THURSDAY, OCTOBER 12, 1916.

BRITISH FORESTRY.

British Forestry: Its Present Position and Outlook after the War. By E. P. Stebbing. Pp. xxv+257. (London: John Murray, 1916.) Price 6*s*. net.

THIS book, by the Lecturer in Forestry at Edinburgh University, is a study of the various problems which are involved in making provision for adequate supplies of timber after the war. In time of peace we were dependent on foreign countries for the great bulk of the timber, paper pulp, and other forest products which we consumed, the annual import into the United Kingdom being valued at no less than 43,000,000*l*. in 1913. During the war, owing to cessation of exports from the Baltic and lack of shipping generally, our supplies of timber have been much curtailed, although our need is now greater than ever. The trenches, railways, and other military works at the front have used up vast quantities of timber; while our collieries and mines have not abated their demand for pitwood. We have been forced to draw largely on our own woodlands, which are rapidly being felled under the auspices of the Home-grown Timber Committee, appointed by Government some months ago. The preservation and restoration of the existing woodland area call for immediate consideration.

Mr. Stebbing's remedy, which is developed in some fifty pages, is a national planting scheme to be taken in hand immediately. The recommendations of the various Government Committees and Commissions on Forestry since 1887 are shown to have had little effect. With regard to the existing woodland area, Mr. Stebbing demands that "all woods purchased and felled by Government at the present high rates should be at once replanted by the owner, as a condition of the contract." His planting scheme includes, in addition to the renovation of the woods that are now being denuded, the planting of 5,000,000 acres of wasteland, the whole to be carried out in thirty-two years, roughly equivalent to the taking in hand yearly of about 200,000 acres. A planting plan should be drawn up, county by county, under which the felled-over areas, the woods consisting mainly of useless scrub, and the most accessible of the wastelands would be selected and the order of planting laid down. The land might be acquired in many cases by lease or purchase. In other cases the Government, going into partnership with the landowner, might provide the money for planting and fencing up to a prescribed sum per acre. Compulsory powers to purchase wasteland, and enforced management of privately owned woods, according to plans approved by a State Forestry Board, though necessary if great progress in forestry is aimed at, are not distinctly advocated in this book.

The question of labour is discussed at length, two chapters being devoted to the employment of women, whose services might be useful in forest nurseries. At the end of the war partially disabled soldiers and sailors will be available, as well as a large number of ordinary labourers. The work could be commenced immediately by utilising the expert woodmen from among our prisoners; and thousands of acres of our denuded woods could be replanted during the coming winter.

Mr. Stebbing has made a special study of the timber trade and forests of Russia, Finland, and Siberia, and devotes a hundred pages to this subject. The immense supplies of timber available in this vast territory are of great importance to the Allies, in view of the reconstruction necessary at the end of the war in the devastated districts of Belgium, France, Serbia, and Poland. Mr. Stebbing urges the British Government to lease large areas in the Crown forests of Russia, which we could work in the period following the war, and thus obtain what timber we require at a reasonable cost. This measure would seem to be of doubtful utility, as it is probable that all the accessible forests (those near rivers where timber can be felled profitably) are already taken up.

CHEMICAL WATER PURIFICATION.

Water-Purification Plants and their Operation. By M. F. Stein. Pp. viii+258. (New York: J. Wiley and Sons, Inc.; London: Chapman and Hall, Ltd., 1915.) Price 10*s*. 6*d*. net.

THIS volume is another addition to the already large number of books on water purification coming from the United States; and while, perhaps, the subject is not treated in quite such a scientific manner as in some of the others, there is a quantity of concise information useful to one who is in charge of a modern water-purification plant, and particularly of one where chemicals are used.

To anyone acquainted with methods of water purification as usually practised in this country the book will show vividly the wide differences existing not merely between the problems that present themselves to water undertakers in Britain and America, but still more their different methods of dealing with them. In this country slow sand filtration, usually preceded by more or less lengthy storage, is the general rule, while in America the usual methods appear to be rapid mechanical filtration after the addition of chemicals for coagulating, sterilising, or softening purposes. This is probably due to the fact that to a large extent the water used in the United States is derived from the great rivers and lakes, and is often very turbid and sometimes highly polluted, whilst over here many of the large towns obtain their supplies from upland gathering grounds, where the water is impounded in large lakes or reservoirs away from any chance of serious pollution, and only a com-

paratively few towns are supplied from polluted rivers. Another reason may be that in this country there is still a popular prejudice against the chemical treatment of a drinking water which is probably not nearly so marked in America.

As is usual with works on water purification, the book opens with a chapter dealing with the sources of supply and impurities likely to be found in water from different sources. The next chapter, and by far the longest, deals with types of purification plants, and describes in some detail the works of several large American cities, which may be taken as typical of the others.

Chapters follow on physical and chemical tests, bacterial tests, and the interpretation of these tests. In these chapters the author goes into very minute detail on the methods of carrying out these tests. It is worthy of note that no mention is made of chemical tests for organic impurities, the author confining his attention to tests for such substances as affect the dose of chemicals to be added—*e.g.* alkalinity and CO_2—and the estimation of any excess of the chemicals added. This is certainly at variance with the usual practice of English water analysts. Another point is the method suggested for the detection of *B. coli* in water, which is quite different from that usually adopted in this country, and scarcely seems to be capable of being used with any great degree of certainty, depending as it does on the relative proportions of CO_2 and hydrogen formed by the fermentation of dextrose broth. One cannot but feel that it is not altogether desirable that persons other than qualified chemists and bacteriologists should be entrusted with the carrying out of these tests on water, especially when, as in this case, the descriptions are given by an engineer.

The best part of the book is what follows in chapters dealing with coagulation and sterilisation, water softening, and sedimentation. These subjects are clearly and fully treated, and the chapters contain a host of valuable information.

The last chapter consists of notes on filtration and general operation. Next follow some very ingenious charts for computing the results of analyses and the amounts of chemicals required according to the analysis of the water. These charts, however, are on rather too small a scale to be of much practical use. The work concludes with appendices dealing with the analysis of coagulants, standard solutions, specifications for coagulants, and one or two useful tables.

The book is decidedly limited in its scope, and deals with only a few of the modern methods of purification, and, indeed, entirely omits to mention several important processes introduced in this country during the last decade. For example, no mention is made of either Houston's Excess Lime method of sterilisation and softening or the use of such substances as Permutit.

The volume is clearly printed and profusely illustrated with diagrams and photographs.

DENISON B. BYLES.

THEORY AND EXPERIMENT.

A Text-Book of Practical Physics. By Dr. H. S. Allen and H. Moore. Pp. xv+622. (London: Macmillan and Co., Ltd., 1916.) Price 8*s.* 6*d.* net.

THE distrust which the "practical man" feels for science is well known, and it must be confessed that he is by no means alone to blame for his attitude in the matter. The fault lies to some extent with the teacher of science, who too often lays undue stress on the theory, and, if an experiment which is supposed to illustrate the theory does so but indifferently, the student is apt to get the impression that theory and fact are somewhat distantly related. For example, a student who, having been rashly told that Atwood's machine is used for measuring "g," finds by careful experiment that the value obtained differs more or less widely from that given in text-books, generally concludes that the experiment is "wrong." He rarely has sufficient confidence in his work to know that the experiment cannot be wrong, and that it is the theory which is at fault. Of course, the trouble lies in an insufficient realisation of the assumptions made in the theory. If the experiment does not agree with theory, the student should be taught to find the cause of the discrepancy and to estimate the degree of concordance which the limitations of the theory and the accuracy of his measurements may lead him to expect. It is of the utmost importance that such discrepancies should not be passed over; and in a book like that before us, in which theory and experiment are brought together, the valuable introductory note on the accuracy of observations might with advantage have been amplified.

The course covered is a very complete one (up to about Pass B.Sc. standard), and we are glad to see that a fair share of attention has been devoted to mechanics. The electrical section, also, is very full, and has a valuable chapter of notes on electrical apparatus. An appendix contains mathematical tables and an assortment of useful data which are constantly being required in a physics laboratory. The book is convenient in size, well arranged, well illustrated, and well produced, and there are remarkably few misprints.

Each experiment is preceded by a brief theoretical account of the principles involved, which should enable the student to acquire an intelligent appreciation of the experiment to be performed; but in some cases scarcely sufficient attention is directed to the possible experimental errors.

There are occasionally statements which might prove misleading. We cannot, for example, agree that "the truth of Archimedes' principle can be demonstrated readily by purely theoretical methods." Such a statement tends to conceal the purely experimental foundation of the principle.

In the optical section "pin methods" receive perhaps more attention than they deserve, and in some cases they might with advantage be replaced by the more accurate and quicker "line methods." We should also like to have seen a description of

the standard Pentane lamp instead of the vague statement that "some other standardised source [than the standard candle], such as a Pentane lamp, is used," without any indication of the way in which such standardisation is effected. We are glad to note, however, that Swan is given due credit for the prism-photometer, the origin of which is usually concealed so effectively under the name Lummer-Brodhun.

In dealing with methods of measuring the coefficient of linear expansion of a solid, the authors are scarcely fair to the optical lever, which is described as "not at all accurate": we should say that much depends upon the experimenter! The attention of the student might also have been directed to the fact that all these methods give only the difference between the expansions of two bodies, one of which is supposed not to expand. On p. 336, in the experiment on expansion of air at constant pressure, mention should have been made of the error due to the saturated water vapour in the flask. The experiment given on p. 357 to illustrate Newton's law of cooling will fail to do so unless the top of the calorimeter is closed; and the statement on p. 383 that "if the air is cooled down *locally* to this temperature [the dew-point] dew will be deposited on any flat surface exposed to this cooled air," requires modification.

In the section on magnetism we are sorry to see the statement (p. 393) that "a magnet of any shape usually behaves as though forces of attraction or repulsion originated from two definite points in its substance, which may be termed its poles." Careful experiment soon convinces an intelligent student that a point pole is a fiction. Again, on p. 426, it would be well to point out that the tacit assumption that the moments of the two magnets are unaltered by their mutual action when in close proximity is not justified by experiment.

In reference to the determination of the efficiency of an electric lamp, attention is rightly directed to the fact that this should be expressed as candle-power per watt, and not watts per candle-power.

The book as a whole is a valuable addition to the list of text-books on practical physics, and the authors show an intimate acquaintance with the difficulties of both students and teachers which should make it very acceptable to both.

G. A. S.

SYSTEMATIC ZOOLOGY.

(1) *The Fauna of British India, including Ceylon and Burma. Rhynchota:* vol. vi. *Homoptera:* Appendix. By W. L. Distant. Pp. viii + 248. (London: Taylor and Francis, 1916.) Price 10*s.*

(2) *Catalogue of the Ungulate Mammals in the British Museum (Natural History).* Vol v.: *Perissodactyla (Horses, Tapirs, Rhinoceroses), Hyracoidea (Hyraxes), Proboscidea (Elephants).* By the late Richard Lydekker. Pp. xlv + 207. (London: Printed by Order of the Trustees of the British Museum. Sold by Longmans and Co., 1916.) Price 7*s.* 6*d.*

(1) MR. DISTANT'S Appendix to the account of the British Indian Homoptera in the admirable "Fauna" has plenty to chronicle in the shape of novelties. In the Cicadas, so striking a group in the warm regions of the earth, he has to record as many as twenty-three new species since he dealt with the family in vol. iii.; and naturally among those families which make less noise in the world the proportion of novelties is greater, even the little Jassidæ claiming thirty-two new forms, and the Cercopidæ, familiar to us in the person of the "cuckoo-spit" insect, as many as fifty, a number more than trebled by the Fulgoridæ, most of which are not large and conspicuous like the celebrated "lantern-flies" which popularly typify the family. The Membracidæ have more than sixty new forms described, which fully bear out the family reputation for eccentricity in thoracic appendages. Among the new forms described there is a large proportion of new genera, which are fully characterised, so that it is not surprising that the present volume is a fair-sized one; it is well illustrated, having 177 figures.

(2) In addition to the Perissodactyles, Elephants, and Hyraxes, this concluding volume of the British Museum Ungulates contains an appendix to the Bovidæ, the general systematic index, and the index to the whole work. It has naturally suffered by the death of its author before he could revise, or indeed even complete, it; thus the lists of specimens in the museum do not go beyond the Horses and Tapirs, though in the remaining families the synonymy and localities are given. We are told that it has not been thought advisable to complete the volume on the full original plan, partly for lack of a competent author and partly for fear of detriment to science resulting from a mixed responsibility. It seems a great pity, however, that descriptions were not added throughout, as the responsibility difficulty could surely have been got over by bracketing and initialling them; while it does not conduce to the credit of science to issue a work dealing with such important and generally interesting animals with its last volume disfigured and rendered half useless by their general absence. Some can be found in the accounts of the Hyraxes and of the Bovines in the Appendix; in the case of the one equine described, *Equus quagga cuninghamei,* the description is made misleading by the figure being incorrect, since it is said to have the mane well developed, while the animal figured has scarcely any. This is one of the "Burchell's Zebra" subspecies, all of which, we think reasonably, are treated as forms of the Quagga, the typical race of which is extinct; but the Kiang, Chigetai, and Onager are given full specific rank. There are thirty-one illustrations in all, exclusive of an excellent portrait of Lydekker which forms the frontispiece.

F. F.

OUR BOOKSHELF.

An Introductory Course of Continuous-current Engineering. By Dr. Alfred Hay. Pp. xii+360. Second edition, revised. (London: Constable & Co., Ltd., 1916.) Price 6*s.* 6*d.* net.

LIKE all Dr. Hay's books, the present work will well repay the elementary student for the time spent on its study. It first treats of the elementary laws of electromagnetics, then proceeds to deal with instruments, machines, secondary cells, electric lamps, switchgear, and conductors. In places it lacks depth, whilst such things as definitions, fundamental ideas, and the distinction between E.M.F. and P.D. are not quite so clear as they might be.

