SOCIETY, at 8.—Alloys of Copper and Tin, Aluminium and Gold: Col. C. T. Heycock.

FRIDAY, JANUARY 19.

ROYAL INSTITUTION, at 5.30.—Soap Bubbles of Long Duration: Sir James Dewar.

INSTITUTION OF MECHANICAL ENGINEERS, at 6.—The Manufacture of Gauges at the L.C.C. Paddington Technical Institute: A. G. Cooke, W. J. Gow, and W. G. Tunnicliffe.

SATURDAY, JANUARY 20.

ROYAL INSTITUTION, at 3.—The Lakes and Mountains of Central Africa: A. R. Hinks.

MONDAY, JANUARY 22.

ROYAL GEOGRAPHICAL SOCIETY, at 8.30.—Yunnan and the West River of China: E. C. Wilton.

ARISTOTELIAN SOCIETY, at 8.—Monism in the Light of Recent Developments in Philosophy: C. E. M. Joad.

TUESDAY, JANUARY 23.

ROYAL INSTITUTION, at 3.—The Old Brain and the New Brain, and their Meaning: Prof. C. S. Sherrington.

INSTITUTION OF CIVIL ENGINEERS, at 5.30.—The Physical Features of "Adam's Bridge," and the Currents across it, considered as affecting the Proposed Construction of a Railway connecting India with Ceylon: F. J. Waring.

WEDNESDAY, JANUARY 24.

ROYAL SOCIETY OF ARTS, at 4.30.—Relief Work in Belgium: W. A. M. Goode.

GEOLOGICAL SOCIETY, at 5.30.—Easter Island: W. Scoresby Routledge.

THURSDAY, JANUARY 25.

ROYAL SOCIETY, at 4.30.—*Probable Papers*: The Dynamics of Revolving Fluid: Lord Rayleigh.—Spectroscopic Observations on the Active Modification of Nitrogen. V.: Hon. R. J. Strutt.—Magnetic Induction and its Reversal in Spherical Iron Shells: Profs. J. W. Nicholson and E. Wilson.—The Two dimensional Motion of a Plane Lamina in a Resisting Medium: S. Brodetsky.

FRIDAY, JANUARY 26.

ROYAL INSTITUTION, at 5.30.—Epicurean Philosophy: Prof. G. Murray.

PHYSICAL SOCIETY, at 5.—A Clock of Precision: C. O. Bartrum.—The Effect of the Water Vapour in the Atmosphere on the Propagation of Electromagnetic Waves: Dr. F. Schwers.

SATURDAY, JANUARY 27.

ROYAL INSTITUTION, at 3.—The Lakes and Mountains of Central Africa: A. R. Hinks.

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