THURSDAY, APRIL 25, 1918.

## SOME "INTELLECTUAL ADVENTURES."

(1) *The Self and Nature.* By DeWitt H. Parker. Pp. ix+316. (Cambridge, Mass.: Harvard University Press; London: Humphrey Milford, 1917.) Price 8*s*. 6*d*. net.

(2) *Locke's Theory of Knowledge and its Historical Relations.* By Prof. J. Gibson. Pp. xiv+338. (Cambridge: At the University Press, 1917.) Price 10*s*. 6*d*. net.

(3) *The Problem of Creation: An Attempt to Define the Character and Trend of the Cosmic Process.* By the Right Rev. Dr. J. E. Mercer. Pp. xiii+325. (London: S.P.C.K., 1917.) Price 7*s*. 6*d*. net.

(4) *Originality: A Popular Study of the Creative Mind.* By T. Sharper Knowlson ("Thomas Sharnol"). Pp. xvi+304. (London: T. Werner Laurie, Ltd., 1917.) Price 15*s*. net.

(1) IN reading Prof. Parker's book we breathe that delightful and invigorating atmosphere of the New World which seems the vital condition of American philosophy. We are not startled with new doctrines or confronted with strikingly original theories. The problems are all familiar enough, whether they are old or new, yet the author makes us feel that we are out on "an intellectual adventure," and though we are journeying through a well-charted country we are bent on discovery. The book is pervaded throughout with the spirit of William James, the father of all such as dwell in philosophical tents and go forth on philosophical pilgrimages. James produced no system, introduced no new method, stereotyped no principle, had none of those qualities we associate with the founders of schools, and yet no philosopher of our generation lives on in his influence so definitely and so directly as he. The joy of living is in every word he has written. Few philosophers contradicted themselves more often or set forth with the full confidence of conviction so many inconsistent theories, yet few have had so many and so varied a following.

Prof. Parker's book is a general treatment of metaphysical problems, especially of the central problem of the nature and unity of mind, and the method is described as "radical empiricism extended through the imagination." To summarise the author's views on the problems would serve no purpose, and would destroy the main charm, which is the personal freshness of the treatment.

(2) By way of contrast there is something of the stolid British nature, as well as sound and original philosophy, in Prof. Gibson's study of Locke's theory of knowledge. It is a work of deep and penetrating scholarship, which must have occupied many years of the author's life, and yet it is written with a lucidity and charm which make the reader unconscious of the erudition.

The "Essay" of the great English philosopher still suffers, we are told, "from the twin assumptions that it can be understood without being studied, and that its full significance can be summed up in a small number of simple propositions." This is true, no doubt; but of what great classic could not the same be said? Prof. Gibson means, we suppose, that he would like to see Locke's "Essay" more regularly included among the set books of Philosophy Honours Courses. There are only two ways of approaching the study of the great philosophies. One is to study a special work as a compendium of precise knowledge. In this way the Catholic seminaries teach the philosophy of St. Thomas Aquinas. The other is to study a philosophy as the historical expression of an ever-changing problem, ever-changing because, like life itself, it never attains finality. If Locke's "Essay" suffers peculiar injustice because it is generally taken as read, on the other hand, when it is closely studied for its own sake, we have to be constantly on guard lest we read into it concepts and developments of concepts which did not become explicit until long after. To understand the philosophy of a bygone age we must recognise that for that age it was fully concrete. We must install ourselves within the historical conditions, and not merely know the historical relations. Then we shall cease to lament the absence of our cherished concepts, and not continually bewail the "unfortunate" orientation of the author's mind.

Prof. Gibson has brought out with great clearness the predominant concept which determined the form and direction of Locke's philosophy—the idea of composition. To the philosophers of his age the main task of philosophy seemed to be the discovery of the simple ideas out of which the complex and complicated ideas had arisen, and to reveal the nature of the aggregation and agglutination. This notion of composition dominated the intellectual outlook as completely as the notion of evolution dominates the thought of our time.

What we seem to miss in this thoroughly scholarly and most useful introduction to the study of the father of English philosophy is the true note of the historical concept. The chapters on the historical relations, excellent as they are, are not historical judgments in the full philosophical meaning; they are comparisons with systems which preceded and systems which have followed.

(3) The "intellectual adventure" to which the Bishop of Tasmania invites us in his "Problem of Creation" is of another order. We have the feeling of being on a personally conducted tour rather than on a voyage of discovery. We are shown the wonders of Nature, taken into perilous places, made to look into volcanoes, and cross torrents; we get thrills, and yet all the time we feel we know that there is no real danger. Dr. Mercer, nevertheless, propounds a serious argument, and very ably sustains it. He holds firmly the principle *ex nihilo nihil fit*, and his purpose is to reconcile it with the orthodox view of creation, with the concept of God, and with the ethical principle of freedom. He also discusses its bearing on the problem of evil. Dr. Mercer is not, however, always a guide to be depended

upon when he expounds scientific theory. It is a little disconcerting, for example, to find (p. 5) Dr. A. A. Robb's theory of time and space referred to as a form of the theory of relativity. The misprint *Rolls'* for *Robb's* is perhaps pardonable carelessness, but the account of Einstein's principle of relativity is so slight and inadequate as to be positively misleading.

(4) "Thomas Sharnol" describes his adventure as "a popular study of the creative mind." It deals with the problem which is the most deeply interesting of all the problems of philosophy, yet the impression the reader is likely to derive is one of bewilderment in regard to the precise concept of "originality" he is invited to study. The book is an amazing pot-pourri of opinions, sentiments grave and gay, quotations from, and references to, writers of all sorts, past and present. The main philosophical motive which serves to hold the attention amidst the author's exuberance is the notion with which Bergson has familiarised us, that life is an impetus finding expression in the new forms it creates. Combined with this is the notion of the structure of unconscious mind which we owe to the discoveries of Freud and Jung. The book is very uneven, sinking at times to sheer triviality, yet pleasantly written and always good-humoured. It is intentionally addressed to the thoughtful man of general culture, and not to the student of technical philosophical problems.

H. W. C.

## *PHYSICS TEXT-BOOKS.*

(1) *A Text-book of Physics for the Use of Students of Science and Engineering.* By J. Duncan and S. G. Starling. Pp. xxiii+1081. (London: Macmillan and Co., Ltd., 1918.) Price 15*s.* net.

(2) *Advanced Text-book of Magnetism and Electricity.* By R. W. Hutchinson. Vol. i., *Magnetism and Electrostatics.* Pp. vii+372+Index xii. Vol. ii., *Electrodynamics.* Pp. vi+468+Index xii. (London: University Tutorial Press, Ltd., 1917.) Price, 2 vols., 8*s.* 6*d.*

(3) *Lecture Notes on Light.* By J. R. Eccles. Pp. vi+217. (Cambridge: At the University Press, 1917.) Price 12*s.* 6*d.* net.

(4) *A Manual of Physics, Theoretical and Practical, for Medical Students.* By H. C. H. Candy. Second edition. Pp. viii + 451. (London: Cassell and Co., Ltd., 1918.) Price 7*s.* 6*d.* net.

(1) ENGINEERING students too often look upon physics as little more than a necessary evil, and a book that connects the scientific aspects of the subject with its modern practical applications fills a real need. The authors of this volume—one an engineer and the other a physicist—are to be congratulated on the successful way in which they have accomplished this task.

The book, which is both theoretical and practical, gives a course in dynamics, sound, light, heat, magnetism and electricity, which the authors claim is suitable for intermediate examinations. A student, however, who knew all in the book would be well beyond this stage. Few of the objectionable features of examination text-books occur, and the treatment is lucid and up-to-date. Modern high vacuum pumps, internal-combustion engines, periscopes, range-finders, kinemacolor, dynamos, X-rays, and radio-activity, are all considered. Strangely, there is no reference to wireless telegraphy, and some criticism might be offered of the treatment of Newton's "Laws of Motion." Minor details apart, however, the book is most satisfactory and should make a strong appeal to all engineering students.

(2) This is a text-book for final degree examinations, and it will probably appeal to the student who has but little outside assistance. The explanations are very full, and definitions and statements of special importance are printed in heavy type. There is a large collection of problems, taken chiefly from university examination papers, and some of these have been fully worked out. Brief directions for practical work are also given in the text.

The treatment mostly follows on stereotyped lines, but references to modern developments are interspersed, and the chapters on radio-activity, the passage of electricity through gases, and electronic theories are well written, and it is here difficult to find any of the more important developments of the subject that are left untouched.

(3) This book was originally written for the pupils of Gresham's School, Holt, and it probably forms a satisfactory supplement to the author's course of lessons; but it is nevertheless unlikely to make any general appeal.

The master is supposed to "lecture on the lines of the notes and draw the diagrams on the board," whilst the boys enter the diagrams in special copies of the book with blank left-hand pages. The present volume is intended as a guide to the master, and the diagrams—some very carefully drawn—are inserted. The wording throughout is somewhat loose, but in spite of this the author wishes his definitions to be "learnt by heart." On p. 117 the "edge of a prism" is defined! Further, we are told that, "since light travels in straight lines, any one of these straight lines is called a ray of light." The objection to the corpuscular theory is that, "if the corpuscles travelled with this immense velocity, they would possess considerable momentum, of which there is no evidence"; whilst, after three lines of explanation, the wave theory is dismissed as "the one that is now in vogue."

(4) Students working for the First Examination of the Conjoint Board, or even possibly for the London University First Medical, will find in this book most of the information they need. In addition to the ordinary theoretical work, about forty pages of the book are devoted to brief instructions for carrying out a number of illustrative experiments. The style is simple throughout, sometimes even at the expense of accuracy, and descriptions of out-of-date pieces of apparatus still occur. Nevertheless, those who have never studied physics before will find the book very useful. The present edition appears to be a

very considerable improvement on the first, and there are a number of references to the applications of physics to medicine that may help to bring home to the student the dependence of his future work on the more fundamental sciences.

G. D. W.

## MEDICINE AND THE LAW.

*Lyon's Medical Jurisprudence for India, with Illustrative Cases.* By Lt.-Col. L. A. Waddell. Sixth edition. Pp. xiii+783. (Calcutta and Simla: Thacker, Spink, and Co.; London: W. Thacker and Co., 1918.) Price 28s. net.

THE reviewer remembers the appearance of the first edition of this work in 1888, for in that year he passed from military to civil employ under the Government of India and became a district civil surgeon. That officer, to a certain extent, combines the duties of police surgeon and coroner, since all medico-legal cases are submitted to him. Upon his report further action depends. Where the use of poisons is suspected he passes on the viscera or other material to the chemical examiner, whose report is attached to the surgeon's record. In the Presidency cities where there exist coroners' courts a special surgeon is appointed for medico-legal work. In Calcutta and Bombay that officer is also lecturer on medical jurisprudence in the medical college. The later editions controlled by Lt.-Col. Waddell have maintained the reputation which Lyon's work acquired at its first appearance. With advances in research and experience new tests and methods have been added, while old technique has been improved. Time brings few changes in fundamentals, but, as knowledge increases, science follows more closely the track of the criminal and provides more certain help to those who administer the law.

There can be no more profitable school for the student of forensic medicine than a large Indian city such as either Bombay or Calcutta. Lyon took his material from the police records of Bombay and from that classic storehouse of illustrative cases erected by Norman Chevers. As regards toxicology Lt.-Col. Waddell was specially fitted for the editorial work through practical knowledge acquired as a Government chemical examiner in Calcutta. It is again, in this new edition, from Bombay that much help has come. In the "Preface" Lt.-Col. Waddell records indebtedness to the experience of Prof. Arthur Powell, lecturer on medical jurisprudence at the Bombay University.

Very useful advice is given to the medical witness as to demeanour in court and as to the character of his replies to questions. This advice is amplified in the appendices, where examples are given of the kind of question which may be expected in particular cases.

Now that well-deserved praise has been given, is there anything lacking, anything that might be amended? While most of the chapters contain the latest information, it is noticeable that chap. xxvii., "Snake Venoms," gives no reference to the valuable recent researches of Acton and Knowles ("Ind. Jour. Med. Res.," 1914, pp. 46–148). This paper "throws the searchlight into many dark places, straightens some crooked ways, and is altogether illuminating and inspiring" (Alcock).

Again, one is surprised to find scorpions and spiders classed as "venomous insects" (p. 592). Errors which might be due to proof reader or printer are few and of no great importance. "Myer" for "Mayer" (pp. 623, 624) might lead to momentary difficulty, but the reagent is well known. The book has a good general index and also a "Vernacular Index of Plants and Drugs." We notice some differences in the spelling of certain names in the text and in the latter index. This may be due to different hands using slightly different methods of transliteration. As cases of self-inflicted injuries to support false charges are rare in England, it may be mentioned that the case of Jitan Ali Mir (ref. p. 573) was fully reported, under the title "Two Interesting Medico-legal Cases."

J. H. T. W.

## OUR BOOKSHELF.

*Department of Commerce, U.S. Coast and Geodetic Survey. Terrestrial Magnetism. United States Magnetic Tables and Magnetic Charts for* 1915. By D. L. Hazard. Pp. 256+maps 5 in pocket. (Washington: Government Printing Office, 1917.)