The chapter on armature windings could be improved. The statements made regarding wave-windings have the ordinary two-circuit four-pole winding in view, and one at least of them is not even universally true for this. It is a mistake to hide from the student that many other wave-windings are possible, especially as some of them have practical advantages which will lead to their more extended use in future.

The chapter on storage cells ought to have at least one illustration showing a complete cell or battery, and the diagrams showing the construction of the plates might have been of a more modern type. The really useful primary cells should surely have found a place in "Continuous-current Engineering."

The chapter on switchgear is to be especially commended, as it gives much more information than is usually found in a small general text-book.

Although we have criticised several details, we are pleased with the book on the whole, and can recommend it to those requiring an elementary book on the subject. DAVID ROBERTSON.

My Yoruba Alphabet. By R. E. Dennett. Pp. xi+45. (London: Macmillan and Co., Ltd., 1916.) Price 1*s.* 6*d.* net.

THOSE who have been accustomed to depend upon the classical work of Col. Ellis on the Yoruba people may be surprised at Mr. Dennett's speculations. Ellis, a careful, competent writer, tells us that they worship a pantheon of nature deities, like Olorun, the sky-god, and phallic gods of fertility, like Elegba, to whom human sacrifices in a brutal form were, or are, offered. Of their higher spirituality he gives little or no evidence. Mr. Dennett, a competent philologist, starting from his own "firm conviction that all the works of the Great Creator of the Universe . . . conform to one definite universal order, and that the spirit, or inner consciousness of man, moves in conformity to this universal order so long as that consciousness works in obedience to the dictates of its Great Author," finds beliefs of a similar type among the Yorubas, who "are by nature deeply religious." Their alphabet, as interpreted by him, expresses eight "Elemental Factors," such as Authority, Morality, Potentiality, and so on. He claims that the summary of his results "should establish decisively and conclusively the systematic conformity of the construction of Yoruba words—especially the Yoruba primitive verbs—with the eight elemental factors of the Great Universal Order." Whether the hypothesis meet with acceptance or not, Mr. Dennett's book will be useful to students of the Yoruba speech, and, in particular, the system of transliteration now proposed deserves careful consideration.

Bacon's War Maps. Europe, embracing all the Countries Involved. (London: G. W. Bacon and Co., Ltd., n.d.) Price 6*d.* net.

THIS folding war-map includes the greater part of Europe and is on a scale of 1 : 4,000,000. It is politically coloured, fairly clear, and has a large number of names, but the only attempts to show relief is by a few stray caterpillar heights. In elevated areas like the Alps and the Carpathians these serve some purpose on a small-scale map like this, but in a lower region, such as the Allies' western front, the few heights that are shown are more misleading than useful. In the Balkans the map fails to reveal the significance of the Vardar valley. Nor is there any attempt to show marsh lands, the military importance of which has been demonstrated on more than one front. In the matter of names there is some scope for criticism. Halicz is not marked and Gorizia appears in the unusual form of Gorz. The map leaves scope for many improvements, which might have been carried out at the expense of the somewhat glaring political colouring if cost was a first consideration.

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.*]

Science in Education.

PERMIT me to suggest that the science of man is scarcely "a vicious circle of introspective examinations," but is itself "one of the realities of external Nature," to use Prof. Soddy's definitions (NATURE, October 5, p. 90). The science of man, as a biological phenomenon that changes the aspect of the inanimate world and interferes with most branches of living matter—as an organism the groups of which have a definite life-history of growth and decay of ability, sometimes called cycles of civilisation—or producing collective average mentality, which results in rapid expansion of ability combined with great destructiveness—in all these ways the science of man appears to stand, like geology or astronomy, apart from all introspection. The purely scientific study by comparison of these phenomena in mass-action, apart from individual movement, is as scientific as the study of mass-action of matter, physical and chemical, apart from tracing the movement of single atoms. The understanding of this seems to be academically needed if we are to escape from British narrowness, and see the world whole. F.R.S.; F.B.A.

Pre-Boulder Clay Man.

IT will no doubt be remembered that at the time of the discovery in 1911 of a human skeleton in a sand pit in the occupation of Messrs. A. Bolton and Co., Ltd. (late Bolton and Laughlin), of Henley Road, Ipswich, it was held by some geologists and by myself that the remains occurred beneath an undisturbed stratum of weathered chalky boulder clay. Since this discovery I have been enabled to investigate extensively the small valley adjoining the sand pit in which the human skeleton was found, and to conduct excavations in the immediate vicinity of the spot where the bones occurred.

These investigations have shown that at about the level at which the skeleton rested the scanty remains of a "floor" are present, and that the few associated flint implements appear to be the same as others found on an old occupation-level in the adjacent valley. This occupation-level is in all probability referable to the early Aurignac period, and it appears that the person whose remains were discovered was buried in this old land surface. The material which has since covered the ancient "floor" may be regarded as a sludge, formed largely of re-made boulder clay, and its deposition was probably associated with a period of low temperature occurring in post-chalky boulder clay times.

It appears, then, that the human skeleton found is referable to a late Palæolithic epoch, and cannot claim a pre-chalky boulder clay antiquity. I wish to take this opportunity to state that those who opposed my contention as to the great age of these remains were in the right, while the views held by me regarding them have been shown to be erroneous.

J. REID MOIR.

12 St. Edmund's Road, Ipswich.

Variable Stars.

THERE are good reasons for believing that when a molten sun has sufficiently cooled down to allow of the formation of a solid surface, the solid surface rapidly cools. We may, therefore, regard a cooling sun as passing through three stages: (1) a stage in which the light emitted is very intense and regular; (2) a stage in which the surface from time to time solidifies and breaks up again; in this condition the emission of light would be very variable; (3) a stage in which the crust had become so firm as to be practically permanent, little, if any, light being emitted.

The conditions obtaining during the second stage are supposed to be of comparatively short duration.

May not some of the irregularly variable stars be in stage 2? If such were the case we should only expect a small proportion of the stars to show this variability; for there would be only a small proportion of them in stage 2.

R. M. DEELEY.

Abbeyfield, Salisbury Avenue, Harpenden,
October 2.

[This question is dealt with in the Hill Observatory Bulletin, vol. i., No. 2, p. 4.—Editor, NATURE.]

Scarcity of Wasps.

IT would be interesting to know whether the scarcity of wasps which is so marked in this district is general. I have seen only one wasp here this season. I am informed that sixty-seven queens were destroyed in one week this spring on the Earl of Crewe's estate, but this cannot fully account for the absence of wasps. Also, while at Bordon (Hants.) for three weeks in August I saw only one wasp.

Are there general causes to account for the scarcity, such as the cold spring, or disease, or is there a cycle of fecundity and scarcity? Possibly some readers of NATURE have observed and remarked the absence of wasps this season in other parts of the country, and may be able to forecast the probable effect on insect pests next summer.

H. V. DAVIS.

"Noddfa," Wistaston, Crewe, October 3.

CAPT. KEITH LUCAS, F.R.S.

ON Thursday last, October 5, Capt. Keith Lucas lost his life in a flying accident. In his short span of life—he was but thirty-seven—he had become the leading authority on the phenomena of excitation in nerve and muscle. He had gone through several phases. Coming up from Rugby, he obtained a minor scholarship in classics at Trinity College, Cambridge, and entered the college in 1897. He passed to natural science studies, and took a first class in the Natural Sciences Tripos. Soon after this he made a bathymetrical survey of a New Zealand lake. He then began research in physiology, was elected a fellow of Trinity in 1904, and a little later was appointed lecturer of the college and demonstrator of physiology in the University. The line of research he had chosen led to the development of his inherited faculty of mechanical design, and each additional step of his work was marked by the invention of a new instrument or by some striking improvement in instrumental methods necessary for the successful investigation of the problem. His exceptional mechanical ability found further scope when he became one of the scientific directors of the Cambridge Instrument Company.

On the outbreak of war he gave up work at Cambridge and undertook research at the Royal Aircraft Factory. His success in modifying the magnetic compass for use in the peculiar conditions of aircraft flight has been specially noted in the recently published report of the Advisory Committee for Aeronautics. The committee pointed out how greatly flyers are indebted to Dr. Lucas. His subsequent investigations afford an instance of his thoroughness and devotion to the work in hand. He acquired, as an accessory matter, a personal knowledge of the conditions of flight, and obtained a pilot's certificate. It was while engaged in this investigation that the accident happened which cost him his life.

Much as Keith Lucas had achieved in physiology, it is certain that, had he lived, he would have done much more. He conceived early the whole scheme of investigation necessary to settle his particular problem, and he followed it up step by step with unsurpassed logical method. So far as it can be said in science that the determination of a special problem depends on one man, it can be said of Keith Lucas. His friends loved the quiet and unassuming manner which carried so much strength of character.

J. N. LANGLEY.

SIR AUREL STEIN'S THIRD JOURNEY IN CENTRAL ASIA.

SIR AUREL STEIN publishes, in the August and September issues of the *Geographical Journal,* an account of his third journey in Central Asia.

Starting from Srinagar, in Kashmir, in July, 1913, the first point of interest reached was the Darel Valley, where, at his new capital, Gumarekot, Raja Pakhtun-wali, son of Mir Wali, the murderer of Hayward the explorer, has succeeded in building up a new kingdom, the last, perhaps, which India has seen founded on the old adventurous lines. The fine glacier scenery of this region is illustrated by the view of the Chillinji Glacier (Fig. 1). In this valley of Darel the explorer succeeded in identifying, at Poguch, the site of an ancient Buddhist monastery which the Chinese pilgrims specially mention on account of its miracle-working colossal image of Maitreya Buddha in wood. As an illustration of the continuity of Oriental cults, the site is now occupied and the healing business taken over by the tomb of Shaha-Khel Baba, a Mohammedan saint, who has inherited the miraculous powers of his Buddhist predecessors. Thence over very difficult ground the traveller pushed on through the Yasin Valley to the Darkof Pass, the scene of the remarkable exploit by which a Chinese force, dispatched in A.D. 747 from Kashgar against the Tibetans, succeeded in effecting an entry into Yasin and Gilgit.

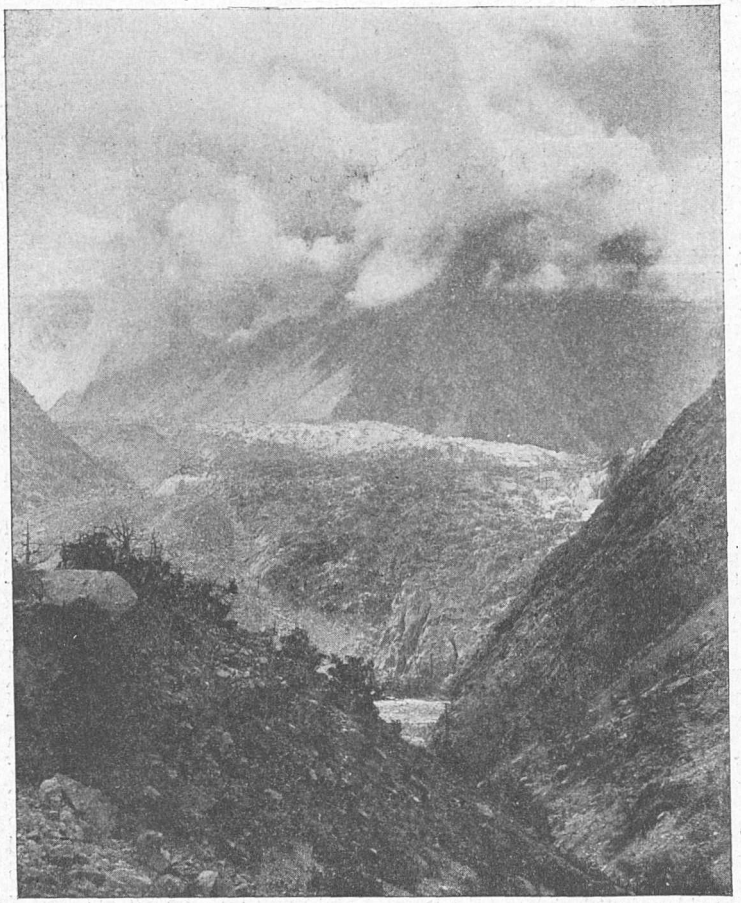

FIG. 1.—Lowest portion of Chillinji Glacier, seen from west across Ashkuman River. From the *Geographical Journal.*

By the beginning of September the party reached the main head of the Hunza Valley, and marched thence to Tashkurghan and Kashgar, where, as usual, Sir G. Macartney, the British Consul-General, supplied liberal aid to the expedition. Since Sir Aurel Stein's last visit, owing to the Chinese revolution of 1911, the political situation had changed for the worse. Mandarins had been assassinated, and local revolts had resulted in a general weakening of Chinese authority. From Kashgar the goal was the region round the dried-up Lop-nor, in the extreme east of the Tarim Basin. Beyond Mural-Bashi, Stein reached the most forbidding region he had hitherto encountered in Taklamakan, and after meeting great difficulties he returned to his old station, Khotan. In this region many interesting discoveries were made. He succeeded in fixing the site of Hsuan-tsang's Pi-mo, the Pein of Marco Polo, at a Buddhist shrine near Domoku, and a large number of tablets inscribed in the Kharoshthi character, and dating from the first century of our era, was found.

Passing Charchan on New Year's Eve, 1914, he found that a band of so-called "gamblers," or vagrant outlaws, had overthrown Chinese authority. At Miran paintings of great interest, almost Hellenistic in style, were unearthed. Later on the ancient Chinese road into the Tarim Basin was identified, and further finds of decorated silk fabrics will contribute to the solution of the problem of origin in the designs discovered in an earlier journey near Tun-huang, usually attributed to Persian art of the Sassanian period. Equally interesting were the desiccated corpses of the old chief and his family, with their well-preserved arms and dresses. The illustration (Fig. 2) of an ancient fort near Lou-Lan gives a good idea of the sites which came under investigation.