THE latest American publication of similar scope referred to 1905, but declination charts for 1910 have been published. The observing stations used for the present charts exceeded in number those used for the 1905 charts by some 50 per cent. For declination 405 sea observations were used, and results from 6120 land stations, including 1129 in Canada, Mexico, and the West Indies. The first set of tables give declination (D), inclination (I), and horizontal force (H) results obtained at successive epochs at repeat stations. The D and I results are given to the nearest 1′, the H results to the nearest 10 γ. The second set of tables gives the corrections for reducing observations taken at different epochs and in different geographical positions to the epoch January 1, 1915. They are followed by tables giving D, I, and H, first as observed at the several stations, then as reduced to January 1, 1915. The last set of tables gives for each whole degree of latitude and longitude the values for January 1, 1915, of D, I, H, total force (T), and north, east, and vertical (V) components. Latitudes from 19° to 51° N. are included. At 19° N. the longitudes range from 74° to 105° W., while at 47° N. they range from 64° to 128° W. In these final tables the D and I results go to 0·1°, the force results to 0·001 C.G.S.

A pocket at the end of the volume contains charts of D, I, H, V, and T for the epoch January 1, 1915, the lines of equal values of the elements being in red. The first three charts include lines of equal annual change in blue. The extreme values of the annual change in D are met with on the Canadian border on the Atlantic coast, where westerly declination has an annual increase of 6′, and in the S.W. in Texas and California, where easterly declination has an annual increase of 3′. Inclination is increasing as much as 7′ a year in the extreme south of Florida, whereas in the extreme north, on both the Atlantic and Pacific shores, it shows an annual fall of 1′. H is falling throughout the whole of the United States, the annual decrease varying from 10 $\gamma$ in the extreme north to 120 $\gamma$ in the extreme south. The volume contains a great mass of magnetic information in a convenient form.

C. CHREE.

*Directions for a Practical Course in Chemical Physiology.* By Prof. W. Cramer. Third edition. Pp. viii + 119. (London: Longmans, Green, and Co., 1917.) Price 3*s*. net.

"THE text of this edition is (apart from a few verbal alterations) identical with that of the second edition. The changes in the external appearance of the book have been made with the object of keeping the price as far as possible at its former level." So runs the preface, and that being so, any extended notice of this book is unnecessary. The second edition was fully reviewed in NATURE for March 25, 1915, and we then took occasion to point out what we conceived to be its defects. These defects still remain, but, in spite of them, the work has been a success, seeing that a new edition has been necessary after so short an interval.

## 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.*]

### Reconstruction Problems and the Duty of Science.

IT is sufficiently obvious that the problems of reconstruction following the war will tax the intelligence and good will of mankind to the utmost. It is also certain that mistakes made during this period will have more serious consequences than similar errors in a period of less social plasticity. By the same token, wise moves will produce greater and more permanent good. Never before, perhaps, has the obligation to choose between good and evil been quite so insistent, or the danger of a wrong choice quite so perilous.

Already we observe several groups of people preparing to deal with this situation. Their methods are diverse, and their aims more or less conflicting. Upton Sinclair sends us the first number of a new periodical, devoted to social justice. Yesterday I attended a meeting in which college students were invited to consider the ethics of Jesus as a foundation for the new democracy. The speaker spent some time in explaining to us that the movement, which is a national one, was neither pacifist nor pro-German. Business men, we read in the papers, are inviting the Germans to consider the conditions under which it will be possible to resume commercial relations. All these movements, and others, invite public discussion, and are beneficial to that extent at least. Underlying the Christian and Socialist propaganda is the entirely right feeling that mankind must agree on some system of ethics, some basic philosophy, which will make for co-operation and human welfare. It is possible that there is more than one such system which would fairly serve our purpose; but it is certain that we must, in the main, agree. The very existence of democracy implies some such agreement, and its failures result from the partial lack of it.

So far, I think scientific men can reasonably, indeed enthusiastically, go with the religious and radical groups. We are all seeking an absolutely necessary basis for conduct. Yet at this point, where we seem unanimous, grave possibilities of conflict arise. The scientific man is obliged to ask: What will be the consequences of the doctrines we propose to adopt, and how will they harmonise with natural law? There was a time when it was generally agreed that illness was due to evil spirits, and in a certain sense the facts were as postulated. Yet the total ignorance of the nature of those "spirits," of bacteria, left man in a very defenceless position. Nature penalised him, and she always does, for his ignorance, not asking whether he "ought" to have known. So it must always be, and *mere* good intentions or pious motives, without wisdom, avail us nothing. They may avail less than nothing if they create an impression that our problems have been met, when they have only been evaded. This is clearly seen by the ablest representatives of most movements, but not so clearly by a large portion of the rank and file. It is because it is so easy to allow emotion to crowd out intellect, and then to lead it to waste its energies in uninformed sentimentalism, that unpatriotic motives have sometimes been ascribed to those whose love of their country and their fellows was actually keener than ordinary. Such injustice is naturally resented; but it remains a fact that there are many who for various reasons are particularly interested in preventing the great volume of hope and good will from turning the wheels of reform. To such all ineffective efforts afford "aid and comfort."

While the scientific fraternity, thus confronted with a perplexing situation, is making up its mind how to act, what may be considered a perfect manifesto on its behalf has come from an unexpected source. The *New Republic* of February 16 prints the report on reconstruction by the Sub-committee of the British Labour Party. The concluding passage of that report reads as follows:—

"The Labour Party is far from assuming that it possesses a key to open all locks, or that any policy which it can formulate will solve all the problems that beset us. But we deem it important to ourselves, as well as to those who may, on one hand, wish to join the party, or, on the other, to take up arms against it, to make quite clear and definite our aim and purpose. The Labour Party wants that aim and purpose, as set forth in the preceding pages, with all its might. It calls for more warmth in politics, for much less apathetic acquiescence in the miseries that exist, for none of the cynicism that saps the life of leisure. On the other hand, the Labour Party has no belief in any of the problems of the world being solved by good will alone. Good will without knowledge is warmth without light. Especially in all the complexities of politics, in the still undeveloped science of society, the Labour Party stands for increased study, for the scientific investigation of each succeeding problem, for the deliberate organisation of research, and for a much more rapid dissemination among the whole people of all the science that exists. And it is perhaps specially the Labour Party that has the duty of placing this advancement of science in the forefront of its political programme. What the Labour Party stands for in all fields of life is, essentially, democratic co-operation; and co-operation involves a common purpose which can be agreed to; a common plan which can be explained and discussed, and such a measure of success in the adaptation of means to ends as will ensure a common satisfaction. An autocratic sultan may govern without science if his whim is law. A plutocratic party may choose to ignore science, if it is heedless whether its pretended solutions of social problems that may win political triumphs ultimately succeed or fail. But no Labour Party can hope to maintain its position unless its proposals are, in fact, the outcome of the best political science of its time; or to fulfil its purpose unless that science is continually wresting new fields from human ignorance. Hence, although the purpose of the Labour Party must, by the law of its being, remain for all time unchanged, its policy and its programme will, we hope, undergo a perpetual development, as knowledge grows, and as new phases of the social problem present themselves, in a continually finer adjustment of our measures to our ends. If law is the mother of freedom, science, to the Labour Party, must be the parent of law."

In this spirit all students of science may unite. Through it, and not otherwise, may the decay of civilisation be arrested, and the fair fruits of ages of effort brought to maturity. T. D. A. COCKERELL.

Boulder, Colorado, March, 1918.

## The Motion of the Perihelion of Mercury.

THE type of resistance suggested by Sir Oliver Lodge (NATURE, April 18, p. 125) is very difficult to visualise. The motion of a planet consists practically of a steady motion in a circle, with a superimposed free vibration, the amplitude of which is proportional to the eccentricity, and the phase of which depends on the longitude of the perihelion. The hypothesis that the perihelion can be made to move without alteration in the eccentricity is equivalent to assuming that a free vibration can persist in a resisting medium without change of amplitude. It is true that the absolute resistance would be expected to be greater at perihelion than at aphelion, on account of the difference in density at the two points, but this difference contains the eccentricity as a factor, and it is for this reason that the rate of decrease of the eccentricity and the motion of the perihelion would be of the same order of magnitude.

The limitation of the resistance to a force parallel to the minor axis would mean that the departure of the orbit from circularity determines a very small part of the resistance, most of this being due to a general motion of the medium in that direction with a velocity far exceeding the parabolic velocity. Even without the difficulties introduced by the high density required, such a velocity could not be accepted.

One effect of a difference between longitudinal and transverse electromagnetic masses was shown by Mr. G. W. Walker, in the April *Philosophical Magazine*, to be a change in the plane of a planet's orbit. The nature of this change can be found without much difficulty to be a rotation of the plane about the projection on itself of the sun's motion in space, the speed of rotation being proportional to the product of the components of the sun's motion in and perpendicular to the plane. The rotation being about an axis in the plane of the orbit, the effect on the nodes should be much less than that on the inclinations, whereas the contrary is the case. Thus it seems that the motion of the node of Venus cannot be accounted for in this way, and either one of the two component velocities must be very small or the effect of absolute motion on electromagnetic mass must be in some way compensated in the law of gravitation itself. The absence of the variations in the eccentricities that would be expected to be produced by a motion of the sun through space also suggests that there is such a compensation. HAROLD JEFFREYS.

## A Plea for the Naturalist.

THE naturalist is not so black as he is painted. Conditions of modern technological inquiry are against him; the splitting of species into geographical and local races, distinguished by the finest touches of colour or the minutest of structures, has put the detailed identification of many of our native creatures beyond his compass.

But there is still a wide field for the naturalist, the closer observation of the habits of our native creatures. It is to be regretted, therefore, that in this his proper field his work should be slighted and minimised by the worker who prides himself, and rightly, on his technical equipment for specialised work. In a recent issue of NATURE (March 21) a writer grouped naturalists with "landowners, sportsmen, farmers, rat-catchers," as well as a large class of bird-lovers, as being of the people whose personal opinion "is really of very little moment," in a matter which, after all, is mainly one of observation—an inquiry into the economic significance of the feeding habits of birds.

Why the fact that a man possesses or farms a few acres should invalidate his natural history observations is not easily understood. And, after all, are the opinions of the naturalist really so much at fault? Many times during the last few years we have been told in effect that years of careful work by an experienced investigator, supplemented by the researches of many others, had at last made it "possible to state definitely that at the present time there is ample evidence of a far-reaching kind to prove that no quarter should be shown to the wood-pigeon," that the rook "is far too plentiful at the present time, that it prefers a grain diet, and that it is injurious," that "the starling has increased in numbers enormously," and that "the bullfinch and blackbird in fruit-growing districts are most destructive."

But the naturalist knew and had recorded these things; pigeon-shoots are not affairs of yesterday; and already in the early part of the fifteenth century the Scottish Parliament had passed a law for the destruction of rooks precisely on account of their "gret skaithe apone cornis." On the whole, the naturalists and farmers were right, and minute researches have confirmed their general opinions.

On the whole, too, the results of the minute researches are less definite than would at first sight appear, for, apart from the difficulty of contrasting vegetable with animal food as it is represented in the food canal of a bird some time dead, there is the danger of reaching conclusions from unconsciously selected specimens. The gull on the turnip-field is likely to be shot and sent for examination, that on the offal of the fishing village is likely to be left unharmed, and the percentage of injury caused by gulls rises accordingly. No one would dream of deprecating such inquiries as have been carried on. They are necessary and of the greatest value, and in the hands of an organised group of observant workers of wide sympathies they will yield a large proportion of truth. But they are not infallible.

The contributions of both naturalist and laboratory expert are necessary to the fullness of this knowledge, but one without the other leans on a broken reed.

April 11. JAMES RITCHIE.

X Astronomical day



## TIME AT SEA AND THE ASTRONOMICAL DAY.

IN spite of the stress of war, the British, French, and Italian Admiralties found opportunity last year to come to an important decision on the question of timekeeping at sea. Hitherto the general practice appears to have been to set the ship's clocks to the local time corresponding with the place where observations were made, and continue its use until further observations were secured. In consequence, two vessels speaking each other might record different times for their meeting; cases are not unknown where it has been of legal importance to ascertain the exact time of a death occurring at sea, which was a matter of some difficulty on the old system. It has now been resolved to extend to the sea the system which has been so widely adopted on land, of keeping time which differs by an integral number of hours from Greenwich time, the hour being changed on crossing meridians 15° apart. In this connection it may be noted that there is need of a short name for the regions that keep the same time. The word "zone" is to be deprecated, since both by root-meaning and by usage it suggests a belt parallel to the equator. The word "lune" has been adopted in works on spherical trigonometry, but is apt to suggest a connection with the moon. The French use the somewhat cumbersome term "fuseau horaire." Mr. T. C. Hudson suggests the term "douve"; it means a barrel-stave, which has some resemblance to the shape of the regions in question.

Commandant P. Vincent has devised a new form of chronometer dial to facilitate the determination of the ship's time; he describes and illustrates it in *La Nature* for March 2 (see Fig. 1). There are three hands, indicating day of month, Greenwich hour, and minute respectively. Apart from the month hand, which is of the nature of a luxury, the new form of dial could be readily adopted for all chronometers. It has five concentric circles of graduation: first, the degrees of longitude, counted from 0° to 180° in each direction; second, the hours to be added or subtracted; third, the graduations of the minutes of time; fourth, the Greenwich hours, reckoned from 0h. (midnight) to 23h.; fifth, the days of the month; inside these the compass points are indicated, but they can be omitted if desired.

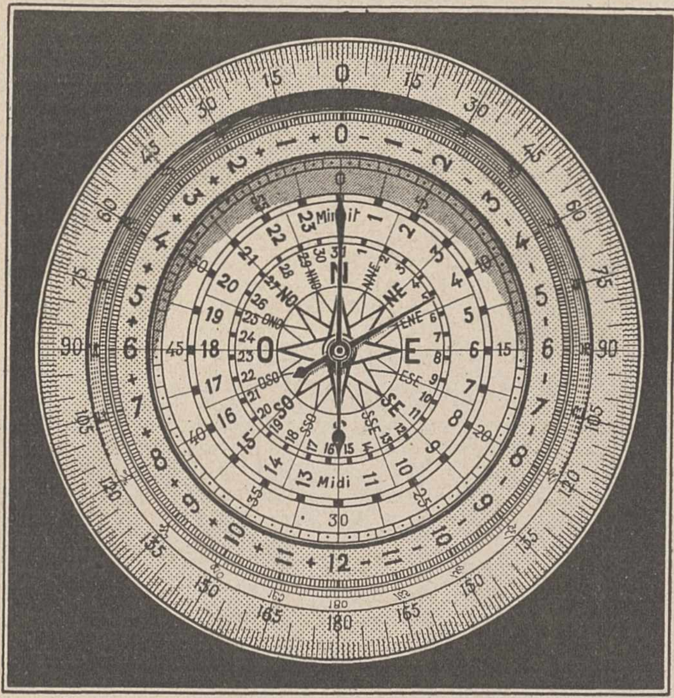


FIG. 1.—P. Vincent's design for chronometer dials.

The discussion on time at sea has incidentally reopened a larger question, which was mooted some thirty years ago, but shelved for a time. This is whether the use of the astronomical day, commencing at noon, might not be discontinued, and the civil day, commencing at midnight, extended to astronomy. This matter has been under informal discussion for several months, and in the opinion of the present writer the general feeling is in favour of the change, though there are some names of great weight on the other side. The astronomical day goes back at least to the time of Ptolemy; it is based on the obvious principle that the bulk of observational work is done at night, so that the night should be kept as an unbroken unit. But this point is not gained without appreciable inconveniences; most astronomers must have felt a considerable amount of mental worry in having a different calendar date for all occurrences between midnight and noon, according as we are considering their astronomical or their civil aspect; even the month or year is sometimes affected. There is, moreover, some confusion as to whether the astronomical day begins with mean or apparent noon; the Nautical Almanac uses both systems in different sections, so that several minutes each day form a sort of No-man's-land, being claimed for different dates on different pages of the almanac; there would be no similar confusion at midnight, apparent midnight being a meaningless phrase.

Both the British and French Admiralties are agreed that the use of the civil day would be a convenience to navigators. The French have already decided to adopt the civil day in their abridged Seamen's Almanac from the year 1920. A few British astronomers have suggested that our abridged almanac should be changed, but not the larger one. This would lead to great risk of error, since the larger almanac is often used at sea; the sailor has a claim to consideration before the professional astronomer, since the latter has more leisure to make his calculations, and errors, if made, are less disastrous.

In response to an appeal from the Admiralty, the Royal Astronomical Society is now sending round a circular to representative astronomers and societies in our own, the Allied, and neutral countries. This, after a brief *résumé* of the circumstances, enumerates the changes in the almanac that would be involved if the new system were adopted, and invites suggestions and criticism. It is thought that 1925 is the earliest date that is practicable for making the change, since the almanac goes to press several years in advance. It is proposed that the reckoning by Julian days shall still begin at Greenwich noon, in consequence of the numerous ephemerides of variable stars that have been drawn up on this system; this would afford a means of relief to those astronomers who dislike the change; by dating their observations in Julian days, instead of calendar dates, they could continue to keep their nights undivided.

It is hoped that the change, if made, will be adopted throughout the astronomical world, so that an interval is wisely being left for full ventilation of the subject. Some have hopes that the change might be accompanied by the introduction of twenty-four-hour reckoning by the general public; this system has long been in use in Italy, and leads to a great simplification of time-tables of railways, tides, etc. It does not necessarily involve the use of new clocks with twenty-four-hour dials. It suffices to use the present dials, merely inserting 13h. to 0h. inside the figures 1h. to 12h. In fact, many prefer this system, since the hours on a twenty-four-hour dial are inconveniently close. A. C. D. Crommelin.

## THE RECOVERY OF POTASH FROM BLAST-FURNACE GASES.

THE sources of potash were described by Sir Edward Thorpe in an article in Nature of January 3 (p. 344). One of these sources has been the subject of study by Prof. R. A. Berry and Mr. D. W. McArthur, who have published the results of their investigations in a paper read before, and discussed at, a meeting of the West of Scotland Iron and Steel Institute. These investigators have studied in particular the possibilities of recovering potash from the blast-furnace gases obtained in Scottish practice, with the view of obtaining information as to how far these may be expected to constitute an economic source of supply, when the restrictions imposed by the war no longer hold.

That the dust deposited from blast-furnace and kiln gases contains potash salts has long been known, and in 1884 Barclay and Simpson, of the Harrington Ironworks, Cumberland, took out a patent for the recovery of salts, and especially potash salts, from coke-fed furnaces. The most considerable investigation, however, on this subject is that by Wysor, of the Bethlehem Steel Company, U.S.A., who found that the dust which collected at the bottom of the stone chequer-work in the stoves and gas-fired boilers contained 15 per cent. of water-soluble potash ($K_2O$). Further, he drew up a balance sheet to show the amount of potash charged into the furnace and the percentage recovered. His conclusion was that the greatest losses occurred in the primary and secondary washers, constituting some 56 per cent. of the whole, while 20 per cent. was carried off in the slag; further, that less than 1 per cent. of the potash charged was recovered in the dust alluded to. In 1916 a Cottrell plant for electrostatic precipitation was installed, and it was found that practically all the dust could be precipitated. About 22·4 lb. of potash were charged per ton of pig-iron produced, and after deducting the amount contained in the slag and the dust-catcher, about 15 lb. per ton of pig-iron appeared to be left in the gases, which were then recoverable in the Cottrell plant.

The average potash content of the American ores is about 1 per cent., and as the production of iron in the United States in 1916 was nearly forty million tons, if Wysor's figures are correct the flue-dust from the furnaces should constitute a very considerable source of supply.

As the authors point out, the problem in Scotland is different: first, because coal, and not coke, is the fuel generally used, and secondly, because the ores contain rather less potash. With coke-fired furnaces the gases are not washed, but are led from the catchers direct to the stoves and boilers. In coal-fired furnaces, however, a considerable amount of tarry matter is produced, whereas the dust deposited is relatively very small. The problem of recovery is therefore different. The potassium is present in the ore, principally, no doubt, in the form of silicate. This reacts at the high temperature of the furnace and forms other compounds, for, as the dust analyses show, chlorides, sulphates, and carbonates were the principal acid radicals present. It is well known, further, that potassium cyanide is formed in certain regions of the furnace, but decomposed in others. At the high temperature these potassium salts are vaporised; they condense in the cooler parts of the furnace as fine dust particles, and are carried along with the dust from the fuel and the ores. The first particles deposited are the heaviest, and these are caught in the dust-catcher, in the form of a coarse, black powder; deposition also occurs on the main tube, and these two constitute the tube cleanings. The heavy, tarry matter separates principally in the condensers and carries with it much of the fine dust; the gas then passes to the water scrubbers, which retain the rest of the tarry matter and most of the remaining dust. Any mineral matter still retained is caught in the stove and boilers.

The authors have received and analysed samples of these deposits and liquors from various plants in Scotland, and have determined their potash content. Nine samples of flue-dusts were examined: eight from coal-fired furnaces and one from a coke-fired furnace. The highest yield of dust in the former was only at the rate of 21 tons per annum, as against 300 tons for the latter, and the water-soluble potash averaged 8·86 per cent. The percentage of ash in the tube cleanings varied from 53 to 74 per cent., but these contained a very small percentage of water-soluble potash, the highest being 2·7 per cent. Special attention was paid to the spent liquor, of which the specific gravity, total solids, ash, and water-soluble potash were determined; and the authors discuss various methods of separating the mineral values from the tarry matter, which greatly hinders evaporation.

In the case of one firm the authors have drawn up a balance sheet showing the amounts of potash in the raw materials charged, and its distribution in the products. In one case where 7·6 lb. were charged per ton of pig-iron, 6·04 lb. per ton were accounted for, of which 1·4 lb. were contained in the spent liquor, 1·7 lb. in the pitch, 0·2 lb. in the tube cleanings, 0·04 lb. in the flue- and stove-dust, and 2·7 lb. in the slag, leaving 1·6 lb. unaccounted for. This balance sheet is very different from that obtained by Wysor, but too much stress should not be laid upon it, because the figures refer to one plant only. The authors estimate finally that about 1667 tons of water-soluble potash are recoverable per annum from the 102 Scotch furnaces. They give, however, no estimate of the total amount of insoluble potash, and refer only briefly to the possibility of its being rendered soluble. It does not look as though the prospect of recovering potash profitably in Scotland after the war was at all promising, and this view was emphasised in the discussion which followed.

H. C. H. C.

## WAR-TIME RESEARCH IN THE UNITED STATES.

It is difficult to find in this country in these days a scientific worker, however recondite his studies may have been in pre-war days, who is not engaged in problems connected with the war, the development of industry, or the extension of trade. A similar state of things, at an earlier stage, is to be seen in the United States, where the National Academy of Sciences has formed a National Research Council, which is organising research on current problems. The council is nothing if not catholic in its ideas of war-time research, and the subjects allocated to its committees and sub-committees range from palæontology to psychology.

The council has apparently been much concerned to secure for American libraries and scientific institutions supplies of German scientific literature, held up in Amsterdam and London as a result of the British blockade. The difficulty has been satisfactorily solved, and official forms have been duly evolved for the liberation of consignments, certified by the Library of Congress in Washington and the United States Consul in London.

The Geology and Palæontology Committee of the council has published a brochure entitled "What a Geologist can do in War." This has been freely distributed among Army officers, with the view of explaining what service they can expect from geologists. The same committee is collecting information as to the materials available in the coastal States for the construction of roads and fortifications.

In association with other organisations the Committee on War Minerals has made a census of all minerals required for war purposes, with notes on their production, stocks held in the United States, sources of supply, and other matters. Special surveys have been undertaken in some cases to complete information regarding minerals and to secure data necessary to permit of the rapid exploitation of deposits. Dr. Dean, curator of the Department of Arms and Armour in the Metropolitan Museum and of Fossil Fishes in the American Museum, and a member of this committee, has designed models for modern body armour, which are now being made for trial in field operations.

The Committee on Zoology has organised an extensive field of work in connection with the elimination and control of animal pests, especially those known to be carriers of disease, the examination of pathological specimens, investigation of water and soils from camp-sites, and the disposal of garbage and drainage. Even more important, perhaps, in view of the urgency of the food problems caused by the war, is the work this committee intends to undertake on the improvement of breeds of domestic animals, better methods of increasing and conserving stock, and possible remedial measures against food-destroying insects. Another interesting problem in its programme is the study of limbs and joints with the view of improving the construction of artificial limbs. The utilisation of aquatic birds in locating submarines, a subject which has not escaped the attention of the popular Press in this country, is also being considered.

The programme of the Botanical Raw Products Committee is perhaps the most far-reaching of all, since it aims at establishing for the use of manufacturers a kind of "clearing house of information" regarding raw materials, exclusive of food staples. This committee proposes to collect all available information regarding plants of economic value with the view, among other things, of producing supplies of essential raw materials at home, providing substitutes for materials previously imported, and investigating the possibilities of new raw materials. This committee points out that "often a great industry buys its raw material from a broker or an importing house without knowledge of either the geographic or the specific source. When this source is cut off, as has frequently been the case during the past three years, and as possibly will be more frequent during the next few years, the manufacturer has been placed in an uncomfortable position. Curiously enough, such a predicament is many times brought about by the curtailment of a product used in such relatively small quantities that the fact that it is essential to the finished article is overlooked or forgotten during times of plenty." This opinion is worth quoting, as it diagnoses accurately a predicament in which many a manufacturer in the belligerent countries has found himself during the war with regard to both raw materials and partly manufactured products.

Numerous other committees have been formed, but the foregoing notes will be sufficient to indicate the far-reaching scope of the National Council's activities and the practical character of the work it proposes to undertake. Throughout the programmes of work laid down, but especially in that of the Botanical Raw Products Committee, it is interesting to note that the problems to be solved are of immediate practical importance, and that close co-operation with traders and manufacturers in solving them is considered essential.

T. A. H.

## *NOTES.*

THE British Science Guild is organising a comprehensive British Scientific Products Exhibition, to be held at King's College, London, for four weeks during the coming summer. The exhibition will comprise a large display of products and appliances of scientific and industrial interest which prior to the war were obtained chiefly from enemy countries, but are now produced in the United Kingdom. Much has been accomplished by our manufacturers since the opening of the war in industries in which previously we had been falling behind, and it is believed that the exhibition will have a stimulating influence upon scientific and industrial research by bringing home to the public the supreme importance of science in industry. Particulars of the exhibition will be issued shortly.