The first portion of the narrative leaves the explorer on the western portion of the fortified Chinese line which was first examined in 1907. The fact that he could, after seven years' absence, identify his own footsteps and the footprints of his dog shows the permanence of records of travel in these desert wastes.

The second chapter of the story finds the traveller starting early in 1915 to examine the deserts which fringe on the south and east the

great barren hill region usually designated the Pei-shan Gobi. The site known as that of "The Thousand Buddhas," from which a large mass of material was collected in an earlier tour, in spite of an ill-considered seizure of manuscripts by the Chinese Government, was found capable of providing large additional hoards; while the survey of the ruins of Khara-Khoto established the identity of the site with Marco Polo's "city of Etzina." At the north foot of the T'ien-shan range he traced the original route through which all the historical migrations westward — Indo-Scythians, Huns, and Turks — must have passed. In May, 1915, the traveller returned to Kashgar, and it might have been supposed that the wayworn party would have been satisfied to return and convey the important collections of new material to India. But the indefatigable leader determined to take the opportunity of crossing the Pamirs to study the historical geography of that region. Here one of the most remarkable features of the landscape was the splendid glacier peaks of Muz-tagh, seen from the watershed, about 11,000 ft. high, on the Tars-agar Pass (Fig. 3). It is satisfactory to record that Sir Aurel Stein speaks in high terms of the results of the Russian Topographical Survey of the Pamirs, which had been in progress for some years before the outbreak of the war. At last his desire to visit Lake Victoria or Zor-Kol was satisfied, and thence he passed through Wakhan to Samarkand, and thence into Seistan, where, at Koh-i-Khwaja, he was lucky enough to discover the remains of a Buddhist sanctuary, the first ever traced on Iranian soil. Finally, passing through Baluchistan, he reached the Indian railway system at Nushki, by which he arrived at

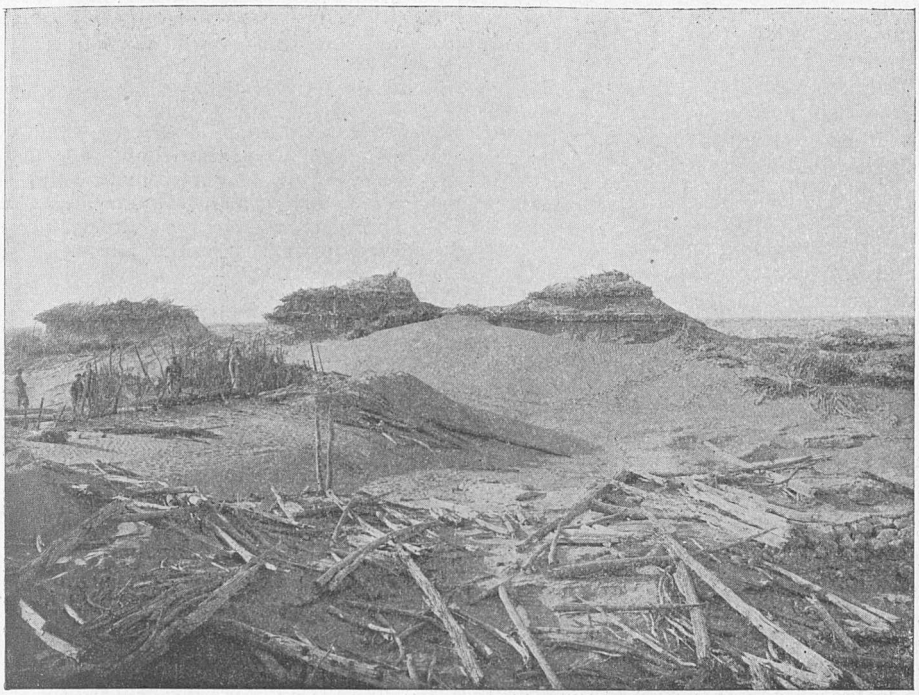

FIG. 2.—Interior of Ancient Fort with wind-breached portion o. Rampart, south-west of Lou-Lan site. From the *Geographical Journal.*

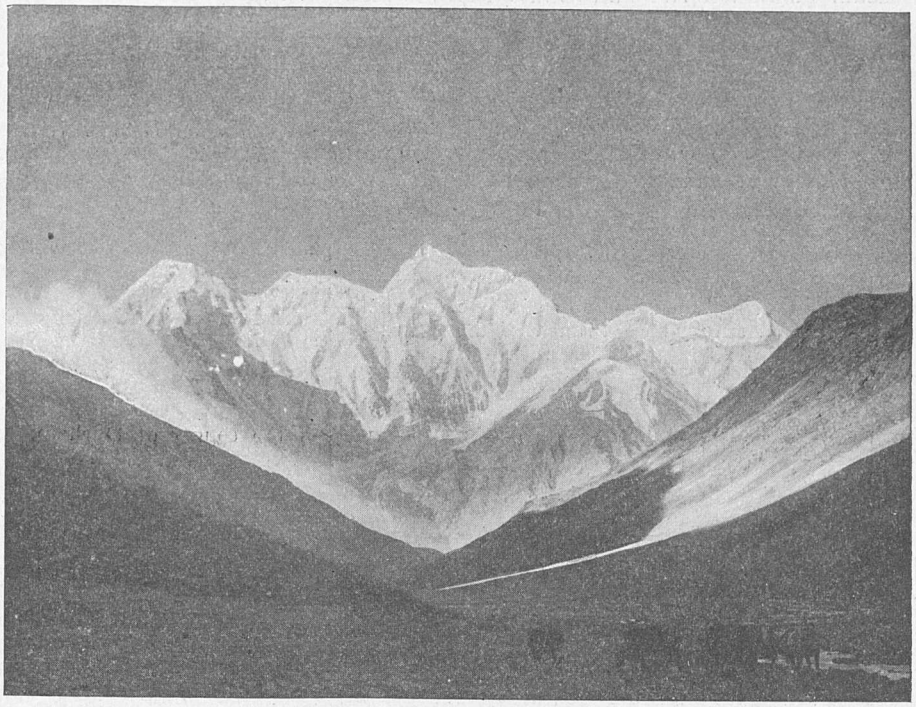

FIG. 3.—Glacier peaks of "Muz-tagh" above Muk-su, seen from watershed (about 11,000 ft.) on Tars-agar Pass. From the *Geographical Journal.*

Delhi to report the result of his journey to Lord Hardinge.

We cannot discuss the many interesting results of this remarkable journey. In the Pei-shan Sir Aurel Stein remarks that inscribed slips of wood, thrown out of ancient office-rooms, were often found in refuse-heaps, covered only by a few inches of gravel or *débris*, their preservation in such condition presupposing a remarkable dryness of climate during the last two thousand years. On the other hand, he points out that the final abandonment of the Khara-Khoto settlement was brought about by difficulties of irrigation, and "it was not possible to determine by conclusive evidence whether this failure of irrigation had been the result of desiccation in the Etsin-gol delta, or had been caused by some change in the river-course at canal-head, with which the settlement for some reason was unable to cope. But there seemed to me good reason to believe that the water-supply now reaching the delta during a few summer months would no longer suffice to assure adequate irrigation for the once cultivated area." Obviously the problem of the changes of climate during the historical period will need much further investigation before it can be finally solved, and in the present fragmentary state of our information the question should not be treated in a spirit of confident dogmatism.

It has been arranged that the Indian Government, which liberally contributed to the expenses of the journey, shall receive a considerable portion of the finds, which will be deposited in the new Museum of Indian Art and Ethnography which has been planned at Delhi. We are now so accustomed to the periodical reports of Sir Aurel Stein's explorations that we may fail to appreciate the remarkable courage, tenacity, and executive ability which he has shown in opening up a new region and in reconstructing a hitherto unknown chapter in the history of man.

NOTES.

MR. RUNCIMAN announced in the House of Commons on Tuesday that he had decided to combine the existing Commercial Intelligence Branch of the Board of Trade and the Exhibitions Branch into a new and enlarged Commercial Intelligence Department. The reorganisation of the department is now proceeding.

A ROYAL Commission has been appointed "to inquire into the supply of wheat and flour in the United Kingdom; to purchase, sell, and control the delivery of wheat and flour on behalf of his Majesty's Government; and generally to take such steps as may seem desirable for maintaining the supply." The names of the members of the Commission are:—The Earl of Crawford (chairman), Alan Garratt Anderson (vice-chairman), Sir Henry Rew, K.C.B., Sir George Saltmarsh, H. W. Patrick, Hugh Rathbone, Oswald Robinson, J. F. Beale, and T. B. Royden. Communications intended for the Commission should be addressed to the secretary at Trafalgar House, W.C.

THE Harveian oration of the Royal College of Physicians of London will be delivered on Wednesday, October 18, by Sir Thomas Barlow.

THE Thomas Hawksley lecture of the Institution of Mechanical Engineers will be delivered by Mr. H. E. Jones on Friday, November 3, upon the subject of "The Gas Engineer of the Last Century."

WE learn from the *Times* that Prof. W. von Waldeyer, professor of anatomy in the University of Berlin, has been raised to hereditary nobility on the occasion of his sixtieth birthday.

THE death is announced, at seventy-seven years of age, of Mr. Herbert Jones, known by his work in archæology, particularly with reference to the Roman occupation of Britain, and investigations relating to it at Silchester, Carlisle, Roxeter, and Greenwich.

DR. LE ROY C. COOLEY has died at his home at Poughkeepsie, N.Y., at the age of eighty-three. He was professor of physical science at the N.Y. State Normal College from 1860 to 1874. In the latter year he became professor of physics and chemistry at Vassar College. He held that post until 1894, when he was appointed to the chair of physics in the same institution. He retired in 1907. He was the author of several text-books of physics and chemistry. In 1899 he was elected president of the N.Y. State Science Teachers' Association.

THE death is announced, in his fifty-seventh year, of Dr. C. S. Prosser, head of the department of geology in the Ohio State University, with which he had been connected since 1899. He had previously occupied the chair of natural history at Washburn College, Topeka, Kansas, and of geology at Union College, N.Y. He was an assistant-geologist of the U.S. Geological Survey, and of the State Geological Surveys of Kansas, New York, Ohio, and Maryland. In addition to many official reports, he had published works on the stratigraphic geology and palæontology of Pennsylvania, New York, Kansas, Nebraska, Maryland, and Ohio, the Devonian of New York, Pennsylvania, and Maryland, and the Permian of Nebraska, Kansas, and Oklahoma.

WE regret to note in *Engineering* for October 6 the death, on October 1, in his seventy-sixth year, of Sir W. Theodore Doxford, at his residence, Grindon Hall, Sunderland. As a shipbuilder Sir Theodore greatly assisted in the development and improvement of cargo-carrying steamers. In 1895 the output of the works on the Wear with which his name is associated exceeded that of any other shipbuilding establishment in the country. Sir Theodore became a member of the council of the Institution of Naval Architects in 1896, and was president of the North-East Coast Institution of Engineers and Shipbuilders in 1886–87. He took an active part in the public life of the district in which his works were located, and was a Deputy-Lieutenant of the county of Durham.

MR. J. ACKWORTH PLOMMER has presented to the Geological Department of the British Museum an unusually fine portion of a Hippurite from the Chalk of Boughton-under-Blean, near Faversham, Kent. The specimen is part of the conical valve of the shell, which must have measured from 2 to 3 ft. in length, with a maximum diameter of about 8 in. The shell-substance is more than 2 in. in thickness, and of the usual open texture. The fossil seems to belong to a species, *Radiolites mortoni*, which is already known by fragments from the English Chalk, and by finer specimens from the Cambridge Greensand. The rarity of Hippurites in the Chalk is curious considering their immense abundance in the limestones of corresponding age in central and southern Europe, and in certain

regions of Asia, where they form the main part of some mountains.

WHEN the Gilbert Club was inaugurated in 1889, it had nearly one hundred members. The president was Lord Kelvin, and the secretaries were Mr. Conrad W. Cooke, Prof. R. Meldola, and Prof. S. P. Thompson, all of whom, except Mr. Cooke, have since died. The first object of the club was to produce and issue an English translation of Gilbert's "De Magnete" in the manner of the folio of 1600. This was done, but no general meeting has been held since the club was inaugurated, and as the principal founder, Prof. Thompson, has passed away, it is proposed to wind up the affairs of the club. A general meeting will be held, therefore, in the rooms of the Royal Society of Arts on Wednesday, October 18, at 3.30 o'clock p.m., the Right Hon. Lord Moulton in the chair, for this purpose. Proposals will be made as to the disposal of the property of the club, consisting of the remaining copies of the book, as well as of such funds as are in the hands of the hon. treasurer, and matters will be brought forward of considerable interest to all who wish to perpetuate the memory of William Gilbert of Colchester.

THE death of Dr. Joseph Anderson, of Edinburgh, at the ripe age of eighty-four, removes a notable personality from the ranks of scientific workers. Born in 1832, he originally intended to devote himself to a scholastic career. After several years of teaching, three of which (1856–59) were spent in Constantinople, he turned to journalism instead, becoming editor of an important provincial newspaper in the extreme north of Scotland. It was during his nine years of residence at Wick that he found his true vocation. Caithness is singularly rich in prehistoric monuments, and Anderson's acute intelligence was at once attracted by the difficult problems which these present. He realised from the outset that the only hope of a solution lay in the rigid application of the methods of science. He therefore set himself to ascertain the precise facts, resolutely refusing to theorise unless and until a sufficient basis for induction had been securely established. His earliest results were so full of promise and were set forth in so lucid and incisive a style that, on a vacancy occurring in 1869, he received a unanimous invitation to accept the keepership of the National Museum of Antiquities in Edinburgh, and with it the assistant-secretaryship of the Society of Antiquaries of Scotland. These posts he held until 1913, when he retired with a Civil List pension. It is not too much to say that in the interval he revolutionised the whole study of Scottish archæology, his chief publications being his five series of Rhind lectures, which stamp him indubitably as a master of the science of research and of the art of clear exposition.

SIR ROBERT HUDSON, chairman of the Joint Finance Committee of the British Red Cross Society and the Order of St. John (83 Pall Mall), publishes in the *Times* of October 10 the following letter received by him from "A Past President of the Chemical Society" and "A Past President of the Society of Chemical Industry":—"An industrial body in the United States of America recently requested our scientific advice. We felt bound to reply that all extraneous work not desired by the State could only be undertaken on behalf of the British Red Cross Society, to which any honorarium must be directly transmitted. The corporation having responded most handsomely to our terms, we gladly hand over cheques each for 1000 guineas, forwarded under the condition above specified. The bounds of the scientific profession are very extensive, and many individuals are receiving large pecuniary benefits accruing, directly or indirectly, out of applied science. We earnestly hope that many colleagues will come forward and help on the beneficent work of the British Red Cross Society." Sir Robert Hudson expresses the hope that the fine example thus set by his two correspondents will commend itself to others; and we are sure that no objects make a stronger appeal to the scientific world than those with which he is associated. Very few men of science, however, are receiving such handsome fees as those which have just been forwarded to him, and most of them are engaged in national work of one kind or another without receiving any payment for their services. The appeal should be, therefore, not so much to scientific workers as to manufacturers and others who are benefiting by expert knowledge, often given gratuitously.

IN the June issue of the Journal of the Royal Society of Antiquaries of Ireland the address delivered by the president, Mr. T. J. Westropp, on "The Progress of Irish Archæology" is published. The society was founded in Kilkenny in 1849, and since then has held a high record for a long series of valuable papers published in its Proceedings. It was said when the society migrated from Kilkenny to Dublin that archæology in Ireland sprang from the novels of Sir Walter Scott or from Macpherson's "Ossian." There is some truth in this statement. The president's account of the early Irish antiquaries, among whom portraits of W. Mollineaux, C. O'Connor, C. Vallancey, and G. Petrie accompany his address, is lively and interesting. He speaks hopefully of the study of Irish antiquities, which, among its ablest students, exhibits a dislike for sweeping theories. But he remarks:—"In our country a bad theory—no matter how often refuted—never dies. Scientific antiquaries have too much to do to refute for the tenth or twelfth time these absurdities. We shall never be in a satisfactory position till in archæology, as in natural science, the man who attempts to revive an exploded error only slays his reputation and deceives no one but himself."

THE problem of the origin of what he called the Indo-Aryan type of Indian temples was never completely solved by James Fergusson, and later inquirers have done little to produce a solution. In the June issue of the Journal of the Bihar and Orissa Research Society Dr. D. B. Spooner, well known for his excavations at the site of Pataliputra, has in a great measure solved the difficulty. Beginning with the most primitive form of shrine, little more than a square box, he shows that the desire of the Indian architect was to produce a play of light and shade by advancing the central portion a little way, and then to repeat the process, so as to produce a lower structure decorated with three miniatures. At some stage of the local architectural history this threefold division seems to have come prominently into notice, and the architect conceived the idea of balancing this triplicity rhythmically by a corresponding threefold division of his tower in horizontal stories. This idea of the architectural rhythm is very ingeniously developed by Dr. Spooner, and his paper deserves the attention of architects. He closes by saying:—"The people of Tirhut are to be warmly congratulated on the possession of so complete a series of temples as they now possess, a series sufficient to illustrate the whole development of this important style, and a series including many shrines of special interest and beauty. Let us hope that they will do their best to safeguard their inheritance, and to maintain the temples we have seen in good condition."

THE "Terrapin" scale (*Eulecanium nigrofasciatum*) is the subject of Bulletin No. 351 of the U.S. Dept. of Agriculture, written by Mr. F. L. Simanton. This is a North American insect, closely allied to our European *E. persicae*, destructive to peach and plum, and feeding also on thirty other trees and shrubs. The females hibernate on the twigs, where, instead of laying eggs, they give birth to active young, which migrate to the leaves. Much damage is caused by the insects' honeydew secretion, which disfigures the fruit. The bulletin is well illustrated, and contains directions for remedial treatment, early spraying with a linseed oil and gasolene emulsion being especially recommended.

NOTES of much interest appear in the *Zoologist* for September on the mammalian fauna of North Cardiganshire. The author, Mr. Frank Wright, records the occurrence, during the last ten or twelve years, of a number of polecats of a very light colour, some individuals, furthermore, exceeding in size the more normally coloured animal. Both light- and dark-coloured individuals have been taken from the same pest. The pine-marten, he remarks, is now exceedingly rare, but a few apparently survive on the high plateau east of Tregaron. The foxes of the uplands also seem to differ from the type in the matter of coloration, being much greyer. But a specimen taken near the summit of Plinlimmon was quite black instead of white on the under parts.

MR. ZONIA BABER, in the *Scientific Monthly* for September, raises a timely protest against the wholesale slaughter of whales which is at present taking place throughout the seas of the world, and this without the slightest attempt at preventive legislation. The author, in his essay, "The Oceans: Our Future Pastures," holds that the time will come when men will have to depend upon the larger Cetacea for their meat supply, since the grazing of cattle will be impossible owing to the density of the population, which will cover the whole habitable globe. While we by no means agree with this view, we are at one with him that, for other and scarcely less cogent reasons, the present ruthless and wasteful exploitation of our whale fisheries constitutes a deplorable lack of foresight on the part of those engaged therein. The matter demanded international legislation long ago, and even now it is not too late, though, unless it come speedily, the Greenland and humped-back whales and the grey whale (*Rhachi anectes*) will have taken their places with Steller's sea-cow and the great auk—victims to man's greed.

IT is clear from the annual report of the British Museum (1915) that the Natural History Departments have been able to render useful aid to the military authorities in matters directly bearing on the war. In one case a leech, removed from the nose of a soldier invalided home from the Dardanelles, was sent to the museum from the military hospital in order that it might be identified and its habits described. A report on the matter was prepared by the keeper of the Zoological Department embodying useful advice and instructions, and this report was sent to the medical officers serving in the Mediterranean in order that the necessary precautions to avoid further infection might be taken. The Botanical Department was enabled to furnish the authorities of the Naval Air Service with valuable information in regard to wood suitable for airship construction. Further assistance was also given in regard to a fungus which was attacking the fabric of airships. Valuable work has also been done in regard to the supposed hibernation of the house-fly, and to the whaling industry in the Antarctic seas, which is carried on in the neighbourhood of South Georgia so thoroughly that some species are threatened with extinction.

THE best-known instances of luminosity in insects are to be found among the beetles; the various species of glow-worm and firefly belong to this order. But the same, or an analogous, phenomenon is occasionally observable in other insect groups, as, for example, in the "fungus gnats" and crickets. There are at least two well-authenticated records of luminosity in the larvæ of moths, and quite recently the Rev. J. Holroyde, vicar of Patcham, has reported to us an observation of luminous larvæ near Brighton. The species of these larvæ was not determined, but they appear to have been the caterpillars of a moth, probably a Noctuid. Boisduval, whose record is one of those above alluded to, believed that the luminescence in his larvæ was due to disease, and it has been suggested that decomposition due to bacterial infection is the cause of a similar appearance that has been described in other insects not usually luminous, as Chironomus (a kind of gnat) and the so-called "lantern flies" of South America. It is evident that the exceptional production of light in the cases just mentioned is very different in nature from the entirely normal illumination of the glow-worms and fireflies, though it may equally be due to the oxidation of some organic material.

THE excellent work in agricultural science which is being carried on at Moscow under the guidance of Prof. D. N. Prianichnikow is amply illustrated in the recently issued report (vol. x.) of the Agronomical Laboratory for the year 1914. As in past years, much attention has been devoted to the investigation of the merits as fertilisers of various natural phosphates and potash-bearing minerals, fully one-half of the papers included in the report having reference to these products. The assimilation and utilisation of ammonia by the plant have also received considerable attention. The experiments with phosphates have demonstrated the relatively high value of certain of the Russian phosphorite deposits, increases of crop as high as 60 to 70 per cent. of the highest obtained with superphosphate having been recorded in tests with cereal crops. This is in marked contrast to the results of earlier experiments recorded in previous reports, which indicated that, in general, phosphorites are almost valueless for cereal crops, though of appreciable value for leguminous crops.

USEFUL data as to the limits of tolerance of crop plants for sodium salts present in the soil are given by Messrs. Headley, Curtis, and Scofield in the latest issue of the *Journal of Agricultural Research* (vol. vi., p. 857). Experiments in Nevada have shown that the limit of tolerance is extremely variable, being influenced not only by such factors as kind of soil, salt, or crop, but the same crop plant shows marked differences in tolerance at different periods of its growth. So far as the amount of salt is concerned the limit of tolerance is dependent not so much upon the total quantity of the salt that may be present in the soil as upon the quantity that exists in the soil solution, and is recoverable from the soil by means of extraction with water. In pot experiments with soil from a tract of salt land in Nevada it was found that the proportion of recoverable salt which would reduce by one-half the growth of wheat seedlings was for sodium carbonate or bicarbonate 0·04 per cent. of the dry weight of the soil, for sodium chloride 0·16 per cent., and for sodium sulphate 0·35 per cent. The proportion of recoverable salt which prevented germination of wheat was for the carbonates 0·13 per cent., for the chloride 0·52 per cent., and for the sulphate 0·56 per cent.

THE investigation of the equations of motion of an aeroplane under the action of atmospheric disturbances such as gusts of wind is a problem to which attention was directed by Prof. Bryan in 1911 ("Stability in Aviation," pp. 178–79, problems 4, 13). An attempt to solve this problem has now been made by Prof. Edwin Bidwell Wilson (S. Doc., 268, Sixty-fourth Cong., 1st sess.). The method adopted in this case consists in treating the disturbed motion as a forced oscillation, the disturbance being expressed in the form of an exponential function of the time. Unfortunately, however, it is not possible to obtain a simple solution of the problem in a symbolic form, and what Prof. Wilson has been able to do is to obtain numerical results for a particular aeroplane of which the values of the stability-coefficients have been determined experimentally. It will thus be necessary to repeat the calculations every time a new aeroplane is built. Prof. Wilson has for no adequate reason departed from the standard notation in his choice of axes. The problem with which he is dealing is only the two-dimensional case of longitudinal disturbances, and it is the universal custom in treatises both on pure and applied mathematics to choose x and y as co-ordinates in all two-dimensional problems. The same practice was followed in the earliest stability investigations both in England and abroad, and the difference of notation is bound to cause confusion.

IN a paper which appears in the August number of the Science Reports of the University of Seddai Messrs. Honda and Okubo arrive at an expression for the force on one of the elementary magnets of a group arranged in a space-lattice due to the presence of the other magnets of the group. From this, on calculating the effect of an external field, they are able to obtain the magnetisation curve, and find it is identical with the well-known experimental curve. On varying the external field in the usual cyclic manner, the hysteresis loop is reproduced. It is then shown that the whole of the magnetic properties of magnetite can be reproduced on the theory that the elementary magnets constitute a cubic space-lattice, while those of pyrrhotine require a hexagonal lattice, as would be expected from its crystalline form. This molecular configuration for magnetite does not agree with that deduced by Bragg from the behaviour of the crystal towards X-rays. Finally, the authors show that the properties of ferromagnetic materials can be more completely and satisfactorily explained on the basis of the mutual action of elementary magnets than by the molecular field theory of Weiss.

A RECENT publication of the U.S. Coast and Geodetic Survey (Serial No. 23, Washington, 1916) gives the results obtained during 1913 and 1914 at the observatory near Tucson, Arizona. This observatory, which commenced operations in 1910, has a set of Eschenhagen magnetographs. The annual variation of temperature in the magnetograph chamber is about 13° C., but the diurnal range is only about 0·1°. Notwithstanding the favourable temperature conditions, the horizontal and vertical force magnetographs have given considerable trouble, large variations taking place in the scale values. The declination magnetograph has worked more satisfactorily, and as three absolute declination observations are taken weekly, the results for that element should be especially trustworthy. The Coast and Geodetic Survey has decided to refer all observations of horizontal force to the so-called "international standard" of the Carnegie Institution of Washington. This entails the application of a correction of $-23\gamma(1\gamma \equiv 1\times10^{-5}$ C.G.S. unit) to previously published values of horizontal force at Tucson, and of a corresponding correction to vertical force. Thus the mean annual values for earlier years printed in the present volume differ from those previously published. Opinions may differ as to whether this departure is not a little premature. Diurnal inequalities are given for the ten quietest days of each month and also for the five international quiet days. Mean monthly values are given for both these sets of days, as well as for all days. The all-day mean in horizontal force, on the average of the twenty-four months of the two years, is about $2{\cdot}6\gamma$ below the other two means. Seven folding plates reproduce the magnetograms showing the chief disturbances of the two years. The largest disturbance in both years occurred in April, but no disturbances were of outstanding magnitude. The observatory also possesses a Bosch-Omori seismograph recording N.-S. and E.-W. components of seismic motion. The earthquakes recorded are enumerated, and particulars are given of their principal features, but there is no information as to their epicentres. Much the largest disturbance recorded was that of March 30, 1914.