ACCORDING to Press reports, platinum has been discovered in some quartz deposits in the Ober Rosbach district of the Taunus Mountains (Germany). Steps have already been taken to work the deposits.

THE death of Mr. Daniel Macalister on April 12 is announced in *Engineering* for April 19. Mr. Macalister was the engineer and superintendent of the Greenock Corporation Water Department, and had also acted as the resident engineer during the construction of the James Watt Dock. He joined the Institution of Civil Engineers in 1882, and held the institution's Miller prize.

WE regret to record the death of Mr. Richard B. Prosser, which occurred on March 26. Mr. Prosser was born in Birmingham in 1838, and was regarded as one of our best authorities on the history of invention. He was connected for about twenty years with the Patent Office Library, and became superintendent examiner of specifications in 1883. An account of his career appears in *Engineering* for April 19.

BY way of supplement to the leaflet entitled, "Birds, Insects, and Crops," the Royal Society for the Protection of Birds (23 Queen Anne's Gate, S.W.1) has issued a series of twelve "Bird-Ally" postcards, each bearing on the front a quotation as to the value of birds on the land, while the back is left free for writing. The postcards, which can be had for 4½*d.* a packet, should be useful at the present time, when the Board of Agriculture has warned growers of probable insect plagues.

THE death is announced, in his eighty-sixth year, of Mr. E. T. Wilson, a well-known medical man, of Cheltenham. In 1901 Mr. Wilson was the president of the Medical Section when the British Medical Association met at Cheltenham. He contributed numerous papers to the medical periodicals, and was the author of "Sanitary Statistics of Cheltenham." He founded a naturalists' society at Cheltenham, and was interested in the collection of Neolithic flint implements. His son, Dr. E. A. Wilson, was a member of Captain Scott's Antarctic Expedition, and died on the journey from the South Pole.

THE subject of the Jacksonian prize of the Royal College of Surgeons of England for 1919 is to be "The Investigation and Treatment of Injuries of the Thorax received in War." The John Tomes prize of the college for the period 1915 to 1917 has been awarded to Mr. J. G. Turner for his work on the subject of dental pathology. In consequence of the temporary removal of the pathological specimens of the museum of the college for greater safety, the delivery of the Erasmus Wilson lectures, and the demonstrations, are to be discontinued for the duration of the war.

BY the death, at the age of seventy-seven, of Col. George Adolphus Jacob, India has lost an accomplished scholar. Belonging to a well-known Anglo-Indian family, which included the famous founder of Jacob's Horse, he entered the Indian service at the age of sixteen in the Bombay Presidency, where he mastered the Marathi language, and later on devoted himself to the study of Sanskrit. His chief work was done in philosophical literature—a monumental concordance to the principal Upanishads and the Bhagavad Gita, and his manual of Indian Pantheism, the best introduction to the Vedanta. His official work was the Directorship of Military Education, and he acted as examiner in Sanskrit and Marathi for the University of Bombay. The University of Cambridge conferred on this eminent scholar the honorary degree of Litt.D.

IN the *Nieuwe Courant* Dr. I. P. Lotsy recently directed attention to the hybridisation experiments of Mr. R. Houwink, a private breeder of Meppel, Holland, who has tested Darwin's view that our domestic fowls are derived from *Gallus bankhiva.* He has obtained fertile hybrids of this species with *G. Sonnerati,* and also with *G. furcatus.* The latter hybrid was again fertile with *G. bankhiva,* whence it would appear that all three species may be among the ancestors of domestic breeds. Domesticated rabbits have been found fertile both with wild rabbits and with hares, and hybridisation experiments are also in progress with jackals, foxes, and wolves, in order to determine the origin of domestic breeds of dogs. Experiments on the crossing of wild and domesticated pigs are subsidised by the Dutch Government.

THE *Times* of April 19 and 20 contained letters by Mr. W. Baden-Powell and Mr. R. B. Marston directing attention to the Order about to be made by the Board of Agriculture and Fisheries authorising the taking of salmon kelts, subject to certain conditions. It is suggested by both correspondents that an excellent opportunity is thus afforded for obtaining evidence with regard to the rather obscure questions whether and to what extent kelts feed in fresh water, and also whether they destroy the young of their own species. Many anglers would probably be glad to take out the stomachs and digestive organs of the fish they kill and send these, with full particulars, to scientific men appointed by the Board. Hitherto it has been illegal to take kelts, and so the evidence with regard to their feeding habits is very unsatisfactory and meagre. Mr. W. J. M. Menzies, in the

*Times* of April 23, states that he has examined a certain number of kelts in all the so-called "mending" stages, and has found no trace of food in any of them.

HULL is probably one of the few places in this country which are extending their museums in these times. It may be remembered that during the Museums Conference at Hull in 1913, Col. G. H. Clarke purchased for 1000*l.* the Mortimer collection of Yorkshire archæological and geological specimens, which the members had an opportunity of visiting at Driffield, and as the building is now required for other purposes the collections have been removed. The Hull Corporation has taken some temporary premises in Albion Street, in the centre of the city, and in these the entire collection has recently been placed, and steps have been taken to prepare the museum for public inspection. When it is remembered that in the archæological collection alone there are the entire contents of nearly four hundred barrows of the Bronze age, as well as several hundred skulls of prehistoric, Roman, and Saxon date, about 1000 prehistoric, Roman, Saxon, and medieval vases, some of large size, and the contents of several Anglo-Saxon and Roman cemeteries, it will be understood that the removal of the collection has been an undertaking of some magnitude. Nearly twenty vanloads were required to remove the specimens, and we understand the entire collection, consisting of about 60,000 objects, has reached its new quarters without damage.

IT is proposed shortly to establish in Naples a National Experimental Station for Ceramics and Glass-making, in which will be incorporated the existing Ceramic Laboratory of the Royal Museum for Industrial Arts at Naples. *L'Economista d'Italia* for April 4 states the objects of the new institution as follows:—(1) To carry out researches bearing on problems connected with ceramics and glass-making, and to promote such manufacture by publications, lectures, and assistance; (2) to experiment with and publish new methods of working, for the better utilisation of raw materials, the improvement of the quality of the products, and the effective utilisation of by-products and waste; (3) to investigate and suggest new sources of supply of raw materials and new markets for the products; (4) to give opinions and advice; (5) to make analyses, tests, and researches, and to verify instruments and apparatus when requested by the public, by manufacturers, or by public bodies; (6) to provide laboratory accommodation, etc., for the use of students; (7) to publish a bulletin giving results of researches and other information; (8) to admit into the laboratories as pupils young students who have passed through a technical college and taken a diploma, etc., and intend taking up the manufactures mentioned; further, to hold evening and holiday classes of theoretical and practical instruction for work-people.

AN account of an interview with Prof. E. H. Starling on the position of natural science in the educational system of Great Britain, as described in the report to which we directed attention last week, is given in the issue of the *Observer* for April 21. The report, Prof. Starling remarked, is an anticipation of and preparation for nothing short of a revolution in the intellectual life of the country. Hitherto in this country we have neglected and despised science. We have not understood that it is simply the whole of human experience ordered and classified. A State which tries to govern its affairs without science is blind. Every step it takes is a step into unexplored ground, and it only learns by bitter experience, by tumbling into every shell-hole it comes across. That is what we call "muddling through"—a method of which some people are proud. The question of the future is whether our democracy has learned the bitter lesson that the war has taught us—that for survival it must use the laws given by science, or go under. The penalty of sin is death. And sin in this case is a neglect of Nature's laws. One of the main points of the report is that it is necessary not only to make scientific experts, but also to educate every individual in this country so that he may know of the existence of this mass of human experience, and may recognise that behind every problem with which he is confronted there is the great body of science to which he can appeal for a right solution to his difficulties.

MR. L. ANDREWS read an interesting and suggestive paper to the Institution of Electrical Engineers on April 18 on the "Overseas Distribution of Engineering Appliances." It is generally admitted that the British artisan as an engineering craftsman can hold his own against all competitors. He attributes, therefore, the commercial success of Germany and America in the pre-war days to the excellence of their systems of distribution. The British manufacturer is in too many cases content to make machines and apparatus and trust to his agents abroad to get the orders, leaving the conveyance of the goods to an outsider. This lack of co-ordination leads to unnecessary expense. To remedy this, Mr. Andrews proposes a modified form of State control. Some system of overseas trade service should be set up and managed by the State or by the State and private enterprise combined. Its first aim would be to provide facilities for British subjects in all parts of the world to secure British-made engineering appliances on satisfactory terms, and its second aim would be to give to British producers the fullest information regarding overseas requirements. Mr. Andrews instanced the Government Postal Service as the kind of department he advocated: it is run on strictly business lines, being financially self-supporting, and yet it competes with no private undertaking. He objected strongly to any despotic mandatory control by the State.

NEWS of the death of Dr. Ethel de Fraine, Fellow of the Linnean Society, for some years lecturer in botany at Whitelands Training College, and afterwards lecturer in botany at Westfield College, University of London, has been received with great regret by many friends. Dr. de Fraine was a conscientious worker in the field of plant anatomy, particularly in the realm of seedling anatomy, a branch which has acquired great prominence of recent years. The series on the Gymnosperms, in which she collaborated with Mr. T. G. Hill, adds considerably to our knowledge of the obscure "transition" phenomena between the vascular structure of the stem and that of the primary root, and a similar independent contribution published in 1910 deals with the seedling structure of Cactaceæ. The School of Seedling Anatomy, to which these publications belong, was initiated by the work of the late Miss E. Sargant, and arose at the beginning of the present century as a modern development of that search for phylogenetic clues, that hunt for the "missing link," which is attributable to the spread of evolutionary ideas following upon the publications of Darwin. Dr. de Fraine, fixing her attention on taxonomic rather than on broad phylogenetic characters, was led to conclude that the study of seedlings was barren from this point of view. Her research career covered a period of about ten years, during which she made an incursion into the realm of fossil botany with a paper entitled "The Structure and Affinities of Sutcliffia." The ecological expeditions in which she took part resulted in 1913 in a treatise on the anatomy of Salicornia, the common seaside glasswort, and her last publication, in 1916, was on the morphology and anatomy of the genus Statice, as studied from its habitat at Blakeney Point. Dr. de Fraine belonged to a type of painstaking worker whose thoroughness of hand and spirit the world of science can ill afford to lose, and it is greatly to be feared that her faithful pursuit of knowledge, coupled as it was with a strenuous professional life, conspired to rob us of the further fruit of her labours. She died at Falmouth on March 25, after an illness of two years.

The Rev. H. G. O. Kendall, in the April issue of *Man*, reports the discovery at East Farm, Winterbourne Monkton, North Wilts, of a fragment of a fine, laminated, micaceous sandstone, very similar to the so-called altar stone at Stonehenge. This has been chipped into shape all round its periphery, so as to produce sharp-cutting edges and to form a knife, apparently of the Bronze age, resembling a small broad-bladed bronze dagger.

Dr. A. M. Meerwarth, assistant-curator of the Ethnographical Museum, Petrograd, recently visited India, and has compiled a useful "Guide to the Collection of Musical Instruments in the Indian Museum, Calcutta." A large proportion of the specimens were presented by the late Raja Sir Sourindro Mohun Tagore, the well-known authority on Indian music. The instruments, except a few of Tibetan origin, are almost exclusively from India or Burma. The guide is carefully prepared and gives much useful information on Indian music. In all 284 specimens are illustrated and described.

The dialects composing the Salinan Indian linguistic group, of which two survive in the Missions of San Antonio and San Miguel, are described in a monograph by Mr. J. Aldem Mason, published in vol. xiv., No. 1, of the Publications of the University of California on American Archæology and Ethnology. Recently Drs. Dixon and Kroeber have connected Salinan with Chumash in an "Iskoman" group, which, in turn, they have later come to regard as part of the Hohan family, a reclassification now accepted by several American philologists and anthropologists. Mr. Mason's monograph gives full linguistic details, and he prints a number of beast folk-tales in the original text with an English translation.

An interesting study of dosage in radium therapy by Mr. J. C. Mottram and Dr. S. Russ is given in the March issue of the *Archives of Radiology and Electrotherapy* (No. 212). Small subcutaneous cancerous nodules were treated, and among other results it was found that there is much less effect upon the skin (inflammation, loss of hair, etc.) when it is exposed for a long time to a weak source of radium emanations than when a strong source is used for a short time, the effect upon the cancerous growths being very nearly the same in the two cases.

The Journal of the Royal Microscopical Society for March (1918, part i.) contains an account, by Mr. R. Paulson, of microscopical and biological work carried out at the civilian internment camp at Ruhleben, near Berlin. The equipment of the laboratory consists of ten microscopes with accessories, a microtome, incubators, etc. Dr. A. E. Lechmere has given a course on elementary biology, Mr. M. S. Pease one on heredity, Mr. S. R. Edge has lectured on animal physiology, and Mr. A. Hill has given instruction on the testing of agricultural seeds. Various friends have presented material. A library of 500 volumes has been got together. At present Nature is the only periodical and link with scientific activity outside.