MANY engineers contend that the pressure over the teeth in modern high-speed gearing must be far from uniformly distributed. An interesting and new method for preventing any excessive concentration of the load on any part of the teeth is described in *Engineering* for October 6. The gearing was constructed by the General Electric Company of Schenectady, and used for coupling a high-speed steam turbine to a low-speed continuous-current generator. The wheels have double helical teeth, and the large wheel is built up of several comparatively thin discs, each separated from its neighbour by a small interval. The discs are bolted solidly together at their inner peripheries, but stand free from each other at their outer circumferences. Each disc has thus considerable axial flexibility, and if the load tends to be concentrated on any one of the discs, that disc bends axially, since the teeth are of the helical type. In this way the disc is relieved of the excess pressure, and a fairly uniform distribution of the load is secured. To enable the teeth to be cut on the rims of the discs, the discs are so made in the first instance as to be in contact also at the outer peripheries. The teeth can thus be milled without the discs springing, and after this operation is finished a narrow cut is made between the discs so as to obtain the required axial flexibility.

A SHILLING edition of Sir Ray Lankester's well-known and deservedly popular "Science from an Easy Chair" has been published by Messrs. Methuen and Co., Ltd. This is the ninth edition of the book, which was first published in April, 1910, and reviewed in our issue of July 14 of that year (vol. lxxxiv., p. 37)

A FRENCH translation of Prof. F. Soddy's monograph on the chemistry of the radio-elements, published in 1912, has been made by M. E. Philippi, and is issued by MM. Gauthier-Villars and Co., in Paris, under the title "La Chimie des Eléments Radioactifs." The price of the volume is 5 francs.

THE Wireless Press, Ltd., will shortly publish "The Measurement of Capacity and Inductance," by W. H. Nottage, illustrated, and a new and enlarged edition of "Elementary Principles of Wireless Telegraphy," by R. D. Bangay.

THE recently issued announcement list of the J. B. Lippincott Company includes the following new books and new editions:—"Shakespeare and Precious Stones," Dr. G. F. Kunz, illustrated: the work will treat of all the known references to precious stones in Shakespeare's works, with comments as to the origin of his material, the knowledge of the poet concerning

precious stones, and references as to where the precious stones of his time came from; "Rings," Dr. G. F. Kunz, illustrated; "The Art of Anæsthesia," Dr. P. J. Flagg, illustrated; and (in "Lippincott's Farm Manuals") "Productive Sheep Husbandry," Prof. W. C. Coffey, illustrated; "Productive Marketing of Farm Products," A. E. Cance, illustrated; "Productive Feeding of Farm Animals," Prof. F. W. Woll, new edition, illustrated; "Productive Soil Maintenance," C. E. Thorne, illustrated; "Animal Husbandry," Prof. C. W. Gay, illustrated; "Productive Grape Growing," Prof. B. S. Pickett, illustrated.

OUR ASTRONOMICAL COLUMN.

FIREBALL OF OCTOBER 3.—Probably what was the most brilliant meteor that has appeared in the present year was seen on Tuesday, October 3, at 8.5 p.m. It passed over Devonshire, and, though the night was cloudy, it gave a very vivid illumination of the sky and landscape, and its apparition was witnessed by great numbers of persons in the S.W. counties of England.

The observations are, however, not very accurate or consistent one with another in consequence of there being very few, if any, stars visible at the time from which its path might be taken. The flight was vertical as observed at Bristol, and was similarly described at various stations in Devon and Cornwall, so that a radiant at or near the zenith is inferred. At Launceston, however, the course is stated to have been from E. to W., and the fireball burst when near the zenith. Mr. W. F. Denning has determined the real path from the data at hand, and places the probable radiant in the head of Cepheus. The height of the meteor was about 67 to 30 miles above a point of the earth's surface some 15 miles E.N.E. of Exeter. A few further observations from Dorset or Devon would be very valuable as affording a test of the accuracy of this result; any such observations should be sent to Mr. Denning, 44 Egerton Road, Bristol.

MERCURY VISIBLE BEFORE SUNRISE.—Mercury will be a morning star during the latter half of this month, and at its greatest western elongation at midnight following October 20. The planet will rise from a point a little S. of due E. at the following times:—

	Mercury rises a.m.	Sun rises a.m.	Mercury precedes Sun h. m.
Oct. 15	4 51	6 26	1 35
17	4 48	6 29	1 41
19	4 46	6 32	1 46
21	4 46	6 36	1 50
23	4 50	6 39	1 49
25	4 58	6 42	1 44
27	5 8	6 46	1 38
29	5 17	6 49	1 32
31	5 27	6 53	1 26

The waning crescent of the moon will be in the same region of Mercury on the morning of October 25.

THE DISTRIBUTION OF B STARS.—An important memoir on the distances and distribution of the B (helium) stars has been published by Prof. Charlier (Nova Acta Reg. Soc. Sci., Upsala, series iv., vol. iv., No. 7). It contains all the details which led to the general conclusions previously announced (NATURE, vol. xcvii., p. 369). In a group of stars having the same luminosity, the distance (r) of each individual star can be deduced from the apparent magnitude (m) by the relation $r = R.10^{0.2\,m}$, where the parameter R is the distance for apparent magnitude 0.0. A first determination of R was based upon the proper motions and radial velocities of 156 stars brighter than 5th magnitude, for which the requisite data were available; its value is 4.76 siriometers (1 siriometer = a million times earth's distance from sun). The corresponding absolute magnitude, or apparent magnitude at a distance of one siriometer, is given by $M = -5 \log R$, and is equal to -3.39. It was next discovered that the fainter stars gave a somewhat smaller value of R, and the brighter stars a higher value. This anomaly was found to be due to the varying luminosities of the different sub-classes. Separate investigation of these showed, in the main, that types B1 and B2 have the greatest luminosity, R being 7.4 sir., whereas types B0, B3, B5 have a value of $R = 3.3$ sir. For each subclass the value of R appears to be independent of apparent magnitude. Having the value of R for each sub-class, the position in space of each star at once follows, and it results that the B stars form a well-defined cluster, gradually thinning out from the centre to a distance of 200 siriometers. The centre of the cluster, which Prof. Charlier supposes to be coincident with the centre of the stellar universe, is in R.A. 7.7h., declination $-55.6°$; it lies in a rich region in Carina, at a distance of 18.2 sir. from the sun. The cluster has an extension nearly three times as great in the plane of the Milky Way as in the direction at right angles, and the sun lies eccentrically with respect to it, at a distance of 4 sir. above the fundamental plane of the Milky Way. The mean density amounts to 0.0026 stars per cubic siriometer. A catalogue of the 804 known B stars is given, showing all the data relating to type, magnitude, distance, galactic co-ordinates, and so on. The distribution of the stars is further shown diagrammatically, and stereoscopic charts are in course of preparation. It is of interest to note further that the nearest B star is α Eridani, with a distance of only 4 sir. ($\pi = 0.0516''$), while the three stars in the belt of Orion come next, with a distance of 8 sir. So far as they go, direct determinations of parallaxes support the values of R used in the investigation.

THE SPECTROSCOPIC BINARY χ AURIGÆ.—An orbit for the spectroscopic binary χ Aurigæ (type B1) has been calculated by R. K. Young from eighty-eight single-prism spectrograms taken at Ottawa in the years 1913–16 (Journ. R.A.S. Canada, vol. x., p. 358). The period has the exceptional value, for an early type star, of 655.16 ± 5.26 days; the eccentricity is 0.171, and the orbital velocity 20.53 km./sec. The residuals from the simple elliptic orbit were examined for indications of the presence of a third body, but no secondary period was found; further investigation of this point, with high dispersion, is considered desirable. The calcium lines (H and K) have an amplitude of about half that shown by other lines of the spectrum. A useful summary is given of the different cases of anomalous behaviour of the calcium lines at present known, and Mr. Young considers that the phenomena are best explained on the supposition that there is a calcium cloud surrounding the binary, the absorption of this substance taking place at a much higher level than that of the other elements.

A NEW ASTRONOMICAL JOURNAL.—We have pleasure in directing attention to the publication in France of a new monthly periodical devoted to astronomy and meteorology. It bears the title *La Revue Verte*, and is edited by the Abbé Th. Moreux. The journal is intended especially for amateurs, and will include articles giving practical instruction in methods of observation, in addition to general astronomical news, and notes on celestial phenomena during each month. In the first number there is an article on sun-spots and meteorology by the editor, and the first of a series of articles on variable stars by Prof. Moye. There is also a brief biography, with portrait, of M. Baillaud, director of the Paris Observatory. All communications are to be addressed to M. l'Abbé Th. Moreux, Observatoire de Bourges (Cher), France. The annual subscription is 6 francs in France, and 7 francs for other countries.

GEOLOGICAL WORK IN THE UNITED STATES.

THE United States Geological Survey, under the directorship of G. Otis Smith, continues to discuss theoretical and practical problems from the most liberal point of view. T. Nelson Dale's account (Bulletin 589) of "Marble and Dolomite of Eastern Vermont" directs attention to a rose-coloured manganiferous calcite marble, "alternating in very small beds with equally small beds of fine-textured white dolomite." The author refers to his previous discussion of dolomite (Bull. 521), and suggests that the dolomite layers were precipitated inorganically, while the pink calcite layers received their manganese from organisms. Both the hard and soft parts of molluscs may contain appreciable percentages of manganese; but why should rose-coloured marbles be comparatively rare? The examples from Vermont lose their colour if used for external decoration.

In Monograph lxiii. F. Leverett and F. B. Taylor provide a detailed description of the "Pleistocene of Indiana and Michigan and the History of the Great Lakes." They conclude that the changes and deformations of shore-lines in this region may be due to crust-creep, as well as to alterations in the ice-burden, but (p. 333) that the land is at present stable. The long eskers, formed during glacier-retreat in channels bounded by the ice, are excellently illustrated in the maps (see, for example, plate viii.), and the elaborate nature of the survey may be judged from the folded sheet, plate vii., where the moraines of the peninsula between Lake Michigan and Lake Hudson, with the lacustrine clays deposited behind them, are shown over a region measuring 300 by 200 miles. The Michigan Geological Survey has furnished important data for this memoir.

Bulletin 600 is a popular guide to the geology and scenery of "The Glacier National Park," Montana. The Continental Divide runs through the park, among peaks carved out of stratified rocks, which are from 9000 to 10,000 ft. in height, and some 6000 ft. above the valley-floors. A few residual glaciers still linger in the cirques. The region was originally purchased from the reservation of the Blackfeet Indians, in order to encourage copper-mining. The mines having proved unprofitable, the beauty of the country was represented to Congress in 1910 (Fig. 1). A good map accompanies this bulletin; but those who become interested in the folding and overthrusting and subsequent dissection of the strata of the park may like to learn more about their geological age than that they "are very, very old."

In North Park, Colorado (Bull. 596), lenticular masses of coal of extraordinary thickness occur in Upper Cretaceous or early Cainozoic strata. These coals may be 20, 35, or even 53 ft. thick, and are referred by A. L. Beekly (p. 94) to local marsh-areas, unconnected with one another, which encouraged rapid accumulation of vegetable or other organic matter. North Park is unfortunately bounded by a ring of mountains, away from trade-routes, and the remarkable cleanness of the coal is likely to prove its chief recommendation.

W. W. Attwood (Prof. Paper 95B) records and illustrates a rather widely spread glacial boulder-clay of Eocene age in south-western Colorado. In a review of recorded "ice-ages," which excludes the evidences of mere valley-glaciers, the author finds no parallel with the Colorado instance, unless in the Eocene of North Italy. W. T. Lee (*ibid.*, 95C) provides a possible source of the Eocene ice-flow in a review of the "Relation of the Cretaceous Formations to the Rocky Mountains in Colorado and New Mexico." He urges that all the Cretaceous coal-seams of the region, from Dakota times onward, were deposited on the margins and sometimes towards the centre of a single gradually subsiding shallow basin, which (p. 57) reached from the Gulf of Mexico to the Arctic Ocean and from Utah to the Mississippi. The orogenic movement of Eocene times resuscitated the Rocky Mountain mass, which had been worn down and buried beneath these Cretaceous strata. Hence the beds which contain conglomerates derived from the newly raised mountains must all be regarded as of Cainozoic age. The folding experienced by the coal-bearing strata during the uplift is well seen in the illustrations from Utah in Bulletin 581E.

From Nevada (Prof. Paper 95A) W. B. Hicks

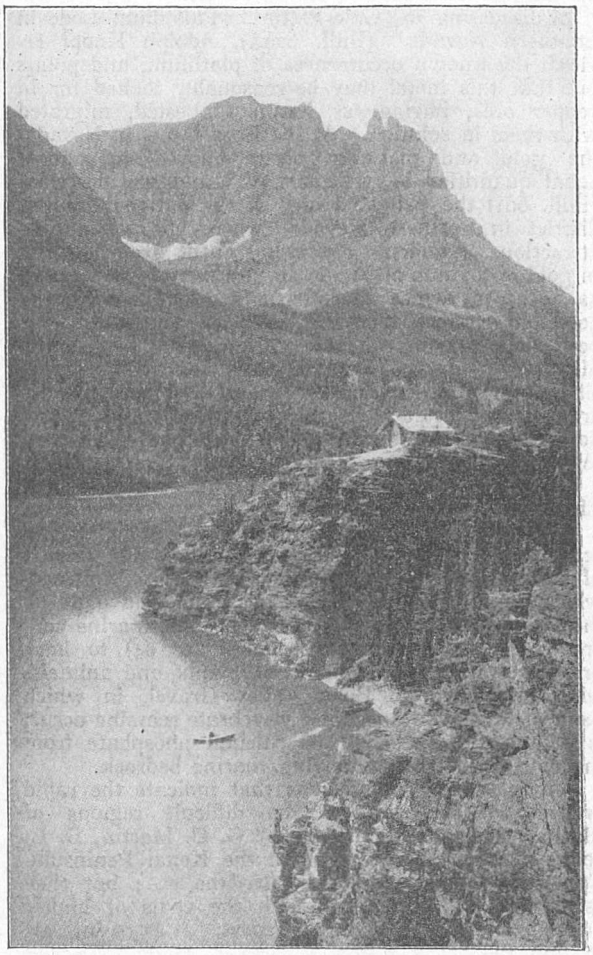

FIG. 1.—St. Mary Lake and Red Eagle Mountain, GlacierNational Park, Montana.

draws interesting conclusions as to the apparent disappearance of potassium from the brines and saline deposits of the desert-basin regions. High percentages of potassium are obtained by boiling the muds of Columbus Marsh with water, and the author believes (p. 9) that these muds have withdrawn potash from percolating solutions, holding it in virtue of their colloids or in a weak chemical combination. Only a small proportion of the potash can be referred to extraction from the mud-forming minerals, and (p. 8) "the potash content of the muds is roughly constant without regard to the character of the material," *i.e.* whether this is sand or clay. The retention of potash by soil-particles has, of course, been discussed by

agricultural investigators, and it here receives a wide geological application. Hoyt S. Gale, in describing (Bull. 580L) the salines of Borax or Searles Lake, San Bernardino Co., California, touches on the same point, and regards the preservation of potassium chloride in the brine of this lake-area as quite exceptional. The analysis quoted on p. 294 of his paper, on which so much depends (see p. 311), seems to have gone far astray. Should we read 12·30 for the percentage of potassium chloride, in place of 1·50? The author's well-illustrated account of the salts crystallised in this desiccating region forms a convenient synopsis for students of mineralogy. Bull. 603 is of interest from the evidence given that the mineral oils north of Coalinga, California, originated in the decay of diatoms of Upper Cretaceous age.

In discussing a "Gold-Platinum-Palladium Lode in Southern Nevada" (Bull. 620A), Adolph Knopf reviews the known occurrences of platinum, and points out that this metal may be reasonably looked for in copper ores, having, as Kemp suggested, migrated with them in solution. At the Boss Mine, in Nevada, the gold and platinum occur alloyed in almost equal quantities by weight. W. Lindgren describes (Bull. 601) the rich gold ores of the national mining district in northern Nevada, where the exceptional attractions of quartz "averaging about $30,000 a ton in gold of a value of $10.60 an ounce" led, as recently as 1912, to armed alarums and excursions of the good old western type. A defensive searchlight has been kept playing on the entrance of the National Mine. Outside the National lode, the veins contain silver and antimony ores; but all the minerals are probably connected in depth, as products of ephemeral hot springs at a late stage in the eruption of Cainozoic (Miocene?) rhyolites.

G. C. Matson's description (Bull. 604) of "The Phosphate Deposits of Florida" is accompanied by a large coloured geological map of the State, on the scale of 1 : 1,000,000. The most interesting feature of this is the famous Florida East Coast Railroad, which steps from isle to isle of coral, and ends on the Pleistocene oolite of Key West. The marine concretionary phosphates are believed (p. 64) to have originated from the remains of plants and animals, while the fluviatile Bone Valley Gravel, in which teeth of Mastodon and other vertebrate remains occur, is held to have received its calcium phosphate from the detritus of the underlying marine bedrock.

Among several publications that indicate the rapid progress of surveying in the difficult regions of Alaska, we note Bulletin 587, by G. C. Martin, B. L. Johnson, and U. S. Grant, on the Kenai Peninsula. Cainozoic coal-seams occur near the sea; but they seem unlikely to compete with the coals of higher grade available on the Pacific coast. It is of interest to find (p. 52) a series of "green scoriaceous and ellipsoidal lavas" of Triassic age overlain by radiolarian cherts. Once more we see that a particular marine condition has brought about the formation of these two dissimilar rock-types, though the clear evidence of succession in this case prevents our ascribing the abundance of radiolarians to the emanation of silica from the lavas. The detailed work by C. W. Wright on Copper Mountain and Kasaan Peninsula (Prof. Paper 87) includes well-illustrated observations on contact-metamorphism. Some of the aplite veins (p. 81) contain as much as 9 per cent. of primary calcite, a mineral that has already taken its place as an original constituent of igneous rocks. S. R. Capps (*ibid.*, 95D) traces the volcanic ash layer of the Yukon basin to a "centre of dispersion," by no means central, north of Mount Logan. At this point the deposit is 300 ft. thick, fading away to a foot in about 150 miles to eastward. The layer is traceable over 140,000 square miles, and, from the thickness of peat above it on the White River, is ascribed to an eruption that took place on the north of the Mount St. Elias region about 1400 years ago. The report by A. H. Brooks, who superintends the surveying work in Alaska, on the mineral resources of the region in 1914 (Bulletin 622) includes an unfavourable judgment on some of the coals from the point of view of the Navy Department; the coal of the Matanuska field, however, is regarded as of excellent steaming quality, and the progress of gold-mining, the great industry of Alaska, may possibly open up this field.

W. B. Clark and M. W. Twitchell have written a monograph on "The Mesozoic and Cenozoic Echinodermata of the United States" (Monograph liv.), illustrated with 108 plates of drawings and direct photographs. While the genera are for the most part of world-wide occurrence, few of the familiar European species are found in American deposits. F. W. Clarke and W. C. Wheeler (Prof. Paper 90L) follow up their work on the composition of crinoid skeletons by an examination of the hard parts of other recent echinoderms. Magnesium carbonate is found in these also; the quantity is large in tropical forms as compared with those from cold waters, and may reach 14 per cent. The authors conclude that a rock formed from any kind of echinoderm "will have the composition of a moderately magnesian limestone." As previous workers have pointed out, the calcium carbonate of echinoderms is always in the calcite form.

Mineralogists and chemists will alike appreciate F. W. Clarke's essay on "The Constitution of the Natural Silicates" (Bull. 588), in which consideration is given to their alteration-products, as suggesting the structure of the molecule of the original mineral. The treatment of spodumene (p. 98) serves as an interesting example, and leads on to new interpretations of the pyroxenes and the amphiboles, which are worked out as mixtures of orthosilicates and trisilicates, while wollastonite and pectolite, which are easily decomposed by dilute acids, remain isolated as metasilicates. Whitman Cross (Prof. Paper 88) enlarges our imperfect knowledge of "The Lavas of Hawaii and their Relations," covering the Hawaian Islands as a whole. The mountain-chain of which these are the unsubmerged peaks extends for 1800 miles in a north-north-westerly direction. The rock-types offer no support to the suggestion of a distinctively Pacific group of igneous rocks, or a group produced under Pacific conditions, and the alkalic and calcic rocks of Rosenbusch occur in the islands (p. 86) as derivatives from a common source. The author doubts (p. 90) Daly's view that limestone has had an influence in promoting the occurrence of the types rich in alkalis. His visit to the islands in 1902 enables him to review his specimens as parts of some of the most striking volcanic landscapes in the world.

The twenty-third volume of the Iowa Geological Survey (1914) consists of O. P. Hay's monograph on "The Pleistocene Mammals of Iowa," the remains being found in interglacial beds. The Aftonian stage, following the first Glacial or Nebraskan stage, is especially the horizon of Mylodon, in North America, and of the last North American Camelidæ. The memoir is fully illustrated. R. S. Lull reviews (*American Journal of Science*, vol. xl., 1915, p. 319) "The Mammals and Horned Dinosaurs of the Lance Formation of Niobrara County, Wyoming," and shows that mammalian remains, including throughout the older multituberculate types, are found in almost all the beds that contain Ceratopsia. The tri-

tuberculate mammals occur, however, on the upper horizons, and may still have existing representatives. H. F. Osborn discusses the "Close of Jurassic and Opening of Cretaceous Time in North America" (Bull. Geol. Soc. America, vol. xxvi., 1915, p. 295), as an introduction to a symposium on the Morrison formation. This discussion has a special application in England to the Purbeck-Wealden question.

The Wisconsin Geological and Natural History Survey has reported on the north-western area of the State (Bulletin No. 45, Madison, 1915), where very little geological work had been done prior to the official entry of Mr. W. O. Hotchkiss and his assistants in 1913. Since the area lies in the Lake Superior iron district, great stress has been laid upon a continuous magnetic survey, the principles of which are set out in chapter iv. This illustrated essay of sixty pages will be of service to mining students in general. The ores are the well-known sedimentary masses of Huronian age, and the extent of the Huronian beds beneath the glacial drift has been largely determined by magnetic readings. Bush-covered ground and rivers, as indicated in the sympathetic pictures of geologists at work, have often hindered observation, and only the most careful organisation could have carried out the survey in so comparatively short a time. G. A. J. C.

THE ZOOLOGICAL SURVEY OF INDIA.

WITH the sanction of the Secretary of State the Government of India has recently converted the professional staff and entire working machinery of the zoological section of the Indian Museum into an autonomous Government department, under the name and style of the Zoological Survey of India.

This conversion, if it were—as to superficial view it might appear—merely a change of name, could pass without comment in a momentous time like the present; but inasmuch as it effects a long-desired and fundamental improvement in the prospects and official status of zoology in India—a country where, private enterprise in the domain of natural science being undeveloped, no branch of science that lacks independent and avowed recognition in the highest official quarters can hope to expand to its full extent—it deserves some notice.

In times not very long past the zoological section of the Indian Museum was administered by trustees, on the model of the British Museum, an arrangement ill-suited to a polity where, outside official circles, trustees with the necessary academic experience are not easy to find. One of the most unsatisfactory results of this system was that, although all ate of one salt and owned the Government as their father and mother, the zoological officers—irrespective of professional seniority or length of service—had always to be the official subordinates of their *confrères* in kindred scientific departments, who were constantly associated with the museum as trustees.

This anomaly was rectified by making the senior zoological officer eligible for the office of trustee, a resort to legal fiction which, although it placed zoology in proper official perspective, was calculated to offend tender consciences.

All such fictions are now obviated by bringing the whole zoological staff and its appurtenance into line with other scientific departments of the Government of India, and placing the senior representative of zoology on the same footing as the directors of the kindred scientific surveys—a position in which his opportunities of advocating and initiating research are much augmented and his responsibilities as an independent scientific adviser to Government are distinct and direct.

In notifying this auspicious change the Government expresses the hope that the establishment of a zoological survey will be of value to India; and when it is remembered—apart from all the economic reflections of the matter—that in territories like India more than 75 per cent. of the annual mortality is due either directly or proximately to noxious animals and animalcules, so that rural sanitation in such countries must rest in the first instance upon accurate and comprehensive zoological foundations, there seems every assurance that this hope will be justified.

Apart from these internal changes, which bring field-work from a precarious position in the rear into the very front rank of the duties of the staff, and transform the trustees from responsible guardians into authorised visitors of the collections, the zoological section of the museum as a going concern will not be altered in any way. Nor is any extra expenditure anticipated for the immediate future, since the available museum grant is ample for the intended purpose, and the collaboration of the Marine Survey Department and the close co-operation of the Forest and Agricultural Departments are assured.

Under the new *régime* the national zoological museum of India promises to be, like some other Indian official organisations, an institution of an exemplary kind.

GENETIC STUDIES IN PLANTS.

IN a paper on "Growth and Variation in Maize" (*Zeitschr. f. indukt. Abstammungs- und Vererbungslehre*, xiv., 1915, Nos. 3–4), Drs. Raymond Pearl and F. M. Surface combine the statistical and individual methods of inquiry. "We have tried," they write, "by studying the growth of the individual to analyse the adult variation curve into its component elements." Height is the character chosen for investigation; the relative variability as observed throughout the season "shows a marked progressive diminution," and the authors believe that the maize plant grows "in a series of cycles." In a second part of the paper they discuss the relation of variation to growth, and from the distribution of small, medium, and large plants conclude that the manner of growth is dependent on Mendelian factors.

Maize is also the subject of a paper in the *Journ. Agric. Research* (vi., No. 12) by G. N. Collins, who deals with "correlated characters" in the species. Eleven characters were selected for study, and of fifty-five possible combinations twenty were found to show significant correlations; but in all but five these appear to be physiological rather than genetic, and in no instance is the coefficient higher than 0·5. The author fears, therefore, that the method of isolating types is inapplicable to maize, though desirable characters derived from different parents may be easily combined.

The "Suppression of Characters on Crossing," illustrated by experiments on species of wheat, is discussed in a paper by R. H. Biffen (*Journ. of Genetics*, v., No. 4). He finds that dominant features, such as greyness of chaff or redness of grain, may be suppressed, so that "recessives make their appearance in F_2 generations from crosses of parents showing dominant characters only." This may perhaps be due to the existence of more than one factor giving rise to apparently the same dominant character, and the consequent possibility that two factors determining the recessive may meet in some of the zygotes that give rise to the F_2 generation.

Dr. T. Tammes contributes a paper to the Proceedings (xviii., No. 7) of the Kon. Akad. v. Wetensch. Amsterdam "On the Mutual Effect of Genotypic Factors." She has experimented by crossing varieties of flax differing in colour (blue or white) and breadth

of the petals. The results are complicated, and not readily summarised, but they confirm a generalisation already established by work in hybridisation among both plants and animals; that "views on the presence and action of factors obtained by an investigation of one single crossing are liable to modification when one of the forms investigated is crossed with a third form. Hence it is necessary to cross the same form with more than one partner in order to arrive, step by step, at the truth."

MATHEMATICS AND PHYSICS AT THE BRITISH ASSOCIATION.