A disease known as "trench fever" has been very frequent among the troops on the Western front. It is characterised by recurrent attacks of fever of short duration, usually at intervals of four or five days, and followed generally by acute pain in the shins and frequently by dilatation and disordered action of the heart. A committee under the chairmanship of Surg.-Gen. Sir David Bruce was instituted to investigate the causation and spread of the disease. As regards the latter, various circumstances implicated the louse, and experiments were made on this hypothesis. Lice were allowed to feed on patients in all stages of the disease, and were then allowed to bite healthy volunteers; the result was negative. Next the excreta of lice similarly infected were applied to a scarified area of skin, and in from six to ten days after, all the five volunteers so treated developed trench fever. From these experiments it is evident that the bite alone of the louse does not produce trench fever, but that when the excreta of infected lice are scratched into the skin the disease is produced. The funds for this research have been provided by the Lister Institute of Preventive Medicine, and details of the research are published in the *British Medical Journal* for March 23 (p. 354).

Present-day applications of experimental psychology were dealt with recently in two lectures delivered at the Royal Institution by Lt.-Col. C. S. Myers. The first lecture was mainly on the application of psychological experiment to industrial efficiency. Laboratory researches on mental and muscular work were described, showing the relation between rest and length of task, the importance of determining and employing the optimal load, and the various psychological factors which affect the work curve. The economical value was emphasised of introducing systematic rest pauses in the workshops and of selecting by appropriate tests employés fitted for tasks demanding special skill. There is a wide difference between the increased production due to the adoption of scientific short-hand methods of industrial efficiency and that due to the more dangerous process of "speeding up." In the second of his lectures Lt.-Col. Myers devoted himself mainly to the subject of nervous breakdown, pointing out the extreme importance of early and proper treatment of the disorder in industrial as well as in Army life. He showed how the enormous importance now attached by psychology to the influence of the feelings had come to revolutionise our conceptions of memory, of personality, and of consciousness generally; and he insisted on the necessity for continuing in peace time the special hospitals and the special psychological training of doctors which it had been found necessary to organise owing to the effects of war-strain.

The Transactions of the London Natural History Society for 1916, which has just been issued, contains a long address on "Apterousness in Lepidoptera," by Dr. T. A. Chapman, which is of remarkable interest. Not only has Dr. Chapman summarised all that has been recorded on this theme, but he has also added many new facts gleaned from a long study of this subject. He is of opinion that the apterousness of the summer moths is due to factors entirely different from those which have brought about the apterousness of winter moths.

The report on the progress and condition of the United States National Museum for the year ending June 30, 1916, has just reached us. While bearing witness to the wide field of activities which this museum embraces, it shows also that the museum's work is fully appreciated by other departments of the State.

The Department of Justice, for example, obtained for Dr. Aleš Hrdlička, curator of physical anthropology, three months' leave of absence from the museum in order that he might undertake the anthropological examination of about 800 Chippewa Indians for the purpose of determining which should be classed as "full-bloods." This necessitated a preliminary study of the Sioux Indians of North and South Dakota. Apart from the immediate purpose of this investigation, valuable scientific results have been obtained, for in all 1200 Indians were examined, and from the data thus collected it has been possible to establish thoroughly the characteristics of the Sioux people, and to put on record the present racial status of the Chippewa people, who, as a pure race, are fast disappearing.

How thoroughly alive the U.S. Department of Agriculture is to all affecting the welfare of agriculture is well illustrated in a recent Bulletin (No. 621) by Mr. E. R. Kalmbach on "The Crow and its Relation to Man." The economic position of the common crow (*Corvus brachyrhynchos*) and its four subspecies has long been an intricate problem, and has formed the subject of many investigations, of which the most important is that of Barrows and Schwarz (1895), based upon an examination of the stomach contents of 909 birds, mainly from the eastern States. The report now issued is based upon an examination of 1340 adults and 778 nestlings. As the result of this inquiry the author shows that 25 per cent. of the yearly sustenance of the adult birds is animal matter, and 71·8 vegetable matter. Of the former 18·7 consists of insects, and of the latter 51 per cent. of corn and other grain, 3·7 per cent. of cultivated fruit, and 17 per cent. of wild fruits and seeds. The young birds remain in the nest for about three weeks. The percentage of animal food in the nestlings was 83·4, and 16·6 of vegetable matter. Of the former 48 per cent. consisted of insects, 6·2 per cent. of rodents, and 1·6 per cent. remains of poultry and their eggs. The actual corn was only about 10 per cent. Mr. Kalmbach is of opinion that the misdeeds of this bird greatly outnumber its virtues, and points out that its capabilities for good or evil are great. The attitude of farmers, he thinks, should be one of toleration where no serious losses are suffered, rather than one of uncompromising antagonism resulting in unwarranted destruction. This bird seems to fill a position somewhat analogous to that occupied by the rook in this country, and from the results obtained in this investigation we should have presumed that a considerable reduction in its numbers was advisable.

THE influence of the Cambridge geological school on palæontology outside our islands is evidenced by the appearance in 1917 of two handsomely illustrated memoirs, one by Dr. F. R. Cowper Reed, on "Ordovician and Silurian Fossils from Yunnan" ("Palæontologia Indica," vol. vi., Mem. 3, Geol. Surv. India), and the other by Mr. H. Woods, on "The Cretaceous Faunas of the South Island of New Zealand" (N.Z. Geol. Surv., Pal. Bull. No. 4).

PROF. E. W. SKEATS (*Amer. Journ. Sci.*, vol. xlv., p. 81, 1918) usefully reviews the evidence of the Funafuti boring in reference to the current discussion on the origin of barrier reefs and atolls, and points out that the discovery of a thickness of 1100 ft. of shallow-water deposits cannot be lightly set aside. On p. 194 of the same volume, he shows that the conversion of marine limestone into dolomite is commonly associated with shallow-water conditions. The rock at Funafuti from 635 ft. down to 1114 ft. is dolomitised, and hence this mineral feature affords additional evidence of subsidence of the atoll as it grew.

OWING to the difficulty most people have at the present time in getting copies of scientific periodicals published abroad, the appearance of the monthly parts of *Science Abstracts* is awaited with much less patience than was the case before the war. The indexes of the two volumes for the year 1917 have just been issued, so that the volumes now become available for reference. The physics volume deals with nearly 1400 abstracts, has 640 pages, the name-index twenty-three pages, and the subject-index forty-four pages. The electrical engineering volume deals with fewer than 870 abstracts, has only 490 pages, a name-index of eleven pages, and a subject-index of twenty-two pages. The average length of an abstract in the former volume is a little more than 0·4, and in the latter a little more than 0·5 of a page. Both show a material increase in length over abstracts of five or six years ago, due, we presume, to so many of the most experienced abstractors being otherwise occupied. The volumes remain two of the most useful issued in this country, and their cessation would entail an expenditure of time on the part of scientific workers in looking up references which cannot be contemplated with any satisfaction.

IN the *Biochemical Journal* for December last Mr. A. Weinhagen describes the reduction of phenylethylamine, prepared from phenylalanine, by shaking the aqueous solution of its hydrochloride with finely divided platinum and hydrogen. It was found that almost exactly the volume of hydrogen theoretically requisite was actually absorbed. The product of reduction is hexahydrophenylethylamine, of which the platinichloride, the aurichloride, and the picrate are described. On the other hand, all the author's attempts to reduce *synthetic* phenylethylamine by the same method were in vain, although the finely divided platinum used was shown to be active. No explanation for the failure can as yet be offered. Practically the only difference between the synthetic phenylethylamine and that obtained from phenylalanine is that the former decolorises permanganate solution only very slowly, whilst the latter does so instantly. Attempts to reduce tyrosine, phenylalanine, and *p*-hydroxyphenylethylamine in the same way were also unsuccessful.

IN our issue of March 9, 1916, we made a passing reference to the Derwent Dam, then recently completed, forming part of one of the five large reservoirs included in the Derwent Valley scheme for the supply of water to the towns of Leicester, Derby, Sheffield, and Nottingham and the counties of Derby and Nottingham. A paper by Mr. Edward Sandeman, read before the Institution of Civil Engineers on April 9, gives a fuller account of the undertaking now being carried out by the Derwent Valley Water Board. The works authorised by Act of Parliament in 1899 comprised the provision, in six large reservoirs, of a total storage capacity of 10,000 million gallons, with aqueducts, filter-beds, and other ancillary works, at an estimated expenditure of about 6,000,000*l*. One of these reservoirs, the highest and smallest, was afterwards abandoned, and the storage capacity of the Derwent reservoir correspondingly increased. The gathering ground is 31,946 acres in extent, and lies on the southern slope of the Pennine Range at an elevation varying from 500 ft. to 2000 ft. The average rainfall is 47 in. per annum. The water is very soft—2° to 3° of hardness—but is discoloured by peat when in flood. The first instalment of work, which has been completed, comprises the Howden and Derwent reservoirs, supplying 13 million gallons per day. The two dams are very similar as regards dimensions, their lengths being respectively 1080 ft. and 1110 ft.; their heights, 117 ft. and 114 ft.; and their greatest base widths, 176 ft.

and 171 ft. The foundations are in beds of black shale and sandstone. Temperature records in the masonry of the Derwent Dam, taken by means of thermophones between the years 1909–15, showed a maximum variation of 80° within 1 in. of the face, and not more than 7° at 30 ft. in the interior. The main aqueduct is 28 miles in length, and consists of 4 miles of tunnels, 7 miles of covered conduit, and 17 miles of main-pipe line.

A HANDY classified catalogue of college text-books and works of reference on agriculture, botany, chemistry, engineering, geology, mathematics, physics, technology, and zoology has just been issued by Messrs. H. K. Lewis and Co., Ltd., 136 Gower Street, W.C.1, and should be of service to many of our readers.

## OUR ASTRONOMICAL COLUMN.

THE COMPANION TO SIRIUS.—In a letter to the *Observatory* for April, the Rev. T. E. R. Phillips directs attention to the fact that the companion to Sirius is now readily visible in instruments of moderate aperture. This is accounted for by the circumstance that the companion is now in the neighbourhood of greatest elongation from the bright star. The star was easily observed by Mr. Phillips with an 8-in. refractor, and it was conspicuously bright in a reflector of 18-in. aperture, but in both cases a quiescent atmosphere was an essential condition. The mean of several determinations gave the position angle of the companion as 72·1°, and the separation as 10·89″. Mr. Innes, of the Union Observatory, Johannesburg, also states that the companion is now an easy object, and for 1917–18 gives the position angle 73·4°, and distance 11·24″. The observations suggest that Doberck's period of 49·49 years is too short by 0·22 year, or that the period is 49·71 years.

PHYSICAL OBSERVATIONS OF VENUS.—Among numerous observations detailed in Circular No. 41 of the Union Observatory, Johannesburg, Mr. Innes reports some interesting observations of the planet Venus. Observations were commenced on November 15, 1917, with the object of determining as nearly as possible the actual date of dichotomy, and these resulted in showing that half the visible disc was illuminated on November 23. The date given in the Nautical Almanac for this occurrence, based on geometrical reasoning, was November 29·9 G.M.T., so that the observed time was seven days in advance of the predicted time. It was remarked by all the observers that while the edge of the planet was very bright, there was a darkish lune along the terminator. It was also noted that the northern cusp was more acutely pointed than the southern.

The circular also includes measures of eighty-seven double stars, photographic observations of comet 1917*a* (Mellish) and of several asteroids, and three additional sheets of the valuable photographic atlas of the southern heavens which is being issued by the Union Observatory.

THE LUNAR CRATER EIMMART.—Attention has previously been directed by Prof. W. H. Pickering to apparent changes in the lunar crater Eimmart, which are of a non-periodic nature and independent of the moon's phase. A careful study of this crater has been carried on at the Florence Observatory during the last three years by Dr. Maggini, who has made use of a telescope of 4-in. aperture, with powers of 175 and 300 (*L'Astronomie*, March, 1918). The crater is situated on the north-western edge of the Mare Crisium, in longitude 295° and latitude 24° N., and has a diameter of about 40 km. It is best observed about two or three days after full moon, when the Mare Crisium is near the terminator. On the western rampart there is a very small crater, which usually appears as a brilliant point, but shows a deep cavity under very oblique illumination. Following a general description of the appearances under different illuminations, Dr. Maggini gives an account of the changes noted in September, 1915, and October, 1916, when certain portions were of quite unusual brightness. The observations suggest that the changes originate in the craterlet, which is surrounded by a white deposit, extending in rays somewhat similar to those about Tycho. It seems possible that there is an occasional recrudescence of activity in the craterlet, with emission of a white substance, masking for a time the craterlet itself, and afterwards dispersing over the surface. Continued observations promise to be of considerable interest.

## THE NATIONAL DYE-MAKING INDUSTRY.

TO assure a national supply of dyes, independent of any foreign sources, it is necessary that in respect of each of the three stages of manufacture—(1) raw products, (2) intermediates, (3) finished dyes—this country should be self-supporting. An abundant supply of the necessary raw products is available in Great Britain, and, moreover, their manufacture in the state of purity required for the production of dye manufacture has long been carried out within the country on a very extensive scale. In respect of intermediates, at the outbreak of war we were very badly placed indeed, for although at one time or another various firms in this country had manufactured a considerable number of the necessary intermediate products, in most instances they had been forced, by continuous underselling on the part of German firms, to abandon their manufacture. This state of affairs led to the result that the British firms which manufactured colours were to a very large extent dependent upon imported intermediate products. The correctness of the statement that before a really national supply of dye can be established there must be a sufficient, and secure, supply of intermediates will not be denied by anyone who has to deal with the manufacture of colouring matters, for without them the dye-maker is in the position of the dyer who has no supply of colours. Moreover, if the dyewares that are to be produced from them are to be of a kind which will enable our textile industry to compete successfully in the open export market, every dye-maker will admit that the intermediates must be of the finest quality.