THE first of the two organised discussions arranged for this section was on "Gravitation." The discussion followed immediately after Prof. Whitehead's presidential address, and it happened that the arrangement was appropriate, for the president's exposition of the logical texture of geometry had carried us far from the ordinary conceptions of space, and paved the way for the revolutionary ideas associated with the space-time world of Einstein and Minkowski. Mr. E. Cunningham, who opened the discussion, and Prof. A. S. Eddington, who followed, dealt with Einstein's recent work, which brings gravitation within the scope of the principle of relativity. If an observer is in a closed lift, it is well understood that an acceleration of the lift upwards is exactly equivalent to an increase of the force of gravity, so far as mechanical phenomena inside the lift are concerned. There would, however, be minute differences in the optical phenomena according to the ordinary theory; relatively to the accelerated lift the path of a ray of light would seem to be curved, whereas for the stationary lift it would be straight if the increased gravitational field makes no difference. Accordingly, the first suggestion towards a relativity theory which shall include gravitation is that the path of a ray of light must be bent by the gravitational field, just as it is apparently bent by an acceleration of the framework of reference. The curvature to be expected is extremely small—amounting to a change of direction of 1·7″ in the case of a star seen close to the sun's limb—and it has not been possible to prove or disprove the hypothesis directly. Meanwhile the theory has been elaborated and generalised by Einstein, who has at length been able to throw the laws of motion, of electrodynamics, and of gravitation into a form which makes the sequence of phenomena entirely independent of any particular framework of reference. The result has been to yield a very striking confirmation of the theory, for it is found to predict a motion of the perihelion of Mercury amounting to 43″ per century—just the amount of the hitherto unexplained discordance. The new theory removes what is probably the most celebrated of the few cases of failure of gravitational astronomy. The discussion afterwards turned to the experimental side. Dr. P. E. Shaw gave an account of his experiments which appear to indicate a change in the constant of gravitation with temperature, and Prof. R. A. Sampson urged that astronomical evidence is not capable of denying this possibility. Dr. W. G. Duffield read a report of the Committee on the Determination of Gravity at Sea, considering especially the difficulties attending the use of the aneroid method, and the possibility of improvements in future attempts.

A paper by Sir Ernest Rutherford on the "X-Ray Spectra of the Elements" was of special interest. He referred particularly to the researches of Siegbahn and Friman, who have extended the work of Moseley to the elements of high atomic weight from gold to uranium by examining the L spectra. It appears that there are ninety-two elements up to uranium. By finding the atomic number of lead it has now been possible to assign the whole series of radio-active products to their places in the scheme. Sir E. Rutherford further described the work done in America with the Coolidge tube, which provides a steady high voltage. It is found that the maximum frequency of the rays which can be obtained follows closely the quantum relation $Ve=h\nu$, the accuracy between 20,000 and 100,000 volts being one per cent. To excite the characteristic radiation of a substance a rather higher voltage is needed than that given by the quantum relation, as though it were necessary to expend some energy in disturbing an oscillator.

Prof. H. H. Turner read a paper on the "Measurement of Time," dealing with daylight saving and justifying the innovation from a scientific point of view. The paper elicited an interesting speech from Prof. J. Perry, who admitted that he had formerly rather thoughtlessly opposed the scheme, and urged the warning against being led by authority in science. Other members, however, professed themselves still unconverted.

Prof. T. H. Havelock gave a review of recent work on the "Propagation of a Signal in a Dispersive Medium." He described the approximate methods of calculation which have been used, showing the relation between the recent methods of contour integration and the older work of Hamilton and Kelvin. The precise nature of the "forerunner," or minute disturbance which travels through the medium in advance of the main signal, is a matter of special difficulty, and an exact solution for any particular cases that may prove tractable would be a great help towards progress.

The absence of several speakers who had been expected to take part rather detracted from a discussion on "Osmotic Pressure," opened by Prof. A. W. Porter. There were many other interesting papers, most of which we must pass unnoticed for want of space, but special mention may be made of Prof. J. C. McLennan's paper on "Ionisation Potential," continuing and extending the results communicated last year; also of Sir F. W. Dyson's "Mean Parallaxes of Stars of Different Magnitudes," which in the main confirm the well-known formulæ given by Kapteyn in 1901. At a separate meeting of the department of mathematics Prof. G. N. Watson gave a general survey of the recent developments of the theory of asymptotic series.

A new departure, which it is hoped may lead to important results, was the formation of a committee representing Sections A and E to consider the needs of geodetic research. This arose from the presentation of a report by Col. Close, Sir F. W. Dyson, and Col. Hills, prepared at the request of the Organising Committee of Section A. The report brought out clearly the lack of organisation and general neglect of higher geodesy in this country, and there was a unanimous feeling that steps should be taken towards the constitution of some committee or association responsible for stimulating this branch of science.

THE BRITISH ASSOCIATION AT NEWCASTLE.

SECTION D.

ZOOLOGY.

ABSTRACT OF THE OPENING ADDRESS BY PROF. E. W. MACBRIDE, M.A., D.Sc., F.R.S., PRESIDENT OF THE SECTION.

THE decision of the Organising Committee to devote the sittings of the section chiefly to the economic and medical applications of zoology must not divert us from the task of research into fundamental laws. The laws of heredity had been intensively studied for the

last twenty years by selective mating, but the study of the laws governing the development of the germ into the adult organism—in a word, of experimental embryology—might eventually throw a great deal of light on the laws of heredity.

After alluding to the work of His, who sketched out the programme of the new science, Prof. MacBride described the work of the first experimenters—Roux, Hertwig, and Driesch—in some detail. He pointed out that the results obtained by these zoologists led them to conclusions about the nature of development which were fundamentally opposed to one another; for Roux, having produced half-embryos by destroying one blastomere of the two-cell stage of the frog's egg, supported the principle of "specific organ-forming regions of the germ," whilst Driesch, having reared a perfect Echinoderm larva of diminished size from one of the first four blastomeres of an Echinus egg, asserted that "the fate of a cell was a function of its position in the embryo," and in this conclusion he was supported by Hertwig, who attempted to interpret Roux's results in a different manner. Even Roux admitted that although half-embryos were formed at first, if they survived they regenerated the missing parts; Roux accounted for his results by supposing that each region of the germ had its peculiar organ-forming substance, or "idioplasson," which conferred on it the power to develop into a definite organ; the regeneration of lost parts he attributed to a special substance, which he called "reserve-idioplasson," which came into play only when mutilation had occurred. Driesch assumed, on the other hand, the existence of a purposeful "entelechy," or "psychoid," inhabiting the living material, and even when, as in his experiments with Ctenophore eggs, he found that isolated blastomeres gave rise to partial larvæ, he did not conclude that definite organ-forming substances were localised in each of the first eight blastomeres; but rather that in these eggs the cytoplasm was so specialised or "stiffened" that the indwelling entelechy could not mould it to its will.

The definite proof of the existence of *organ-forming substances*—a proof which was regarded as one of the great advances made by experimental embryology—was brought by Crampton and by Wilson in their studies of the developing eggs of Mollusca. In the developing egg of Dentalium and of some other Mollusca the first cleavage appeared to divide the egg into three cells, but one of these cells was a mere protrusion devoid of a nucleus, termed the *first polar lobe*, which was reabsorbed before the next cleavage. At the next cleavage five cells were apparently produced, but again one of these was a transitory *second polar lobe*, which melted into one of the four blastomeres before the cleavage to form eight cells began. If the first polar lobe were cut off, the egg developed into a trochophore larva, which was devoid of the apical plate and apical tuft of cilia and also of mesoderm, and of the whole post-trochal region. If the second polar lobe were cut off, a trochophore larva was formed, provided with apical plate and apical tuft, but devoid, as before, of mesoderm and of post-trochal region. The conclusion was inevitable that the specific material for the apical plate and post-trochal region was contained in the first polar lobe, but that the second polar lobe only contained the necessary material for the post-trochal region.

Driesch's objections to this conclusion were founded on the difficulty of conceiving what an organ-forming substance could be like, it being very difficult to picture a substance the molecules of which had the power of "crystallising" into organs, such as, for instance, arms and legs. But if we fell back on our ultimate conception of what we meant by "explanation," we found that it always consisted in comparing a less familiar phenomenon with one about which we thought we knew more. Driesch's entelechy was really an attempt to compare the forces which organise development with the purpose of an intelligent being who wanted to build a house, and, in principle, no fault could be found with it. The great difficulty about it was that this comparison does not help us to understand in the least a large number of phenomena which could be far better "explained" by the theory of organ-forming substances, even although we could not tell what these substances were like. In the development of the Ascidian, *Cynthia partita*, as described by Conklin, the cytoplasm was rendered slaty-blue by inclusions of yolk, and in its outermost zone were numerous particles of bright yellow pigment. Before fertilisation the large germinal vesicle burst, and its contents formed a cap of clear fluid at one pole of the egg. The spermatozoon entered at the opposite pole, and then the clear substance and the yellow pigment were drawn down to meet it, and eventually formed two concentric crescents round the lower pole of the egg. Subsequent development made it plain that the clear substance gave rise to the ectoderm, the slaty-blue cytoplasm to the endoderm, and the yellow material to the mesoderm of the Ascidian tadpole. If one of the first four cells of the segmenting egg were killed, the other three continued their development, and an imperfect embryo was produced; if this cell happened to be one of the two containing yellow substance, a tadpole was produced which had muscles only on one side of its tail. Clearly in this case the organ-forming substances were visible to the naked eye, since they were distinguishable in colour, and their segregation in different regions of the embryo was the real cause of the *differentiation of the germ-layers*. In this process the individual cell was not a unit of any importance; both notochord and nerve-cord arose from the same group of cells, termed by Conklin *chorda-neural cells*; but the cytoplasm of these cells consisted of clear and blue portions, and in the subsequent divisions the clear portions were added to the ectodermic neural plate, whilst the blue portions became the endodermic notochord.

Driesch explained phenomena like these by asserting that these substances were the *conditions*, not the *causes*, of the development of organs; but another experiment, due to Morgan, which had been repeated in the laboratory of the Imperial College of Science, appeared to dispose completely of the idea of there being an intelligent entelechy presiding over development. This experiment consisted in fastening frogs' eggs to a slide, with the black pole uppermost, and fertilising them in this position. When the eggs had divided into two another slide was laid on the top of them and clamped in this position; the whole preparation was then inverted and allowed to develop for five or six days in this position. At the conclusion of this period a double-headed, or double-tailed tadpole was produced. In this case nothing was added to the egg, but the dark substance, which was specifically lighter than the white substance which constituted the rest of the egg, had readjusted itself in each cell under the influence of gravity, in a similar manner to what it would have done in the whole egg if this had been inverted before division into two had taken place. Hence the condition of the formation of a frog embryo must be the *proper spatial relationship between two organ-forming substances*.

If we adopted the view that organ-forming substances were the all-important agents in development, it became of the utmost importance to learn more about them. Observation of the developing egg of Ascaris showed that the relative proportion of such a substance in one cell as compared with its quantity in a neighbouring cell could determine the fate of the cell. This egg divided into two cells at its first cleavage, one of

which produced the ectoderm and the other the internal organs. Boveri showed that if these eggs were fixed to a slide which was inserted in a centrifugal machine and a rapid rate of rotation maintained whilst the egg developed, some of them the axes of which happened to lie exactly in the radius of rotation divided into two equal cells, both of which formed internal organs, and neither of which behaved like the cell in the normal embryo, which produced ectoderm. The slightest obliquity of the egg axis to this radius caused the egg to undergo normal development. This experiment, which had been repeated by us in the Imperial College of Science, showed that some substance was present in greater quantity on the outer part of the egg, so that the upper of the first two cells received more of it than the other, and was thus determined to form ectoderm, but that when under stress of the centrifugal force the division plane separating the first two blastomeres took up an exactly radial position, so that this substance was equally distributed to both cells, neither developed into ectoderm.

The question where these substances were formed was of great importance. *A priori* considerations suggested that they must emanate from the chromatin of the nucleus, since the father was as potent in heredity as the mother, and his contribution to the zygote consisted merely of a mass of chromatin. This conclusion was confirmed both by observation and experiment. In the unripe egg of Cynthia, Schaxel had shown that streams of chromatin poured from the nucleus into the cytoplasm, and if the unripe egg of Ascaris was subjected to the most violent centrifugal force, so that it lost large portions of its substance, and was afterwards fertilised, it gave rise to a normal embryo of diminished size, showing that its cytoplasm was not yet organised as was that of the ripe egg, the different development of which under the stress of centrifugal force we have just described. The pressure experiments of Driesch and Hertwig, in which, by allowing eggs to develop in cramped positions, they disarranged the normal order of the nuclei, showed that the nuclei of the segmenting egg were alike, each possessing all the potentialities of the species, for these distorted eggs when relieved from pressure developed into normal embryos, although the nuclei had assumed abnormal positions, and it was the relative position of the *substances* produced by these nuclei, not of the nuclei themselves, which determined differentiation. Sometimes, as in Herbst's famous experiment of allowing Echinus eggs to develop in sea-water to which salts of lithium had been added, it was possible to inhibit the formation of one of these substances and produce an embryo consisting entirely, or almost entirely, of endoderm. The formation of these substances appeared to last for only a short period; after that, the nuclei appeared to be without formative influence on the cytoplasm, but in animals like Polyzoa and Ascidians which bud, this budding could be best explained as due to a renewed production of organ-forming substances by the nuclei. These substances were often not distributed to the formative tissues of the bud in the same manner as in the embryo, and hence the development of the bud often followed a different course from that initiated by the embryo. The "post-generation" of the missing half, observed by Roux in his half-tadpoles, and by Chun and Mortensen in their half-Ctenophore larvæ, could be explained in a similar way by postulating a renewed activity of the nuclei at the cut surface. Considerations of this kind were fatal to the conception of Weismann of the definite segregation of germ-cells from body-cells at the beginning of development, dependent on a differential division of nuclei, or, as he termed it, the formation of definite *germ tracks*. Indeed, Gatenby had lately shown that in the frog the supposed germ-cells which were segregated at an early period of development would scarcely supply the needs of the first spawning season, and that the eggs needed for subsequent seasons were formed by the metamorphosis of ordinary peritoneal cells.

Next to the discovery of organ-forming substances perhaps the greatest discovery in experimental embryology was the influence which the primary organs exerted on each other's further development. The first discovery of this influence was due to Herbst, who showed that if the ocular peduncle of a shrimp were amputated, the animal was able to regenerate a new one, as was the case also if the other limbs were cut off; but that if the optic ganglion was also removed then an antenna-like organ was regenerated in place of an eye. From this experiment the conclusion was forced on us that in the normal development of the shrimp the ectoderm was caused to mould itself into the retinulæ and crystalline cones of the eye by some influence emanating from the optic ganglion. This influence must be some chemical substance emitted into the blood and comparable to the hormones, which we know to be emitted by organs like the thyroid gland, which so powerfully influence growth in man. Another instance of the same thing was afforded by the experiments of Lewis; this observer cut off the optic vesicle from the brain of a young tadpole, and pushed the amputated organ backwards under the skin to a new position; the wound healed up; no lens developed in the normal position, but a lens was developed from the skin situated over the optic vesicle. This experiment proved that no part of the skin was predestined to form the lens of the eye, but that any part could form the lens if acted on by the emanations from the optic vesicle beneath. A third instance was discovered from experiments in the Imperial College of Science in the rearing of the larvæ of the sea-urchin, *Echinus miliaris*. In normal development the rudiment of the water-vascular system or "hydrocœle" was formed from the cœlomic vesicle on the left side of the larva. Above it the ectoderm became invaginated so as to form the amniotic pit, from the floor of which were developed pointed spines and tube-feet, whilst beneath the hydrocœle a series of pockets grew out from the left posterior cœlomic vesicle which developed into Aristotle's lantern. On the right side of the larva two calcareous plates were developed bearing square-topped spines and pedicellariæ. Under the influence of certain stimuli the larva could be made to develop a second hydrocœle on its right side, and when this took place, from the octoderm of the right side and from the right posterior cœlomic vesicle respectively a right amniotic pit with spines and tube-feet and a right Aristotle's lantern were developed. In other circumstances the formation of a hydrocœle could be inhibited altogether, and then calcareous plates bearing spines were formed on both sides of the larva.

If the second or right hydrocœle was small, it failed to inhibit the formation of plates bearing spines and pedicellariæ proper to the right side, so that both hydrocœle and pedicellariæ could be present together on the same side. The only possible explanation of these facts was the view that any part of the ectoderm could form an amniotic pit, and either left or right cœlomic vesicles could form an Aristotle's lantern, if acted on by influences emanating from the hydrocœle, and that both sides of the larva were really alike in their constitution, and that in the total absence of a hydrocœle each produced calcareous plates with spines.

The discovery of the profound influence exercised by the growing tissues of the embryo on one another lent some support to Dr. J. T. Cunningham's theory of the inheritance of acquired qualities based on the facts known as to the influence of hormones on the growth of the human body. If it should turn out, as seems, from the results of these experiments, to be

the case, that the production of hormones was not at all confined to certain ductless glands, but was a much more widespread phenomenon, we could understand that if, through an alteration in external conditions, a change was induced in some tissue, its chemical emanations would be altered. If, further, these altered substances, circulating in the body fluids, were ultimately stored up in the germ-cells, then eventually as the germ developed the corresponding alteration would be produced in the tissues of the young animal, even before it was exposed to the changed environment.

Of course, the proof that such an influence of a changed environment on subsequent generations was possible must ultimately be found by experiment, and the inherent difficulty of such experiments was very great, but some suggestive work by Kammerer on the inheritance of colour in Salamanders seemed really to supply positive evidence in favour of the inheritance of environmental influence.

In conclusion, let us bear in mind that the hormone theory of the inheritance of acquired characters which a study of experimental embryology inclines us to regard with favour was in principle identical with the theory of "pangenesis" propounded by the founder of modern biology, Charles Darwin.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

LONDON.—A series of public lectures, under the general title of "The University and the Nation," will be delivered on Wednesdays, at 5.15 p.m., at King's College. The lectures will be as follows:—October 25, The Root Fault in the English Attitude to Education, Dr. Burrows, Principal of King's College; November 1, Science and Industry, Mr. James Swinburne; November 8, Science and the Training of the Citizen, Principal Griffiths; November 15, The Spiritual Appeal of the Humanities, Mr. A. C. Clutton-Brock; November 22, The Intellectual Groundwork of Politics, Dr. H. A. L. Fisher; November 29, Education—the Curse of Convention, Mr. Graham Wallas.

Dr. Marie Stopes will begin a course of six lectures and demonstrations on "The Bennettitales" on October 17, at 5 p.m., at University College. The course will be illustrated by lantern-slides and specimens, including microscopic sections of new species. Further particulars can be obtained from the secretary of University College.

Prof. J. A. Fleming will deliver a public lecture on "Long-Distance Telegraphy and Telephony," at University College, on Wednesday, October 18, at 5.30 p.m. This lecture is open to the public without fee or ticket.

OXFORD.—On October 7 the Vice-Chancellor (the Very Rev. T. B. Strong, dean of Christ Church), on entering upon his fourth year of office, delivered the customary address. After mentioning that about 10,500 members of the University were serving in the Army and Navy, and about 500 were in other Government employment, he spoke of the distinctions gained by them in the present war, including 9 V.C.'s, 120 D.S.O.'s, and 700 mentions in despatches. Passing on to speak of the educational deficiencies which had been disclosed by the war, he said that the University must find some way to remedy the neglect of the claims of natural science. Average people were not likely to become advanced students of science, but they wanted everybody, including the average people, to be aware of, or in some degree to understand, the scientific point of view. The country would have to give up its prevalent attitude of distrust towards expert knowledge. The new statute relating to the Honour School of Chemistry was an attempt by the University to put the study of that science on a more satisfactory footing. But it should not be forgotten that the majority of Oxford men would be engaged in the work of administration, for which the knowledge of men was essential.

The University has received with much regret the news of the death of Mr. Horace Hart, who for more than thirty years conducted, as controller, the business of the University Press with marked ability and success.

A MEETING of the Association of Technical Institutions will be held in London on Friday and Saturday, October 20–21. For some time it has been felt that the members of the association should meet together to consider educational questions having special bearing on the work of technical schools and colleges. The governors of the Imperial College of Science and Technology, South Kensington, have placed rooms in the college at the disposal of the association for the purposes of the conference. Sir Alfred Keogh, K.C.B., president of the association, will preside over the meeting. The Right Hon. A. H. Dyke Acland, chairman of the Executive Committee of the Governors of the Imperial College, will welcome the delegates to the college at their first session. On the Friday morning Lord Haldane will deliver an address on "Education after the War, with Special Reference to Technical Instruction." This will be followed by a paper by Sir Trevor Dawson (of Vickers, Sons and Maxim) on "Education after the War, with Special Reference to Engineering Instruction." The afternoon of Friday will be devoted to a discussion of the address and paper. On Saturday, October 21, Major Mitchell, director of the Regent Street Polytechnic, London, will read a paper on "What Can be Done to Train Disabled Sailors and Soldiers in Technical Institutions," to be followed by a discussion.

IN presenting the Education Estimates to the House of Commons on July 18, the President of the Board of Education said that in addition to three committees of experts to investigate different educational questions, a fourth committee was to be appointed which would be a Reviewing Committee. The three expert committees are dealing respectively with the education and care of young persons after the war, and the position of science and modern languages in our educational system. Mr. Bonar Law stated, in the House of Commons on October 10, that the Reviewing Committee, which will be a sub-committee of the Prime Minister's Reconstruction Committee, has for its terms of reference:—"To consider the system of education as a whole; to review and formulate from that point of view proposals for developing it, particularly in directions indicated as desirable or necessary by experience gained during the war, and with special reference to:—(*a*) Proposals prepared before the war for the development of the national system of education; (*b*) the memoranda already submitted by the Education Departments for the consideration of the Reconstruction Committee; (*c*) any proposals submitted hereafter from the departments, or from special committees, or from other responsible organisations; and to recommend from time to time such action, whether by way of legislation or otherwise, as may be practicable." It is understood that this Reviewing Committee will consist of Cabinet and ex-Cabinet Ministers, and possibly of some other persons to be called in for advisory purposes, but no announcement has yet been made as to the actual membership.

AT the invitation of the Universities of Leeds and Sheffield a party representative of the Institute of Journalists, the Circle of Scientific, Technical, and

Trade Journalists, and the British Association of Trade and Technical Journalists paid a visit to these cities on October 8–10. At Leeds University the visitors were received by the Vice-Chancellor, Dr. M. E. Sadler, who gave an inspiring address descriptive of the University's work and its close associations with local industries. The departments visited included those dealing with organic and tinctorial chemistry, leather manufacture, textile work, gas and fuel. The members of the party were then the guests of the Leeds Luncheon Club, after which the Leeds Army Clothing Depôt, the works of Messrs. Albrecht and Albrecht (khaki garment manufacturers), and the Cardigan Boot Factory were inspected, these industries being selected in view of their close connection with the work of the University. Finally, the visitors were the guests of the Lord Mayor for tea. At Sheffield the Vice-Chancellor, Dr. H. A. L. Fisher, also addressed the visitors, who were conducted over the chemical and medical departments, while Prof. Ripper gave an account of the many special interesting researches undertaken on metallurgy and the testing of steel. The factories visited included the armament works of Messrs. John Brown and Co., where the party was invited to lunch by the Master Cutler, and the shell factory of Messrs. Thos. Firth and Sons. A feature in the arrangements at both cities was the co-operation of journalists representing the local papers, and the visits furnish an interesting illustration of the growing desire for closer relations between the universities and the Press. The visitors were much struck by the pride taken by Leeds and Sheffield in their universities, and the general recognition among local manufacturers of the value of the work that is being done there.

BOOKS RECEIVED.

The Loose Leaf Laboratory Manual. Electrical Measurements and Testing Direct and Alternating Current. By C. L. Dawes. (New York: J. Wiley and Sons, Inc.) 3*s*. net.

Lectures on Ten British Mathematicians of the Nineteenth Century. By A. Macfarlane. Pp. 148. (New York: J. Wiley and Sons, Inc.; London: Chapman and Hall, Ltd.) 5*s*. 6*d*. net.

Engineering Applications of Higher Mathematics. By V. Karapetoff. Part ii., pp. v+103. Part iii., pp. v+113. Part iv., pp. v+81. Part v., pp. vii+65. (New York: J. Wiley and Sons, Inc.; London: Chapman and Hall, Ltd.) 3*s*. net each.

The Psychology of the Organized Group Game, with Special Reference to its Place in the Play System and its Educational Value. By M. J. Reaney. Pp. 76. (Cambridge: At the University Press.) 5*s*. net.

A History of British Mammals. By G. E. H. Barrett-Hamilton and M. A. C. Hinton. Part xix. (London: Gurney and Jackson.) 2*s*. 6*d*. net.

A Critical Revision of the Genus Eucalyptus. By J. H. Maiden. Vol. iii., part 7. (Sydney: W. A. Gullick.) 2*s*. 6*d*.

The Essentials of Chemical Physiology. By Prof. W. D. Halliburton. Ninth edition. Pp. xi+324. (London: Longmans and Co.) 6*s*. net.

The Rt. Hon. Sir Henry Enfield Roscoe. a Biographical Sketch. By Sir E. Thorpe. Pp. viii+208. (London: Longmans and Co.) 7*s*. 6*d*. net.

La Chimie des Eléments Radioactifs. By Prof. F. Soddy. Translated by E. Philippi. Pp. 173. (Paris: Gauthier-Villars et Cie.) 5 francs.

Aérodynamique. By N. Joukowski. Translated by S. Drzewiecki. Pp. xviii+227. (Paris: Gauthier-Villars et Cie.) 11 francs.

Notions Générales sur les Appareils à Réaction. By P. Popovatz. Pp. 35. (Paris: Gauthier-Villars et Cie.)

Report of the Director-General of Public Health, New South Wales, for the Year ended December 31, 1914. Pp. v+206. (Sydney: W. A. Gullick.) 7*s*.

Carnegie Endowment for International Peace. Year Book for 1916. Pp. xvii+204. (Washington, D.C.)

The Geology of Ben Nevis and Glen Coe, and the Surrounding Country. By E. B. Bailey and others. Pp. x+247. (Edinburgh: H.M.S.O.; London: E. Stanford, Ltd., and others.) 7*s*. 6*d*.

The Technical Chemists' Handbook. By Prof. G. Lunge. Second edition. Pp. xvi+264. (London: Gurney and Jackson.) 10*s*. 6*d*. net.

DIARY OF SOCIETIES.

THURSDAY, OCTOBER 12.

CHILD STUDY SOCIETY, at 6.—The French Child at School: Cloudesley Brereton.

TUESDAY, OCTOBER 17.

INSTITUTION OF PETROLEUM TECHNOLOGISTS, at 8.—The Norfolk Oil shales: W. Forbes-Leslie.

WEDNESDAY, OCTOBER 18.

ROYAL MICROSCOPICAL SOCIETY, at 8.—Certain Parasites of the Mouth in Cases of Pyorrhœa: Dr. H. Pixell Goodrich and M. Moseley.

ENTOMOLOGICAL SOCIETY, at 8.—Parthenogenesis in Stick-Insects: H. Ling Roth.—Diptera from the Falkland Islands: C. G. Lamb.

FRIDAY, OCTOBER 20.

INSTITUTION OF MECHANICAL ENGINEERS, at 6.—Trials on a Diesel Engine, and Application of Energy Diagram to obtain Heat Balance: The late Lieut. Trevor Wilkins; presented by Prof. Burstall.

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