On Saturday last, April 20, a considerable party, representing the Press of this country, visited the works of British Dyes, Ltd., at the invitation of the management of the firm. The chairman of the company (Mr. J. Falconer, M.P.) and the managing director (Mr. J. Turner), in their remarks to the assembly emphasised the great importance of intermediate products, and also the fact that to ensure a sufficient national supply of these compounds of the highest quality was one of the first aims of the company. During the inspection of the works the party visited the research, technical control, and large-scale experimental laboratories; colour sheds; plant for the production of intermediates, both the trial and the large plants being included; and the various subsidiary plants for the production of the requisite heavy chemicals, gas, power, etc.; and those present were able to obtain a very fair idea of the progress that has been made by the company. It must have been gratifying to the visitors to see at work the large plants which recently came into operation for the production of some of these essential intermediate products, particularly to those who had a grasp of the great amount of preliminary work that is necessary before operations upon so large a scale can be commenced. Mistakes there are bound to have been, but that the company has made a definite step towards its objective, and towards the assurance of a national supply of dyes for this country, cannot be denied. On the other hand, what has been accomplished is but small in comparison with what remains to be done; for the large plants visited produce but a small fraction of the total number of intermediates that are of primary importance. Despite this, when the actual progress that has been made by British Dyes, Ltd., and by other firms, in the face of the great difficulties of the times, is fairly surveyed, the confidence that British chemists and engineers can place the country in a position of independence as regards dyes is confirmed, but it is also clearly seen that this result can only be achieved by years of strenuous work, by co-operation, and with the aid of sympathetic national support of the industry.

A. E. E.

## SCIENTIFIC PROBLEMS OF REFRIGERATION AND COLD STORAGE.

A COMMITTEE has been set up by the Food Investigation Board of the Department of Scientific and Industrial Research to consider engineering and physical problems which arise in connection with the use of cold to preserve food, and to organise such research on these subjects as may be considered necessary.

The Committee consists of Sir Alfred Ewing (chairman), principal, University of Edinburgh; Sir Richard Glazebrook, director, National Physical Laboratory; Commdr. C. F. Jenkin, professor of engineering science, Oxford; Mr. S. R. Beale, of Messrs. Louis Sterne and Co.; Prof. H. L. Callendar, professor of physics, Imperial College of Science and Technology; Messrs. G. C. Hodsdon and F. A. Wilcox, of Messrs. J. and E. Hall, Ltd.; Prof. C. H. Lees, professor of physics, East London Technical College; Mr. A. Macdonald, superintendent engineer of the Commonwealth and Dominion Line, Ltd., of the Cunard Line; Mr. J. T. Milton, chief engineer surveyor of Lloyd's Register of Shipping; Mr. W. B. Statham, of the Messrs. Lightfoot Refrigerating Co.; Mr. J. Thom, chief engineer of the London Central Markets Cold Storage Co.; and Mr. A. R. T. Woods, general manager of the H. and W. Nelson Line.

The terms of reference to the Committee are designedly wide, so that its activities may be as little hampered as possible. They cover refrigerating machines and the insulation of cold stores in general, and in particular the application of refrigeration in ships, barges, and railway vans for the conveyance of produce at low temperatures, and the methods of measuring the temperature and degree of moisture in closed spaces.

The Committee may be said to be taking up work at the point at which it was left by the Refrigeration Research Committee of the Institution of Mechanical Engineers, but with greatly extended terms of reference. That committee, which was also under Sir Alfred Ewing, was appointed to define a standard in refrigeration, and the valuable results of its deliberations were issued as a report of the institution in October, 1914.

In setting up the present Committee an attempt has been made to include experts representing each division of the subject, and in attempting a general survey of the scientific problems which press for solution on the engineering and physical sides the Committee will be guided by the first-hand knowledge of its members. It includes engineers with much experience in the practical work of refrigeration, and also physicists familiar with the methods of experimental research which are likely to be relevant.

No single committee, however, can hope to possess an exhaustive acquaintance with all aspects of so wide a question. The work will therefore be helped forward by suggestions received from without, and the Committee would welcome suggestions as to specific questions on which further knowledge is needed. Any communication should be addressed to the Secretary, Sir Alfred Ewing's Committee, Scientific and Industrial Research Department, 15 Great George Street, Westminster, S.W.1.

## PRESENT AND PROSPECTIVE FOOD SUPPLIES.

RECENT reviews of the outlook for food supplies after the war have been so uniformly pessimistic that a note of comparative optimism from so eminent an authority as Sir R. Henry Rew is doubly welcome at the present juncture. In his address to the Royal Statistical Society on December 18 last (Journal of the Royal Statistical Society, January, 1918) Sir Henry was able to arrive at the conclusion that the prospects of food supplies for the hungry world after the war are at least not hopelessly gloomy, although indeed his considerations were limited solely to supplies, and did not cover the problem of transport.

Dealing first with breadstuffs, and reviewing the existing position as regards production and requirements in the chief importing and exporting countries, he deduced that although there is an immediate deficiency of normal breadstuffs, available to meet the existing demand, there is no shortage in the world's supplies as a whole, if Australia be included. Moreover, the shortage affects only the northern hemisphere, and, so far as can be judged, the wheat crops south of the equator will compensate for the deficient wheat crops north of it. As to the food situation which will exist when the war ends, it is by no means certain that the Central Powers will draw heavily upon extra-European sources of supply, since their needs will probably be met adequately from Russia and the Balkans. Another factor which must be taken into account is the reduction in the number of bread-eaters in the countries at war. It is difficult to assess the present reduction of food requirements from this cause at less than one million tons of cereals alone. Moreover, it is probable that demobilisation will lead to a reduction in the average food consumption per head of the men affected, and that the general economy in the use of food which war conditions have engendered will persist for a considerable period.

As regards meat, there has been a serious reduction in the number of cattle, sheep, and pigs in Europe during the war, but, on the other hand, a very substantial stimulus has been given to the overseas trade in meat, and sources of supply hitherto almost untapped, such as Brazil and South Africa, are being steadily developed. On the whole, therefore, Sir Henry found reason to believe that there are, and will be, adequate supplies of meat in the world to satisfy the demands of carnivorous Europe, again assuming, as in the case of breadstuffs, that they can be shipped. Transport is thus obviously the dominant factor, and no optimism as to the world's supplies can modify the grave fact that the most rigid economy of food is essential throughout the war, since the food available is limited, not by the world's supply, but by the quantity which can be brought to, or produced in, the country which needs it.

The optimism expressed in the paper was not entirely shared by speakers in the subsequent discussion, Mr. Udny Yule, in particular, giving reasons for belief that Sir Henry's estimates of the exportable surplus of wheat from North and South America would not be realised. He agreed, however, that the outlook as regards cereals was less serious than as regards meat. The cereal supply might recover with comparative rapidity after the war if the land had not become seriously foul and impoverished, but it might be some years before the meat supply attained anything like its former plenty.

## SLEEPING SICKNESS AND BIG GAME.

WE have received the report of the Sleeping Sickness Commission of the Royal Society, No. xvi. (pp. 221+17 plates+3 maps), which bears date 1915, but has only just been distributed. This volume, most of the papers in which have been already published in the Proceedings of the Royal Society, gives an account of the investigations carried on by the commission, under the direction of Sir David Bruce, in Nyasaland in 1912–14. The most important conclusion of the commission was that *Trypanosoma brucei*, the cause of nagana in Zululand and other parts of Africa, is identical with *T. rhodesiense*, the trypanosome causing sleeping sickness in man in Nyasaland and Rhodesia. On account of the marked infectivity of the game in the fly-country—"and this fact stands out most prominently and without any shadow of doubt"—it is recommended that efforts should be made to diminish the number of wild animals in fly-areas, *e.g.* by removing all restrictions regarding the pursuit and killing of the game. Removal of infected natives, though they are apparently few and far between, to fly-free areas, and the clearing of the forest around villages so as to keep the fly away, are also useful measures, and the suggestion is made that for purposes of administration it would be well to gather the natives together in fairly large villages. Direct measures for the destruction of the fly are not considered to offer any chance of success, but "when the country becomes opened up, cleared, and settled, the big game will disappear and the tsetse with them."

Major Cuthbert Christy contributes to the *Annals of Trop. Med. and Parasitology* (vol. xi., No. 3, pp. 279–282) a note on tsetse-flies and fly-belts in Central Africa, in which he expresses the opinion that if, in speaking of wild animals or great game, the antelopes are referred to, he is convinced that they play a quite negligible part, if any, in relation to sleeping sickness in man, and that it is possible to exclude with certainty most of the wild animals, though he places one or two under suspicion. Of these, he considers the pig will be found to be the chief culprit, not only the common red river-hog and the wart-hog, but more especially the semi-domesticated pig frequently seen about native villages.

## METALLURGY OF COPPER.

THE Cantor lectures on "Progress in the Metallurgy of Copper," delivered by Prof. H. C. H. Carpenter before the Royal Society of Arts in December last, have just been published. Prof. Carpenter commences with a brief review of the early methods of copper smelting, giving some interesting details of the process in use at Keswick, Cumberland, towards the end of the sixteenth century, traces the origin and rise of the industry of copper smelting in Swansea and the adjoining districts of South Wales, and thus comes to the early years of the nineteenth century, when the influence of the importation of Chilian ores, followed by the utilisation of the vast deposits of Huelva and the adjoining part of Portugal, first made themselves felt. By the end of the nineteenth century the huge copper resources of the United States of America dominated the world's markets, and from that period, when the United States was producing one-half of the copper output of the entire world, up to the present day, American practice has exerted a preponderating influence upon the metallurgy of copper.

Prof. Carpenter gives a full and interesting account of modern American methods, as exemplified in the works of the famous Anaconda Copper Mining Company, and shows well the development of the most modern improvements, especially in the application of the flotation process and of hydro-metallurgical processes. He concludes with an account of the last-named method as applied in the works of the Chile Exploration Company at Chuquicamata, where it is being employed on a vast scale, and points out that the modern tendency in the metallurgical treatment of copper ores is to replace smelting methods by wet methods, so that the similarity between modern processes for the treatment of gold and of copper is becoming more and more pronounced.

Incidentally, attention may be directed to a statement of Prof. Carpenter to the effect that "in the time of Elizabeth, James, etc., the metalliferous ores of this country were reserved to the Crown." This is a mistake; for whilst it is true that in earlier times the Crown had laid claim to such ores, this pretension was constantly resisted, and in 1568 it was definitely disposed of by the Great Case of Mines, in which the judges declared unanimously that if a metalliferous ore or mine contains no royal metal—*i.e.* neither gold nor silver—the proprietor of the soil is owner of the ore or mine in question. It is thus clear that even in the earlier part of Queen Elizabeth's reign the law gave a definite decision to exactly the opposite effect to that stated by Prof. Carpenter.

H. L.

## THE ORGANISATION OF SCIENTIFIC AND INDUSTRIAL RESEARCH.

LAST October Mr. G. Hogben and Dr. J. Allan Thomson submitted to the New Zealand Minister of Internal Affairs a report on schemes adopted in various parts of the British Empire and in the United States for the organisation of scientific and industrial research.

The following abridgment of the report provides a summary of the progress already made and of the plans proposed for the future:—

*Great Britain.*

By Order in Council, July 28, 1915, a Committee of the Privy Council was appointed to direct the application of any sums of money provided by Parliament for the organisation and development of scientific and industrial research. It was further ordered that, for these purposes, there should be an Advisory Council (which consisted at the outset of eight eminent scientific men, three at least of whom were actually engaged in industries dependent on scientific research). To it stood referred for their report and recommendation proposals (i) for instituting specific researches; (ii) for establishing or developing special institutions or departments of existing institutions for the scientific study of problems affecting particular industries and trades; and (iii) for the establishment and award of research studentships and fellowships.

The sum voted for the first year was 25,000*l*. For the second year (1916–17) the sum voted by Parliament was 40,000*l*., but during the course of the financial year the Government decided to establish a Department, the Department of Scientific and Industrial Research, to take the functions and powers of the

Committee of the Privy Council, the official members of which became a trust to administer public and other funds given for the purpose named. The appropriation for the year accordingly took the following amended form:—

| | £ |
|---|---|
| (*a*) Salaries, wages, and allowances ... | 7,250 |
| (*b*) Travelling and incidental expenses ... | 800 |
| (*c*) Grant for investigations carried out by learned and scientific societies, etc. ... | 24,000 |
| (*d*) Grants to students and other persons engaged in research ... ... ... ... | 6,000 |
| (*e*) Scientific and industrial research (grant in aid) ... ... ... ... ... ... | 1,000,000 |
| | £1,038,050 |

Items (*a*) to (*d*) are ordinary annual votes which lapse at the end of the financial year. Items (*c*) and (*d*) are to be distributed by the Committee of the Privy Council, on the recommendation of the Advisory Council, and are intended to meet cases in which assistance is required by the individual worker or by learned, scientific, or professional societies which stand in need of funds to carry on research work. Item (*e*) was paid to the Imperial Trust for the Encouragement of Scientific and Industrial Research, and is intended to cover expenditure for the next five years.

*Imperial Scheme.*

Consequent upon the publication of the proposals for the original British scheme, suggestions were made by the Minister of Public Works of Victoria and by the Premier of New South Wales that the scheme should be extended and made applicable to the Overseas Dominions, or even to the Empire as a whole. A memorandum drawn up by the British Committee of Council was therefore, on March 2, 1916, circulated to all the Governments of the Overseas Dominions, concurring in the suggestion, and inviting each Government to constitute some body or agency having functions similar to those of the Advisory Council which acts for the United Kingdom. The memorandum lays stress upon two points: First, any body or agencies instituted for the purpose should, under their respective Governments, have really responsible functions and substantial authority; secondly, a close connection should be maintained between these bodies and the public educational systems and institutions of their respective countries.

*Commonwealth of Australia.*

An Advisory Council of Science and Industry was appointed on March 16, 1916. Since that date additional appointments have been made, so that the Council now consists of thirty-five members representative of both science and industry, and includes members from all the Australian States. It is a temporary body, designed to prepare the ground for a proposed permanent Institute of Science and Industry, and to exercise in a preliminary way the functions that will in future belong to the institute. The chief of these functions are:—(i) To consider and initiate scientific researches in connection with, or for the promotion of, primary or secondary industries in the Commonwealth, and (ii) the collection of scientific industrial information and the formation of a bureau for its dissemination amongst those engaged in industry.

At its first meeting the Advisory Committee elected an Executive Committee, of which the Prime Minister (or, in his absence, the Vice-President of the Executive Council) is chairman. The deputy-chairman is Prof. D. Orme Masson. The Executive Committee at first consisted of six members besides the chairman; to these were afterwards added the chairman of the several State Committees as members of the Executive Committee *ex officio*.

The Committee in each State consists of the State representatives on the Advisory Council, together with any other associate members appointed on the nomination of State Governments, one of whom is generally a professor of the university.

The first work of the Advisory Council was, *inter alia*:—

(1) To make a register or census (*a*) of Australian industries, their distribution and importance; (*b*) of problems connected with them; (*c*) of the equipment and *personnel* of laboratories available for industrial scientific research; (*d*) of research work in actual progress in laboratories and at Government experimental farms; and (*e*) of the facilities available for the proper training of future scientific investigators.

(2) To establish relations with other authorities, as State Governments, scientific and technical departments, universities, technical colleges, scientific societies, and associations and committees representing the pastoral, agricultural, manufacturing, and other industries.

(3) To encourage and co-ordinate researches already in progress (much of the work of the Executive has been of this kind).

The next step was the initiation of new researches. Having collected all the information from reports and experts on any special question, the Executive appointed in each approved case a small Special Committee to report further or to carry out actual experimental investigation. In the latter case the Executive selected the locality and the institution for conducting the research, appointed a salaried investigator to assist the Special Committee, and voted a reasonable sum for expenses.

Twenty such Special Committees were appointed up to June 30, 1917; some of these committees each carried out or initiated several researches. Their work was in addition to the research work being carried out by Government Departments, by such societies as the Pastoralists' Committee, and by universities and other institutions or by two or more of these bodies acting together.

The scheme distinguishes between laboratories primarily for scientific research and laboratories primarily for the necessary routine work of departmental testing. It is recommended that (*a*) the control of the present Commonwealth laboratories should not be disturbed, but that they should be co-ordinated, their staffs increased, and their equipment improved; (*b*) any new national laboratories which may be created for special purposes of research and experimental inquiry, including a physical laboratory for testing and standardising purposes, should be controlled by the institute.

The Executive Committee urgently recommends the establishment of the permanent institute under statutory authority. It advises (i) that an Advisory Council consisting of nine members representing science and the principal primary and secondary industries should be appointed by the Governor-General in Council; (ii) that, for the purpose of controlling and administering the institute and of collecting information and determining on the researches to be undertaken and directing their elucidation, three highly qualified salaried directors, of whom one should be chairman of the directors, should be appointed by the Governor-General in Council; (iii) that of the three directors one should be an expert business and financial man with ability in organisation; the other two should be chosen mainly on account of scientific attainments and wide experience; their tenure should be fixed by the Act; and that the scientific staff should be appointed by the Governor-

General in Council on the recommendation of the directors.

It is intended that so far as possible the Advisory Council shall act in co-operation with the Advisory Council of the Imperial Privy Council and with similar bodies in other parts of the Empire.

It is understood that for the carrying out of the original scheme the Prime Minister stated that the Commonwealth Government was prepared to spend 500,000*l*.

*Canada.*

On the recommendation of the Minister of Trade and Commerce, the Governor-General in Council approved, on June 6, 1916, of the appointment of a Committee of the Privy Council, consisting of the Minister of Trade and Commerce, the Minister of the Interior, the Minister of Mines, the Minister of Inland Revenue, and the Minister of Agriculture, which should be charged with, and responsible for, the expenditure of any moneys provided by Parliament for scientific and industrial research; and also of an Honorary Advisory Council, responsible to the Committee of Council, to be composed of nine men representative of the scientific and industrial interests of Canada, who should be charged with the following duties:—(*a*) To consult with all responsible bodies and persons carrying on scientific and industrial research work in Canada with the view of bringing about united effort and mutual co-operation in solving the various problems of scientific and industrial research which from time to time present themselves; (*b*) to co-ordinate so far as possible the work so carried on so as to avoid overlapping of effort and to direct the various problems requiring solution into the hands of those whose equipment and ability are best adapted thereto; (*c*) to select the most practical and pressing problems indicated by industrial necessities and present them when approved by the Committee to the research bodies for earliest possible solution; (*d*) to report from time to time the progress and results of their work to the Minister of Trade and Commerce as chairman of the Committee of Council.

On November 29, 1916, the nine members of the Honorary Advisory Council were appointed, six of them being presidents or professors of Canadian universities. On December 13, 1916, the number of the members of the Honorary Advisory Council was raised to eleven, and Dr. A. B Macallum was appointed permanent chairman of the said Council, with headquarters at Ottawa, with a salary of 2000*l*. per annum.

*United States of America.*

In the United States before the war scientific research was probably better organised than in any other country except Germany. The chief agencies were several important Government scientific bureaux; certain institutions privately, and in a few cases munificently, endowed for research; some universities and schools of technology carrying on researches, and scientific societies and industrial corporations giving a certain amount of opportunity for, and support of, research. What was chiefly wanting was organisation and co-ordination, to avoid overlapping and to secure the proper distribution of effort over the whole field in which scientific research in connection with national defence and industrial efficiency was likely to be profitable.

In April, 1916, the National Academy of Sciences offered its services to the President of the United States in the interest of national preparedness. President Wilson accepted the offer, and, after preliminary work by an organising committee and the appointment of representatives of the Army, Navy, Smithsonian Institution, and various scientific bureaux of the Government and of universities, scientific associations, and of engineering institutes and societies, the National Research Council was formed, and held its first meeting in September, 1916. The council consisted of thirty-seven members, Dr. George E. Hale, director of the Mount Wilson Solar Observatory, being chairman. The main work, however, is done by the Executive Committee, consisting of ten members (now more), of which Mr. J. J. Carty, chief engineer of the American Telephone and Telegraph Co., is chairman. Committees were also set up to prepare a national census of research and of the equipment and *personnel* available, and for other purposes of organisation.

The research committees are of two kinds: (*a*) central committees, dealing with various departments of science, composed of leading authorities in each field; (*b*) local committees in universities, colleges, and other co-operating institutions engaged in scientific research; and other special committees.

It is not intended to supersede or to interfere with existing institutions carrying on research, but where necessary to increase their usefulness by placing additional funds at their disposal and in other ways. For instance, each State is to have an additional grant of 3000*l*. a year for research conducted by institutions situated in it. The Throop College of Technology, a research institute in California, received a grant of 20,000*l*., and the Massachusetts Institute of Technology a gift of 100,000*l*., to be used for the most part for research.

The relation between the central committees and the local and other special committees may be illustrated by reference to chemical research. There is a central committee of chemistry, which deals in the first instance with all industrial problems connected wholly or mainly with chemistry. This committee defines the specific problems to be investigated, and assigns them to the local committees at certain institutions, or to other special committees consisting of experts in the branch in question.

*South Africa.*

As a consequence of the memorandum from the Committee of the Privy Council the South African Government towards the end of the year 1915 appointed a Committee under the title of the Government Munitions and Industries Committee, the members being representative of the chambers of commerce and manufacturers' associations. The work of this Committee was in the main confined to practical engineering matters, and by no means covered the whole field of industrial research.

In October, 1916, the Government appointed an Industries Advisory Board, which was intended to have a wider scope; its members, who were to hold office for three years, were almost exclusively business men representative of commerce, manufactures, and labour.

In February, 1917, the Advisory Board recommended "the appointment of a Scientific and Technical Advisory Committee to deal with all scientific and technical questions, and questions of research which may be referred to them by the Industrial Advisory Board." The Government accordingly constituted a Committee of ten members—men of science and engineers—the functions of which were to be to provide for scientific research; to co-ordinate industrial investigation and research in South Africa; to co-operate with other Government Departments in South Africa and with similar Departments in the United Kingdom and the Dominions; to carry out an economic survey of the resources of South Africa; and to deal with certain other economic, industrial, statistical, and educational matters. Both the Board and the Committee are under the control of the Minister of Mines and Industries. The Committee has begun its work by instituting a general survey of the position in the Union under forty-eight special headings, covering a wide range of natural and manufactured products of South Africa, each portion of the "survey" being entrusted to a reporter, who is apparently a scientific or technical expert.

*New Zealand.*

The British memorandum on the suggestions for making the British scheme applicable to the whole Empire was referred by the Hon. Minister of Internal Affairs to Dr. Thomson for report. At that time the original Australian proposals were also available in New Zealand. Dr. Thomson's report consisted of two parts, the first exposing the defects of the pre-war relationship between science and industry, the second outlining proposals for New Zealand.

At the annual meeting of the New Zealand Institute on January 31, 1917, the reports of the affiliated societies were adopted, and the following resolutions were passed:—(1) That scientific research be endowed to a very much greater extent than has been done in the past; (2) that the importance of research in pure science be recognised as of equal importance with that in applied science; (3) that as a definite step towards the endowment of research adequate provision be made for the appointment of fully qualified assistants to the professors of science in the four university colleges; (4) that a Board of Science and Industry be constituted, to consist of (*a*) members selected by the New Zealand Institute; (*b*) representatives of the scientific Departments of the Government; and (*c*) leaders in industry and commerce. This Board to recommend and direct research problems, and to have power to spend money voted by Parliament for the purpose.

The New Zealand Institute further offered its services at a deputation to the Acting Prime Minister, and received the reply that the matter would be referred to the National Efficiency Board, the setting up of which was contemplated.

The Standing Committee of the New Zealand Institute has, at the request of the Efficiency Board, set up an Industrial and Research Committee in Wellington to receive and co-ordinate suggestions from the affiliated societies of the institute and from other bodies interested, and to frame a scheme for submission to the board of governors. Consequent on the resignation of the National Efficiency Board, the chairman of that board has intimated that it is the desire of the Government that the New Zealand Institute should proceed with its deliberations and report directly to the Government.[1]

In the meantime the General Council of Education had set up a Recess Committee to consider the adaptation of the educational system of the Dominion to the development of its resources. The Committee met in Christchurch from May 16 to 18, and the report dealing with scientific research was adopted by the Council in the following form:—

(1) There should be a National Advisory Council on Research, consisting of (*a*) four scientific men, one of whom should be a scientific expert attached to a Government Department, (*b*) three members connected with leading industries of the Dominion, one of whom should represent agriculture.

(2) (i) The National Advisory Council should consider and allot to the proper persons for investigation all proposals for specific researches (or at its discretion reject such proposals). The proposals might be referred to it by the Efficiency Board, or might come from institutions, or societies, or private persons, or might originate in the Council itself. (ii) The Council might also consider the problems affecting particular industries, to determine along what lines research might be instituted. (iii) The Council should award and supervise the tenure of the research fellowships mentioned below, and should, on the request of the University of New Zealand, consult with and advise the Senate of the University in matters relating to the national research scholarships in the award of that body. (iv) The Advisory Council should consider and advise the General Council of Education as to the lines along which there could be brought about a general improvement in scientific education with the view of the training of experts, and should co-operate with that Council and other public bodies in taking such steps as may lead to the better appreciation of the aims and advantages of science on the part of producers and the general body of citizens.

(3) In addition to the existing national research scholarships (the number of which should be increased) there should be established research fellowships tenable for two, three, or more years by men or women qualified and willing to conduct researches approved by the Council. (The fellowships should be of sufficient value to prevent the possible holders from being attracted away to other positions.)

(4) The University and the University colleges should assist the fellows in their research in such ways as may be arranged.

(5) It is suggested that three Ministers of the Crown should form a Research Committee of the Executive Council, and that all the proposals of the National Advisory Council involving additional expenditure or a question of policy should come before the Committee for approval. Except in this respect the National Advisory Council should not be considered as a department of the public service, but should be free to act as it thought fit in regard to matters within its control.

(6) (i) In further explanation of the functions of the National Advisory Council it is suggested that the following should be included among them. The Council might (*a*) recommend to industrial firms or companies scientific managers, superintendents, assistants, or scientific experts; (*b*) advise industrial firms or companies as to improvements in the arts and processes employed, and as to the utilisation of waste products; (*c*) make recommendations as to the adoption in any industry of the results of investigations conducted under its directions; (*d*) undertake the investigation of industrial problems that, if unsolved, would obstruct the development of industries concerned; (*e*) advise the Government in regard to the help that should be given to any new industry that is likely to be ultimately of value to the country, though at first it may not be worked except at a loss. (ii) The Council might advise the Government as to what contribution, if any, should be made towards the cost of any research by the firms or companies concerned.

(7) That all bulletins and reports relating to the researches set up by the Council should be drawn up and published with its authority.

(8) That the Council of Education communicate with the chambers of commerce, the annual conferences of the Agricultural and Pastoral Association, the New Zealand National Dairy Association, and the New Zealand Farmers' Union intimating that the Council would welcome any suggestion from these bodies as to how the educational agencies of the Dominion might assist in achieving the purpose of bringing the produce of our New Zealand industries into the most profitable relationship with the markets of the world.

(9) That the attention of the Government be directed to the necessity for establishing a course for the training of hydro-electric engineers.

During the past year various industrial bodies have discussed the general question, and passed resolutions approving of increased Government aid to industrial research, but no details of any scheme have been framed by them.

[1] In view of the reappointment of the National Efficiency Board, the institute will presumably report to that body as originally requested.

## THE FREQUENCY OF EARTHQUAKES.[1]

THE publication of an abstract of twenty years' record of earthquakes in Italy gives an opportunity for studying the effect of the gravitational attraction of the sun; the period is so nearly coincident with the lunar cycle of nineteen years that the effect of the moon may be regarded as eliminated, the record is of exceptional continuity and completeness, and the number of observations is large enough to allow of the extraction of groups sufficiently numerous to give good averages.

The distribution of the stresses throughout each diurnal period presents two peculiarities: first, the range of stress is greater during the day than during the night in summer, with an opposite variation during winter; secondly, the general effect of the vertical component is towards a progressive diminution of the downward pressure during the six hours preceding, and towards an increase during the six hours following, the meridian passages at noon and midnight.

Investigating the first of these, a division of the year into two parts, at the equinoxes, gives a proportion of shocks during the day to those during the night, somewhat greater than the average during the summer half, and somewhat less during the winter. As this result might be purely fortuitous it was tested by a similar treatment of two other records which stood ready for use—Milne's catalogue of Japanese earthquakes from 1885 to 1892, and the after-shocks of the Indian earthquake of 1897. They show a variation identical in character with that of the Italian record. A second test depends on the argument that, if the variation is in any way seasonal, the divergence should be increased at the height of each season; the figures for the months of January–February and of June–July were taken out, as representing midwinter and midsummer respectively, and found to show a divergence in each case greater than, and in the same direction as, the respective half-years.

The actual figures are as follows, the frequency being expressed as a ratio to the mean, of each group, taken as 100:—

DISTRIBUTION OF SHOCKS BY DAY AND NIGHT.

*Italy*, 1891–1910.

| | Day | Night |
|---|---|---|
| June–July ... ... | 90 ... | 110 |
| Summer half ... ... | 88 ... | 112 |
| Whole year ... ... | 84 ... | 116 |
| Winter half ... ... | 81 ... | 119 |
| December–January ... | 77 ... | 123 |

*Japan*, 1885–1892.

| | | |
|---|---|---|
| Summer half ... ... | 102 ... | 98 |
| Whole year ... ... | 97 ... | 103 |
| Winter half ... ... | 93 ... | 107 |

*Assam After-shocks.*

| | | |
|---|---|---|
| Summer ... ... ... | 113 ... | 87 |
| Whole record ... ... | 107 ... | 93 |
| Winter ... ... ... | 101 ... | 99 |

Taken by itself the variation, as between any pair of ratios, is as likely to be in one direction as in the other, but the odds against a complete concordance throughout the whole series are 31 to 1; it may, therefore, be taken that the variations are not fortuitous, but due to some common cause which tends to increase the frequency during the day and decrease it during the night in summer, with the opposite in winter.

[1] From a paper entitled "Some Considerations arising from the Frequency of Earthquakes," read before the Geological Society on February 6 by R. D. Oldham, F.R.S.

For the second line of investigation a computation was made of the mean amount of stress for the whole of Italy and the whole year for each of the six hours preceding and following the meridian passage. These were plotted and compared with the corresponding curve of frequency of earthquakes; the result showed no apparent relation between the frequency and the total, or the horizontal, stress, though a close one with the variation of the vertical stress, the greatest number of earthquakes being in the period in which there is the greatest increase of downward pressure. As the rate of increase diminishes the frequency of shocks is less, suffering a further diminution as the pressure begins to decrease, and reaching its minimum in the period where the decrease in pressure is greatest, increasing again in the same way to the maximum.

The Japanese record is not directly comparable with the Italian, being dominated by the after-shocks of great earthquakes of the world-shaking type, and nearly half of the whole record consists of after-shocks of the Mino-Owari earthquake of 1891. Taking these separately, we get a curve of frequency similar to the Italian, except that the maximum and minimum are reversed, the greatest number of shocks corresponding with the period when the load is being lightened most rapidly, indicating that these shocks were due to a general movement of elevation rather than depression, a conclusion in accord with field observations of other great earthquakes.

The actual figures of variation of stress, in Italy, and the frequency of earthquakes are as follows:—

| Hours ... ... | XII | II | IIII | VI | VIII | X | XII |
|---|---|---|---|---|---|---|---|
| Mean range of vertical stress in each two hours, Italy. | −0·14 | −0·27 | −0·13 | +0·13 | +0·27 | +0·14 | |
| Ratio of actual to mean frequency of each two-hour period, Italy, 1891–1910... ... | 1·06 | 1·17 | 1·01 | 0·90 | 0·88 | 0·99 | |
| After-shocks of Mino-Owari, Oct. 28, 1891, Japan. | 1·01 | 0·95 | 0·96 | 0·97 | 1·08 | 1·03 | |

The principal point of interest in these figures is that they give a means of estimating the rate of growth of the strain which produces earthquakes. Accepting the hypothesis that earthquakes are due to the relief by fracture of a growing strain when this has reached the breaking point, it can be shown that a variable strain, acting alternately in increase or decrease of the general growth, while leaving the average rate of growth unaltered, will give rise to a corresponding variation in the frequency of shocks in each period, and, besides that, there is a simple relation between the magnitudes of the two stresses, to which the strains are due, and the variations from the mean frequency of earthquakes. A calculation based on this shows that the growth of strain for Italy is such that the breaking strain would be reached in about three and a half years, starting from a condition of no strain. The after-shocks of the Mino-Owari earthquake give about five to six months, if account is taken of the difference between the resistance of rock to tension and compression. These figures are given for what they are worth; at the least they are of interest as being the first authentic estimate which it has been possible to make of the time required to prepare for an earthquake, and, thence, of the rate of growth of the particular tectonic process involved in their production.

## UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

IN spite of the war, changes have been carried through with the object of placing higher technical education in Holland on a university basis. About twenty years ago the engineering and technological college at Delft became a technical university; later, a commercial high school was started at Rotterdam. Now the Minister of Agriculture has brought about the reorganisation of the veterinary college at Utrecht and the agricultural college at Wageningen; both these have recently been converted into institutions of university rank. It was at the Utrecht veterinary school that van't Hoff taught chemistry and physics from 1875 to 1877, before his appointment to a professorship at Amsterdam.

## SOCIETIES AND ACADEMIES.

LONDON.

**Zoological Society,** April 9.—Dr. A. Smith Woodward, vice-president, in the chair.—Miss J. **Proctor**: The variation of the pit-viper, *Lachesis atrox*. The paper dealt with the variation of the principal characters of the Central and South American pit-viper, *Lachesis atrox*, L., of which the author regarded *L. lanceolatus*, Lacép., as a synonym, and *L. affinis*, Gray, *jararaca*, Wied, and *jararacussu*, Lacerda, as varieties. The author laid special stress on the different patterns of markings, discussing their evolution and regarding that shown by the more northern form, *L. affinis*, as the most primitive, from which all others could be derived.

**Mathematical Society,** April 18.—Prof. E. W. Hobson, vice-president, in the chair.—P. A. **MacMahon**: The attraction of a circular disc.—H. **Hilton**: *n*-Poled cassinoids.

## BOOKS RECEIVED.

Malaria in Macedonia: Clinical and Hæmatological Features and Principles of Treatment. By P. Abrami, G. Paisseau, and H. Lemaire. Translated by Dr. J. D. Rolleston. Pp. xxx+115. (London: University of London Press, Ltd.) 6*s*. net.

The Science and Practice of Photography. By Dr. J. R. Roebuck. Pp. xiv+298. (New York: D. Appleton and Co.) 2 dollars net.

Medical Contributions to the Study of Evolution. By Dr. J. G. Adami. Pp. xviii+372. (London: Duckworth and Co.) 18*s*. net.

A Text-book of Mycology and Plant Pathology. By Prof. J. W. Harshberger. Pp. xiii+779. (London: J. and A. Churchill.) 15*s*. net.

A Treatise on the Principles and Practice of Harbour Engineering. By Dr. Brysson Cunningham. Second edition. Pp. xvi+377. (London: C. Griffin and Co., Ltd.) 25*s*. net.

## DIARY OF SOCIETIES.

*THURSDAY*, APRIL 25.

ROYAL SOCIETY, at 4.30.—Bakerian Lecture: Experiments on the Production of Diamond: Sir Charles Parsons.

INSTITUTION OF ELECTRICAL ENGINEERS, at 6.—Large Batteries for Power Purposes: E. C. McKinnon.

*FRIDAY*, APRIL 26.

ROYAL INSTITUTION, at 5.30.—Food Production and English Land: Sir A. Daniel Hall.

PHYSICAL SOCIETY, at 5.—Notes on the Pulfrich Refractometer: J. Guild.—The Accuracy attainable with Critical Angle Refractometers: F. Simeon.—Cohesion: Dr. H. Chatley.

*SATURDAY*, APRIL 27.

ROYAL INSTITUTION, at 3.—Modern Investigation of the Sun's Surface: Prof. H. F. Newall.

*MONDAY*, APRIL 29.

ARISTOTELIAN SOCIETY, at 8.—The Conception of Social Orders: Prof. H. J. W. Hetherington.

*TUESDAY*, APRIL 30.

ROYAL INSTITUTION, at 3.—Cave-hunters: Prof. A. Keith.

ROYAL SOCIETY OF ARTS, at 4.30.—British Guiana: Sir Walter Egerton.

*WEDNESDAY*, MAY 1.

ROYAL SOCIETY OF ARTS, at 4.30.—Sugar from several Points of View: G. Martineau.

ENTOMOLOGICAL SOCIETY, at 8.

GEOLOGICAL SOCIETY, at 5.30.—The Relationship between Geological Structure and Magnetic Disturbance, with Special Reference to Leicestershire and to the Concealed Coalfield of Nottinghamshire: Dr. A. Hubert Cox.

SOCIETY OF PUBLIC ANALYSTS, at 5.—Factors Affecting the Composition of Plant Ashes, with Special Reference to Tobacco: O. D. Roberts.—The Effect of Codeine in Hindering the Precipitation of Morphine by Ammonia from a Solution of its Lime Compound: H. E. Annett and H. Singh.—Analysis of "Cocoa Teas": J. L. Baker and H. F. E. Hulton.

*THURSDAY*, MAY 2.

ROYAL SOCIETY, at 4.30.—*Probable Papers*: Nerve End Cells in the Dental Pulp: Dr. J. H. Mummery.—The Nature of Growths in Colloidal Silica Solutions: H. Onslow.

ROYAL SOCIETY OF ARTS, at 4.30.—The Freedom of the Seas: Gerard Fiennes.

LINNEAN SOCIETY, at 5.—A New Fresh-water Shrimp (*Caridina*) from Fiji: G. M. Thomson.—(1) *Bennettites scottii*, sp. nov., a European Petrifaction with Foliage; (2) A Survey of the Biological Aspect of the Constitution of Coal: Dr. Marie Stopes.

*FRIDAY*, MAY 3.

ROYAL INSTITUTION, at 5.30.—The Spinning Top in Harness: Sir G. Greenhill.

INSTITUTION OF MECHANICAL ENGINEERS, at 6.—Employment of Women in Munition Factories: Miss O. E. Monkhouse (*Discussion*).

*SATURDAY*, MAY 4.

ROYAL INSTITUTION, at 3.—Modern Investigation of the Sun's Surface: Prof. H. F. Newall.

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*Editorial and Publishing Offices:*
MACMILLAN AND CO., LTD.,
ST. MARTIN'S STREET, LONDON, W.C.2.

*Advertisements and business letters to be addressed to the Publishers.*

*Editorial Communications to the Editor.*

*Telegraphic Address:* PHUSIS, LONDON.
*Telephone Number:* GERRARD 8830.